Autism and Child Psychopathology Series
Series Editor: Johnny L. Matson

Justin B. Leaf
Joseph H. Cihon
Julia L. Ferguson
Mary Jane Weiss
Editors

Handbook of Applied Behavior Analysis Interventions for Autism

Integrating Research into Practice

Springer

Autism and Child Psychopathology Series

Series Editor

Johnny L. Matson, Louisiana State University, Baton Rouge, LA, USA

Brief Overview
The purpose of this series is to advance knowledge in the broad multidisciplinary fields of autism and various forms of psychopathology (e.g., anxiety and depression). Volumes synthesize research on a range of rapidly expanding topics on assessment, treatment, and etiology.

Description

The **Autism and Child Psychopathology Series** explores a wide range of research and professional methods, procedures, and theories used to enhance positive development and outcomes across the lifespan. Developments in education, medicine, psychology, and applied behavior analysis as well as child and adolescent development across home, school, hospital, and community settings are the focus of this series. Series volumes are both authored and edited, and they provide critical reviews of evidence-based methods. As such, these books serve as a critical reference source for researchers and professionals who deal with developmental disorders and disabilities, most notably autism, intellectual disabilities, challenging behaviors, anxiety, depression, ADHD, developmental coordination disorder, communication disorders, and other common childhood problems. The series addresses important mental health and development difficulties that children and youth, their caregivers, and the professionals who treat them must face. Each volume in the series provides an analysis of methods and procedures that may assist in effectively treating these developmental problems.

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Dedicated to science, the scientific method, and continually seeking knowledge through the scientific process.

Preface

The number of autistics/individuals diagnosed with autism spectrum disorder (ASD) is on the rise. Recent prevalence rates of a child receiving a diagnosis of ASD are estimated at 1 out of every 54 children living in the United States with similar prevalence rates internationally. Autistics/individuals diagnosed with ASD display social communication deficits and engage in repetitive or restrictive behaviors. Additionally, autistics/individuals diagnosed with ASD may display deficits in cognition, play, and adaptive behaviors and display aggression or self-injury. Many autistics/individuals diagnosed with ASD require access to quality, effective intervention to develop important, adaptive behaviors and decrease undesired behaviors. This quality intervention is comprehensive, individualized, compassionate, progressive, and based on the best available evidence.

This handbook was developed to provide valuable information on evidence-based practices for professionals in the field of behavior analysis and autism intervention, parents/caregivers of autistic individuals, and autistics/individuals diagnosed with ASD. We hope that it serves as a resource for finding information about interventions likely to be effective and the process of sorting scientifically supported procedures from procedures that do not have evidence or merit. The first part consists of eight chapters which provide an overview of the terms *evidence-based* and *non-evidence-based* and the conditions that may lead one to select an evidence-based or non-evidence-based procedure. The second part consists of 22 chapters highlighting several approaches, procedures, and interventions that are considered to be evidence based for autistics/individuals diagnosed with ASD. We wish to thank all the authors who contributed to this book, without whom this book would not have been possible.

Beverly, MA, USA
December 2021

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Contents

1 Introduction to the Handbook of Applied Behavior Analysis Interventions for Autism

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1.1 Introduction to the Handbook of Applied Behavior Analysis Interventions for Autism

In 1938, Leo Kanner began the study of 11 children who displayed similar behaviors that would later be described in his 1943 article entitled, "Autistic Disturbances of Affective Contact." Specifically, Kanner (1943) detailed descriptions from the parents of the 11 children including birth conditions, observations from the clinic, any available case history, and common themes across the 11 children. Following this in-depth description, Kanner made the case for distinguishing between schizophrenia and what would later be called autism (e.g., onset of symptoms, impervious to people, rigidities). As a result, Kanner is often credited for being the first to codify the concept of autism as a syndrome and not a symptom of some other disorder (e.g., childhood schizophrenia).

Throughout the years, the diagnostic criterion of autism spectrum disorder (ASD) has changed (American Psychiatric Association, 1980, 2000, 2013), yet the hallmarks of the disorder have remained relatively consistent. That is, individuals diagnosed with ASD commonly have qualitative impairments in reciprocal social-communication interaction (e.g., joint attention, friendship development, tolerating others) and engage in restricted or repetitive behavior (e.g., hand flapping, scripting, body rocking). In addition to these deficits, it is common for individuals diagnosed with ASD to have qualitative impairments in language and communication (Matson et al., 2013), engage in challenging or dangerous behavior (e.g., aggression, self-injurious behavior; Jang et al., 2011), and have deficits in self-help/leisure skills (Flynn & Healy, 2012). Recent prevalence research from the Center for Disease Control and Prevention has indicated that the number of diagnoses has increased across the years with 1 out of every 54 children living in the United States receiving an ASD diagnosis (Baio et al., 2018), which has also been reported globally (Christensen et al., 2016).

With prevalence rates of ASD increasing, it is more imperative than ever that access to quality intervention is widely available for those that need it. This intervention should be comprehensive, individualized, compassionate, progressive, and based on the best available evidence. This is a common value among behavior analysts that

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find themselves working in the fields of behavioral intervention and autism. As Van Houten et al. (1988) stated, "behavior analysts have an obligation to only use techniques that have been demonstrated by research to be effective, to acquaint consumers and the public with the advantages and disadvantages of these techniques, and to search continuously for the most optimal means of changing behavior" (p. 383). Although Van Houten and colleagues were describing the right to effective treatment provided by behavior analysts, we believe that autistics/individuals diagnosed with ASD deserve the right to effective treatment by any helping professional (e.g., occupational therapist, speech language pathologist, psychologist).

Unfortunately, the services available for autistics/individuals diagnosed with ASD have long been delivered along with non-evidence-based procedures (e.g., chelation therapy; Singer & Ravi, 2015), interventions with a lack of or limited empirical support (e.g., Social Thinking™; Leaf et al., 2018), interventions which would be considered pseudoscientific (e.g., Son-Rise Program®; Moran, 2014), and antiscientific (e.g., facilitated communication; Lillenfeld et al., 2014). As Normand (2008) stated, "one would be hard pressed to find an area more widely affected by rampant pseudoscience than that of autism treatment" (p. 42). Perhaps even more unfortunate is that even in 2022 these interventions are still promoted, disseminated, and implemented as effective treatments for autistics/individuals diagnosed with ASD (Lerman et al., 2008; National Autism Center, 2015).

Although these non-evidence-based procedures often make promises of effectiveness with little to no effort, and in some cases a "cure," the reality greatly differs (Zane et al., 2008). In fact, many of these non-evidence-based procedures, or fad treatments (Zane et al., 2008), often put the autistic/individual diagnosed with ASD in immediate and long-term risk of harm (Freeman, 2008). One potential risk involved in the implementation of these procedures is that doing so may take away valuable time from more effective, evidence-based interventions. Autistics/individuals diagnosed with ASD may have multiple areas in which skill development is necessary that requires intensive intervention (e.g., Lovaas, 1987). As such, implementing interventions with little to no effectiveness may limit the number of skills that could be developed using otherwise effective, evidence-based interventions. Relatedly, a second potential risk in implementing non-evidenced based interventions is the possibility of diluting or negating the effectiveness of an evidence-based procedure. This is likely to be the case with non-evidenced-based interventions that are based upon competing ideologies or philosophies of behavior (e.g., opposed perspectives on the nature of behavior; Kimberly et al., 2016). These competing ideologies or philosophies of behavior are likely to lead to different approaches of when, how, and if to address various behaviors or skillsets. With two, or more, different philosophical approaches to treatment, it is probable that the effects of an evidence-based intervention may be diluted or, worse, negated.

A third potential risk of implementing a non-evidence-based practice is the cost for the consumer (Zane et al., 2008). It is not uncommon for pseudoscientific interventions to cost an exorbitant about of money, despite a lack of effectiveness, yet the promise of effectiveness with little effort keeps consumers dedicated, continually wasting time and money. The costs associated with these interventions are not only monetary, as they may also take an enormous emotional toll on consumers and their families. Astronomical promises of effectiveness such as effectively communicating, developing meaningful relationships, an immediate end to any and all problematic/dangerous behavior, and living a "normal" life create expectations that are never met. Across time, the realization sets in that these expectations were promised in malice taking almost immeasurable emotional toll on consumers and their families. This emotional toll can be devastating and could even result in depression (Maurice, 1993). It can also reduce the likelihood of hope for the future effectiveness of evidence-based interventions and may make caregivers and individuals impacted hesitant to embrace treatment in the future.

A fourth potential risk relates to the limited research on the possible long-term side effects of non-evidence-based procedures. It may be possible that the known short-term effects of the use of non-evidence-based procedures are continually exacerbated. Is it possible that non-evidence-based procedures lead to increased reports of anxiety, depression, or post-traumatic stress symptoms? Is it possible that non-evidence-based procedures lead to harm in an individual's physical or medical health? Is it possible that exposure to ineffective intervention(s) over time, with the concomitant reduction in hope, leads to lowered investment in and enthusiasm for intervention? Without additional research on the long-term side effects of non-evidence-based procedures, these questions will remain unanswered. While the research on the long-term side effects of non-evidence-based procedures is lacking, the research is clear that eclectic approaches that include non-evidence-based procedures are ineffective or less effective than the use of solely evidence-based procedures (Howard et al., 2014).

Due to the continued growth, popularity, and proliferation of non-evidence-based procedures for autistics/individuals diagnosed with ASD, the increase in the number of ASD diagnoses, the need for quality and effective intervention, and the risks of implementing non-evidence-based intervention many professionals have discussed non-evidence-based practices within scholarly works. For example, Horner et al. (2005) provided parameters to determine if an intervention would be considered evidence based which included: (a) the practice being clearly defined, (b) the outcomes of the practice being defined, (c) the use of treatment fidelity, (d) a functionally related change, (e) the intervention being implemented and demonstrated to be effective across five studies, (f) the intervention being conducted by at a least three different research labs, and (g) the intervention being evaluated across at least 20 participants. Additionally, numerous chapters exist to help identify the quality of an intervention explored within a specific study. For example, DiGennaro Reed et al. (2017) provided professionals with a checklist/questionnaire of how to determine the quality of any intervention.

Researchers and professionals have also helped to evaluate the evidence and quality of research supporting the effectiveness of an intervention or procedure through the publication of literature reviews (e.g., Park et al., 2019) and meta-analysis (e.g., Eldevik et al., 2009). These reviews and/or meta-analysis commonly involve an examination of the conceptual underpinnings, theory, and/or data behind any given procedure. For example, there have been several literature reviews related to Social Stories™ that have resulted in warnings against their use due to weak empirical evidence and methodological rigor (e.g., Leaf et al., 2015; Milne et al., 2020; Reynhout & Carter, 2011; Styles, 2011).

One of the most substantial contributions to assist with identifying the evidence to support the use of an intervention or procedure has been the creation of standards projects which evaluate a plethora of interventions (e.g., National Autism Center, 2009, 2015). These projects are typically done with the help of many professionals. They create a set of criteria to determine if an intervention would be considered evidence based and conduct searches in a systematic and methodological manner. The conclusion of this process usually results in a list of interventions which would be considered evidence based and a list of interventions which would not be considered evidence based. These reports are immensely helpful for consumers to identify which interventions to implement and which interventions to avoid.

Although there have been numerous reviews (e.g., Odom et al., 2010), chapters (DiGennaro Reed et al., 2017), books (e.g., Reichow et al., 2011), and standards projects (e.g., National Autism Center, , 2015) dedicated to identifying and listing evidence-based practices as it relates to autistics/individuals diagnosed with ASD, the continual proliferation of non-evidence-based practices and emerging research makes it crucial to continue to publish materials about evidence-based and non-evidence-based procedures. As such, the editors of this handbook sought to develop a book in which leaders in the field of autism and behavior analysis were invited to write chapters on various topics related to evidence-based practices and autistics/individuals diagnosed with ASD. Our hope is that this book will function as a guide for practitioners in the selection and implementation of procedures based on their research evidence and effectiveness, rather than unsubstantiated claims. As such, this handbook consists of two parts: (I) an overview of evidence-based practices and (II) procedures and interventions which would be considered evidence based.

1.2 Part I: An Overview of Evidence-Based Practice

The first part is meant to provide a discussion of what we mean when using the terms *evidence based* and *non-evidence based* and the conditions that may lead one to select an evidence-based or non-evidence-based procedure. The second chapter of this handbook was written by the editors who operationally define what constitutes an evidence-based practice, provide detail on the three criteria of evidence-based practices, and compare and contrast how evidence-based practices have been evaluated and defined from other resources and entities. The third chapter was written by Elizabeth M. Kryszak and James A. Mulick who describe the history of non-evidence-based procedures that have been implemented for autistics/individuals diagnosed with ASD and why implementing non-evidence-based practices may be harmful. Chapter 4 was written by Videsha G. Marya, Victoria D. Suarez, and David J. Cox who discussed various decision models on how to proceed when making ethical decisions about interventions. The fifth chapter was written by Melissa Olive and provides the context for how evidence-based practices fit into the law. Chapter 6 was written by Ilene S. Schwartz, Alice Bravo, Robin Finlayson, Jessica Flaherty, and Adriana Luna who provided the context on how evidence-based practices fit into the Individuals with Disabilities Education Improvement Act, how evidence-based practices fit into services within a school system, and how evidence-based practice should be implemented as part of the Individualized Education Program process. The seventh chapter was written by Thomas Zane, Robin M. Kuhn, Samantha R. Volpe, Mariah Mussetter, and Jessica F. Juanico and discusses the reasons why a professional may choose to implement evidence-based or non-evidence-based practices. Chapter 8 was written by Mary Jane Weiss, Lisa Tereshko, Kristin Bowman, Kimberly Marshall, and Karen Rose who outline how to work collaboratively with other professionals when it comes to implementing evidence-based practices and how to manage circumstances when other team members or families recommend the use of non-evidence-based procedures. The final chapter in the first part of the book is Chap. 7, written by Shahla Ala'i-Rosales, Malika Pritchett, April Linden, Isabel Cunningham, and Noor Syed. This chapter discusses important cultural considerations within the context of evidence-based practices.

1.3 Part II: Evidence-Based Practices in Autism Intervention

The second part of this handbook highlights several approaches, procedures, and interventions that are considered to be evidence based. These chapters are the bulk of the content of this handbook. Each chapter discusses how the approach, procedure, or interventions meet standards developed to be considered evidence based. This part includes a chapter on discrete trial teaching (DTT) written by Justin B. Leaf, Julia L. Ferguson, and Joseph H. Cihon that describes DTT, the research that has been conducted using DTT to teach various skills, and how DTT meets the standards of an evidence-based practice. Gail McGee provided a chapter on incidental teaching that describes some of the research behind incidental teaching as well as future areas of research. Lynn Kern Koegel, Elizabeth Ponder, Katie Stolen Nordlund, and Brittany L. Koegel wrote a chapter discussing pivotal response training (PRT), the research that has been conducted on PRT to improve behavior, the strengths and limitations found in the research, areas in need of future research, and clinical implications. Ruth

M. DeBar, Courtney L. Kane, and Jessica L. Amador provided a chapter describing video modeling and the different variations that are commonly implemented and evaluated the research, future directions of the research, and clinical implications related to video modeling. Ashley Creem, Sacha Shaw, Callie Plattner, and Jennifer Posey wrote a chapter dedicated to the teaching interaction procedure (TIP) and behavioral skills training (BST). In this chapter the authors examined the evidence base for both procedures, highlighted the similarities and differences between the two procedures, provided areas of need in the literature, described how research can relate to practice, and how TIP and BST meet the definition of an evidence-based practice. Christine M. Milne and Ashley Creem provided a chapter on social skills groups that described the research and provided clinical recommendations for implementing social skills groups.

Sarely Licona, Lauren Bush, Victoria Chavez, Emily Dillon, and Allison Wainer wrote a chapter evaluating the research related to parent-mediated interventions that described the research and provided clinical recommendations. Melissa Mello and Sally J. Rogers provided a chapter on the Early Start Denver Model (ESDM). In this chapter, the authors evaluated the research on ESDM, provided clinical recommendations, and suggested areas for future research. Mark Dixon, Zhihui Yi, and Amanda N. Chastain provided a chapter on PEAK that described the background of PEAK, the research on PEAK, and clinical recommendations. Rocío Rosales and Yaimarili Marin-Avelino wrote a chapter on the Picture Exchange Communication System (PECS) that described the research related to PECS and provided several clinical recommendations related to its use. Hayley Neimy and Brenda Fossett provided a chapter on Augmentative and Alternative Communication (AAC) that included a description of the research on AAC, assessment considerations for the use of AAC, and several clinical recommendations when considering the use of AAC. Joseph H. Cihon provided a chapter on the use of shaping that provided a brief history of the discovery of shaping, the research related to shaping, and research and clinical recommendations related to the use of shaping. Claudia L. Dozier, Adam M. Briggs, Kathleen M. Holehan, Nicole A. Kanaman, and Jessica F. Juanico wrote a chapter on the use of functional analysis methodology that described best practice considerations related to the use of functional analyses.

Joshua Jessel provided a chapter on the use of the practical functional assessment that outlines the research, to date, on its use as well as clinical recommendations when considering the use of a practical functional assessment. Faris Kronfli, Courtney Butler, Christeen Zaki-Scarpa, and SungWoo Kahng wrote a chapter discussing the use of functional communication training (FCT) to teach replacement behaviors. Ashley Bagwell, Monique Barnett, and Terry S. Falcomata provided a chapter on the use of time-out and response cost in which authors evaluated the research on time-out and response cost as well as discussing ethical and clinical considerations with their use. Patrick M. Ghezzi and Ainsley B. Lewon wrote a chapter that discusses the research and, more importantly, the ethical considerations related to the use of token economies. Amanda S. Freeman, Christine M. Fry, and Gregory S. MacDuff provided a chapter on the use of activity schedules and script fading that evaluated the research for these two procedures, highlighted areas for future research, and provided clinical implications and best practices for their integration into an ABA approach. Timothy R. Vollmer, Janelle K. Bacotti, and Lindsay A. Lloveras wrote a chapter on the use of differential reinforcement and extinction. The authors evaluated the relevant research, noted areas for future research, and provided clinical implications. Catia Cividini-Motta, Hannah MacNaul, Haley M. K. Steinhauser, and William H. Ahearn wrote a chapter that discussed the use of response interruption and redirection (RIRD) which included relevant research and ethical and clinical considerations with the use of RIRD. Kimberly B. Marshall and Jessica L. Rohrer provided a chapter that evaluated the use of self-management and monitoring procedures for autistics/individuals diagnosed with ASD. The authors highlighted the relevant research, discussed research and clinical implications, and described how self-monitoring and self-management meet the definition of an evidence-based practice. Finally, the editors provided a chapter that summarized and provided a general overview of the state of evidence-based practices in the field of ASD. Overall strengths, future research directions, and clinical needs are discussed.

1.4 Conclusion

Evidence-based intervention is crucial to achieving meaningful outcomes for autistics/individuals diagnosed with ASD. Time, money, and hope are wasted on interventions that offer promise but do not deliver results. In this book, we explore the foundational need for evidence-based practices, how these practices are vital to outcomes, and how they are woven into effective treatment, along with strong collaboration and cultural humility. We also discuss state-of-the-art implementation of a variety of evidence-based interventions for autistics/individuals diagnosed with ASD and provide suggestions for ensuring their effective implementation. It is our hope that this book serves as a guide for the consideration of intervention approaches and assists clinicians in providing maximally effective, empirically supported, individualized treatment plans to their clients with autism.

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Part I

An Overview of Evidence-Based Practice

2 Defining Evidence-Based Practice in the Context of Applied Behavior Analysis and Autism Intervention

Julia L. Ferguson, Mary Jane Weiss, Joseph H. Cihon, and Justin B. Leaf

2.1 Defining Evidence-Based Practice in the Context of Applied Behavior Analysis and Autism Intervention

2.1.1 The Quest to Identify Evidence-Based Practice

Evidence-based practice is frequently cited as a value and a goal across professions (e.g., American Psychological Association, 2005; American Speech-Language Hearing Association, 2021; Behavior Analyst Certification Board, 2020; Institute of Medicine, 2001; National Association of Social Workers). It is the foundation of effective treatment and is associated with maximizing outcomes of an intervention (e.g., Howard et al., 2014). In the helping professions, evidence-based practice has been emphasized for several decades (e.g., Levant, 2005), as there has been an increased sensitivity to the use of effective procedures and the allocation of resources to interventions likely to effect change.

Within the field of psychology, evidence-based practice has been highlighted for decades (e.g., American Psychological Association, 2005; Levant, 2005). Task forces within the field of psychology have defined evidence-based practices and empirically supported treatments by focusing on the breadth of evidence (e.g., number of studies, quality of data, research design), the independence of published researchers, the manualization of the approach, the specificity of treatment, and the effectiveness of treatment (American Psychological Association Presidential Task Force of Evidence-Based Practice, 2006). Each of these factors is relevant to confidence in the findings, consistency of results, and implications for practice. These themes have remained and continue to be emphasized in analyses of existing approaches to intervention (e.g., American Psychological Association, n.d.).

Other fields (e.g., American Speech-Language-Hearing Association, applied behavior analysis, American Occupational Therapy Association) have similarly articulated strong values on evidence-based practice and have worked to provide specific guidelines to practitioners for the use of such procedures. The medical field has characterized evidence-based practice as the integration of research-based procedures with clinical expertise and patient values

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(Institute of Medicine, 2001). Within social work, there is an emphasis on locating and evaluating evidence applicable to an issue, applying the evidence to implement a solution, and then evaluating the success of the solution (Drake et al., 2001). There is also an emphasis on integrating clinical expertise, client preference, culture, ethics, and values into the intervention plan (National Association for Social Work, 2021). The American Speech-Language-Hearing Association (ASHA) has called for the use of evidence-based procedures, which are seen as integrating evidence (including research evidence and observational data), practitioner expertise, and client/caregiver perspective (American Speech-Language-Hearing Association, 2021). Finally, the American Occupational Therapy Association (AOTA) has called for the use of evidence-based practices, emphasizing the integration of "critically appraised research results with the practitioner's clinical expertise, and the client's preferences, beliefs, and values" (AOTA, 2021, para 1).

In autism intervention, where fad treatments have been a common challenge (Schreck et al., 2016; Zane et al., 2008), the need for the identification of evidence-based practices and empirically supported treatments is high. Clinicians from multiple disciplines are intensely interested in helping practitioners and families select interventions with merit. Wasted time reduces outcomes, and effective treatment is essential (Zane et al., 2008).

Across disciplines, the addition of clinical judgment is an interesting element that is often included. Indeed, clinical judgment is commonly emphasized and may at times be at odds with other indices of effectiveness (e.g., client preferences, caregiver preference). Nevertheless, given the complexity of clinical presentations and that experience creates more expertise, clinical judgment is generally highly regarded. This integration of practitioner judgment does introduce a combinatorial effect; that is, research evidence is weighed along with clinical judgment to permit an individualized decision about the direction of treatment. Similarly, client values are also highlighted and are accommodated in the selection of treatment.

This qualitative element has become increasingly emphasized in terms of evidence-based practice (i.e., incorporation of client input and sensitivity to client values). While this has always been part of partnering with the client in treatment, it is now more explicitly emphasized in behavior analytic intervention. The new Ethics Code for Behavior Analysts (Behavior Analyst Certification Board, 2020) emphasizes that services are delivered in the context of core principles, which serve as a framework for compassionate service delivery. The four core principles are (a) benefit others; (b) treat others with compassion, dignity, and respect; (c) behave with integrity; and (d) ensure competence. The compassion, dignity, and respect core principle focuses on providing humane care that upholds the dignity and choice of each client. "Behavior analysts respect and actively promote clients' self-determination to the best of their abilities, particularly when providing services to vulnerable populations" (Behavior Analyst Certification Board, 2020, p. 4). In addition, the code states that behavior analysts acknowledge that "personal choice in service delivery is important" (p. 4) and provide "clients and stakeholders with needed information to make informed choices about services" (p. 4). Like other professions, behavior analysis is working to empower clients to make informed choices about treatment and recognizes that client input and comfort are of paramount importance.

2.2 Commonly Used Evidence-Based Practice Standards

Evidence-based practice is generally defined as practices that are used based on: (a) the best scientific evidence, (b) the practitioner's or clinician's experience and expertise, and (c) client values (Slocum et al., 2014). This three-prong approach to selecting interventions helps guide clinicians when selecting interventions to help teach skills to the clients with whom we work. In addition to this general definition of evidence-based practice, individuals and entities have outlined specific criteria and guidelines that would qualify interventions to be considered an evidence-based practice regarding studies using single-subject research designs and group designs and in the context of autism service provision. Outlined next are some commonly used sources to designate if an intervention, practice, or procedure is considered an evidence-based practice.

2.2.1 Horner et al. (2005)

Horner et al. (2005) outlined criteria to help practitioners and educators determine if an intervention is an evidence-based practice when the evidence to support the intervention is evaluated through single-subject research designs. Horner et al. first outlined quality indicators of a published research study using single-subject designs across several variables: (a) description of participants and settings, (b) dependent variable, (c) independent variable, (d) baseline, (e) experimental control/internal validity, (f) external validity, and (g) social validity. Across these variables, Horner et al. further detailed what to examine that would indicate that the study in question was of high quality. For example, quality indicators for the dependent variable would include a description with operational definitions and measurement that is valid and quantifiable, dependent variable is measured repeatedly over time, and interobserver agreement and reliability data are collected on the dependent variables (Horner et al., 2005).

After outlining quality indicators of a single-subject research design study, Horner et al. (2005) indicated how a body of research comprised of high-quality single subject designs would be analyzed in the context of evidence-based practice. The guidelines Horner and colleagues provided for considering an intervention to be an evidence-based practice consisted of five criteria. First, the practice or intervention needs to be operationally defined and described so that other individuals can replicate the procedures with fidelity. Second, the intervention or practice should specify the context in which the interventions should be used and the corresponding outcomes. More specifically, the description of the intervention should specify the conditions under which it should be used, the types of individuals the procedure should be used with, and the types of practitioners or clinicians that are qualified to implement the intervention and outline the specific outcomes that will be affected by the intervention. Third, the body of research supporting the practice or intervention should have data supporting that the intervention has been implemented with fidelity across studies. Fourth, across the body of research, functional control should be demonstrated between the intervention and the corresponding change in the measured dependent variable(s). Finally, for a practice or intervention to be considered an evidence-based practice, their needs to be at least five high-quality single subject research design studies published in peer-reviewed journals. Those studies need to have been conducted by at least three different research groups and across at least three different geographical locations. Additionally, those studies need to include at least 20 participants to be considered an evidence-based practice (Horner et al., 2005).

2.2.2 Gersten et al. (2005)

Published alongside Horner et al. (2005) was a corresponding article on quality indicators for research using group designs (i.e., Gersten et al., 2005). Similar to Horner et al., Gersten et al. (2005) outlined quality indicators to examine when analyzing a research article that utilized a group design and outlined guidelines for how to evaluate a body of research using group designs in the context of evidence-based practice. Gersten et al. outlined quality indicators of a published research study using a group or quasi-experimental design across: (a) description of participants, (b) implementation of the intervention and description of comparison conditions, (c) outcome measures, and (d) data analysis. Across these variables, Gersten and colleagues posed questions for the reader to analyze with respect to indicators of quality. For example, Gersten and colleagues posed questions about outcome measures regarding if multiple measures were used and if the measures were used at the appropriate time to capture the intervention's effect. After outlining quality indicators for group experimental or quasi-experimental research designs, Gersten and colleagues outlined how multiple research articles comprised of randomized group designs and quasi-experiments on a specific subject should be evaluated in the context of evidence-based practice.

When it comes to interventions for children diagnosed with ASD or other developmental disabilities, Gersten et al. (2005) noted that one main issue is the extent to which results found from group designs can be generalized across individuals diagnosed with ASD with varying skill sets and profiles. Gersten et al. noted that determining if an intervention is evidence based is nuanced and will vary depending on the research available for each intervention. With that said, Gersten and colleagues did provide some general criteria for determining if a practice is evidence based: (a) an intervention has at least four published studies that are of acceptable quality or at least two published studies that are of high quality, and (b) across those studies the weighted effect size is significantly greater than zero. The definitions of "acceptable quality" and "high quality" provided by Gersten and colleagues relate back to the quality indicators outlined throughout the article. Additionally, Gersten et al. proposed this criterion for considering a practice to be promising: (a) an intervention has at least four published studies that are of acceptable quality or two published studies that are of high quality, and (b) across those studies there is a 20% confidence interval for the weighted effect size greater than zero.

2.2.3 What Works Clearinghouse

What Works Clearinghouse (WWC) is an organization that was created by the United States Department of Education's National Center for Educational Evaluation and Regional Assistance. The creation of WWC was an important initiative created so that rigorous, current, and evidence-based research would be used within the United States' educational system. The goal of WWC is to assess the available scientific evidence of interventions in order to be the trusted source for "what works" when it comes to educational interventions and practices. To accomplish this goal, the WWC develops a review protocol, identifies relevant literature, screens and reviews the eligible studies, and summarizes and reports their findings (What Works Clearinghouse, 2014). This is a rigorous and detailed process in which each research study is reviewed carefully using specific procedures that apply depending on the research design implemented.

WWC categorizes a study's findings into one of five categories: (a) statistically significant positive effect, (b) substantively important positive effect, (c) intermediate effect, (d) substantively important negative effect, and (e) statistically significant negative effect (What Works Clearinghouse, 2014). When combining multiple study findings for an intervention brief or report, WWC summarizes the data on an intervention across the average improvement index, the statistical significance of an effect, the amount of supporting evidence, and the generalizability of the findings across studies. This level of review and data analysis of the available research allows WWC to provide information to consumers on the effectiveness of interventions or curriculum and if they should be considered to be effective evidence-based practices.

2.2.4 National Standards Project

The National Standards Project was created by the National Autism Center to provide information to practitioners and consumers regarding evidence-based practices for individuals diagnosed with ASD (National Autism Center, 2009, 2015). The National Standards Project sought to summarize the strength of the evidence available for existing educational and behavioral interventions for those diagnosed with ASD, describe the individuals with whom the interventions have shown to be effective, identify the limitations of the current research for autism intervention, and provide recommendations for practitioners using evidence-based practices. To accomplish this goal, they launched the National Standards Project that consisted two phases. Phase 1 of the National Standards Project began in 2005 with the report being published in 2009 (National Autism Center, 2009), and Phase 2 began in 2011 with the report being published in 2015 (National Autism Center, 2015). To begin the project, the National Autism Center convened an expert panel of scholars, researchers, and leaders in the field to conduct their comprehensive analysis of the available research. The expert panel developed a coding manual and a rating scale (i.e., Scientific Merit Rating Scale) to use when evaluating the articles/research available, identified individuals to rate the articles, conducted a search of the literature, trained the article reviewers to establish reliability, and then began the article review process. Once the article review process was completed, the interventions were categorized and the analysis was completed. First, interventions were categorized by their effects: (a) beneficial, (b) ineffective, and (c) unknown. From there, the interventions were then classified based on the strength of the available evidence and categorized as either established, emerging, or unestablished. These classifications all stemmed from the reviewer's analysis of the available research using the Scientific Merit Rating Scale.

The Scientific Merit Rating Scale was developed for reviewers to objectively evaluate each research article based on their scientific rigor. The scale had five dimensions that articles were rated on: (a) research design, (b) measurement of the dependent variable, (c) measurement of the independent variable, (d) participant ascertainment, and (e) generalization and maintenance. The scale further broke down each category with definitions and applied a numerical value on a scale from 0 to 5 based on the outlined criteria. For example, for the research design category, a rating of 5 meant that for a study implementing a single-subject design, a minimum of three comparisons of control and intervention conditions were conducted, the number of data points per condition was 5 or greater, the study had at least 3 participants, and there was no data loss. A rating of 1 for research design meant that the study only had two comparisons of the control and intervention conditions, only included one participant, and had significant data loss. This rating and evaluation process made it possible for the National Autism Center to provide two reports to consumers and practitioners identifying interventions with high-quality research as beneficial and established evidence-based practices for individuals diagnosed with ASD (National Autism Center, 2009, 2015).

2.2.5 National Clearinghouse on Autism Evidence and Practice

The National Clearinghouse on Autism Evidence and Practice (NCAEP) is another organization that has developed criteria and reports to determine what interventions and practices are evidence based for individuals diagnosed with ASD (Steinbrenner et al., 2020). The purpose of the group and the reports produced (e.g., Odom et al., 2010; Wong et al., 2013, 2015) is to describe and analyze sets of practices or interventions that have clear evidence and positive effects for children diagnosed with ASD. To accomplish this purpose, the NCAEP created a process to search the literature, evaluate research studies, identify focused (i.e., practices designed to address a single skill or goal) and comprehensive practices (i.e., set of practices designed to teach broad learning and target the core features of ASD), and synthesize the outcomes in published reports. The NCAEP seeks to continuously update their findings on evidence-based practices for children and young adults diagnosed with ASD because many "treatments" for autism exist and many claim to improve the lives or cure children and adults diagnosed with ASD in the absence of data to support their effectiveness (Steinbrenner et al., 2020). The prevalence of anti-science and pseudoscientific (Green, 1996) treatments for ASD highlights the need for evidence-based practices and entities that identify programs and interventions as evidence based.

According to the NCAEP, a practice is considered evidence based if they: (a) have two or more high-quality group design studies, conducted by at least two different researchers or research groups; (b) have five or more high-quality single-case design research studies, conducted by at least three different researchers or research groups, and have at least 20 participants across those studies; and (c) have at least one high-quality group design study and at least three high-quality single-case research design studies conducted by at least two different research groups. To determine if the articles evaluated were high quality, the NCAEP uses the quality indicators outlined by Horner et al. (2005), Gersten et al. (2005), and What Works Clearinghouse. After evaluating individual articles to assess their quality, the NCAEP categorizes interventions as evidence-based practices or practices with some evidence. Additionally, the NCAEP denotes age groups for whom the interventions have been found to be effective.

Although the NCAEP and their published reports (e.g., Odom et al., 2010; Steinbrenner et al., 2020; Wong et al., 2013, 2015) can be a useful tool to help practitioners and consumers identify if an intervention or practice is evidence based, it should be noted that concerns have been raised regarding the methods used by the NCAEP to identify evidence-based practices (e.g., Leaf et al., 2021). Some of the criticisms of the NCAEP's procedures have included: (a) missing relevant research articles due to their search terms, (b) excluding research articles that use nonconcurrent multiple baseline designs, (c) broad categorization of interventions (e.g., social skills training) in which procedures may greatly differ, and (d) categorizing components of interventions as practices (Leaf et al., 2021).

Table 2.1 Indicators of support for evidence-based practice

	Indicators
Individual studies	Objective measurement
	Clear identification of dependent and independent variables
	Experimental design demonstrating a functional relation
	Generalization and maintenance assessment
	Measures of social validity
	Procedural integrity checks
	Interobserver agreement/reliability of measurement
Across literature	Replication
	Repeated single case studies (multiple)
	Group studies (multiple)
	Randomized control trials
	Component analyses

2.2.6 Summary

Several articles and organizations have worked to develop specific guidelines and definitions to help consumers identify interventions as evidence-based practices for individuals diagnosed with ASD. Although differences exist between what each entity looks for to qualify a study as high quality, many similarities exist between the groups. Across these groups, there is a reliance on objective measurement, clearly outlined dependent and independent variables, experimental design, and replication across research groups and participants (See Table 2.1).

2.3 Differences in Definitions and Terminology

Although similarities exist for identifying procedures as evidence-based practices for individuals diagnosed with ASD, debate remains regarding how the term evidence-based practice should be used in the field of applied behavior analysis (ABA). Additionally, other terminology such as evidence-based practice in psychology (EBPP) and empirically supported treatment (EST) are sometimes used to identify and categorize interventions. This section will overview the differences in philosophy when it comes to the definition of evidence-based practice in ABA and also go over the definitions of EBPP and EST for interventions and treatments.

2.3.1 Smith (2013)

Smith (2013) defined evidence-based practice for behavior analysts first as a service that aims to help solve a consumer's problem. Due to this definition, Smith stated that it is likely that evidence-based practices would be a combined package of procedures that would be defined and manualized. The package would be validated through research studies with socially significant outcomes (Wolf, 1978), and those studies would typically be group designs (Smith, 2013). Smith noted that this definition is much more restrictive than what other organizations have proposed, but he believed that this stricter definition is more appropriate and aligns with the technological dimension of ABA (Baer et al., 1968, 1987). Smith created and advocated for this definition over other common definitions (e.g., Horner et al., 2005; National Autism Center, 2009) because he did not find that the lists created by these entities were very useful for behavior analytic practitioners. Additionally, the evaluation of a practice through both single-subject research design and group design studies leads to flexible definitions and criteria which can put the field at risk of overestimating the accomplishments of our research and how helpful the results are to consumers and practitioners. In Smith's revised definition of evidence-based practice, he advocates for discussing the evidence in terms of packages instead of procedures. The rationale for this approach is that a single component or procedure of an intervention is usually not enough to fix a problem (Smith, 2013). Instead, treatment packages are developed that contain many strategies and techniques to change behavior. Since packages are what are needed to solve problems in behavior analysis, these are what should be evaluated in terms of evidence-based practice (Smith, 2013). Additionally, when choosing an evidence-based practice to implement, the preferences of the individual being served and abilities of the interventionist should be taken into consideration. Smith called for more research testing of the generality of a treatment packages' effectiveness across settings, providers, and clients. Evaluating the packages in group designs is the best way to accomplish this goal (Smith, 2013).

2.3.2 Slocum et al. (2014)

Slocum et al. (2014) also defined evidence-based practice for ABA. Slocum and colleagues' definition of evidence-based practice more closely aligns with a decision-making model. Slocum and colleagues agreed with Smith (2013) in that current organization's definitions of evidence-based practice were not helpful to practitioners due to the lack of nuance in terms of success across participants, settings, and skill level of clients but disagreed with Smith on his definition. Slocum et al. found that Smith's definition of evidence-based practice was what in the field of psychology is referred to as an empirically supported treatment (EST). An EST is a treatment in psychology that has been demonstrated to be effective through the use of rigorous randomized controlled or clinical trials (American Presidential Task Force of Evidence-Based Practice, 2006). To Slocum and colleagues, "evidence-based practice of applied behavior analysis is a decision-making process that integrates (a) the best available evidence with (b) clinical expertise and (c) client values and context" (p. 44). This definition more closely relates to the definition of EBPP which is the "integration of the best available research with clinical expertise in the context of patient characteristics, culture, and preferences" (American Psychological Association, 2005, p. 147). Slocum and colleagues' proposed definition highlights that evidence is not the sole factor for making a decision as a practitioner or clinician. ABA is complicated, and practicing the science requires clinical expertise and judgment when it comes to identifying problems, analyzing the problem, and then deciding on a solution (Slocum et al., 2014). Without a decision-making framework or process, behavior analysts would be considered technicians instead of analysts (Slocum et al., 2014).

In terms of the first component of Slocum et al.'s (2014) definition of evidence-based practice (i.e., best available evidence), the authors provided guidance for deciding the quality of the evidence in terms of the *relevance* and *certainty* of the available research. This highlights that some research will be more relevant to the age of your client, skill level of your client, or the types of targeted skills for your client. It also highlights that some research on interventions will have stronger support for its claims than others. The certainty and relevance of the available research should be assessed on a continuum as behavior analysts use the evidence-based practice decision-making framework.

Client values and context should also be considered using the evidence-based practice decision-making framework (Slocum et al., 2014). This relates to the applied dimension of ABA (Baer et al., 1968, 1987) and to social validity (Wolf, 1978). Behavior analysts target behavior that has practical importance and value to society. Additionally, behavior analysts aim to target goals that are deemed meaningful to our clients, use procedures that are deemed appropriate by our clients, and produce effects that are meaningful and lasting for our clients (Wolf, 1978). Assessing and measuring social validity is important in the context of the evidence-based practice decision-making process (Slocum et al., 2014). It allows behavior analysts to assess client values and the context of the intervention by also asking relevant stakeholders their opinions on the interventions in question (Slocum et al., 2014).

Clinical expertise is the final component of the evidence-based practice decision-making model. After evaluating the best available research evidence and assessing client values and context, behavior analysts use their clinical expertise and judgment to make an evidence-based decision. According to Slocum et al. (2014), clinical expertise in ABA includes seven components: (a) knowledge of the research and how it applies to your specific clients, (b) incorporating the conceptual systems of ABA, (c) the comprehensiveness of the behavior analysts' clinical and interpersonal skills, (d) the integration of the assessed client values and context, (e) recognizing the need for outside consultation and collaboration when needed, (f) making data-based decisions, and (g) ongoing professional development (Slocum et al., 2014).

As these three components are evaluated together, a decision-making framework is followed to make evidence-based practice decisions in the field of ABA. Slocum et al. (2014) advocated for this definition of evidence-based practice over others in ABA as it aligns more closely to the dimensions and tenets of ABA outlined by Baer et al. (1968, 1987)

2.3.3 Summary

Disagreement remains in the field of ABA over the definition of evidence-based practice. For some entities, it is a list of procedures and packages that meet qualifications regarding the available evidence (e.g., National Autism Center, 2009, 2015). Others define evidence-based practice in terms of manualized treatment packages that have high-quality randomized control trials to support their effectiveness (i.e., Smith, 2013). For others, evidence-based practice is a decision-making model that draws upon the best available scientific research, client values and context, and a behavior analyst's clinical expertise (Slocum et al., 2014). Continued discourse on this topic is warranted as behavior analysts and practitioners in the field of autism intervention strive to improve the interventions and practices used to teach individuals diagnosed with ASD skills that will hopefully improve their quality of life. A unified definition that is agreed upon in the field of behavior analysis is needed, and similar to the American Psychological Association (2005), a specific task force on this topic could be created. In the meantime, the entities and other organizations that strive to define and promote evidence-based practices in the field of ABA and autism intervention still have much in common despite some differences in terminology. For now, the exact/precise definition of evidence-based practice may not matter as much as the progress our clients make when evidence-based practice interventions or decisions are being made. Individuals making progress based on objective measurement and data, using interventions that are preferred, and using clinical judgment to make informed decisions are at the heart of evidence-based practice.

2.4 Practitioner Resources

Across disciplines, resources are needed to assist practitioners to identify evidence-based practices. Especially in multidisciplinary settings, it is important to ensure that opinions expressed are backed up with credible resources. Referencing such resources can reduce interprofessional tension and ensure that the conversations are focused on available recommendations rather than differences in opinion across fields or between professionals.

In this context, it is important for practitioners to identify available evidence and the categorizations of suggested treatments in timely ways. Many of the resources previously cited in this chapter share emphases that are commonly cited as indicators of empirical support. These are listed in Table 2.1. To the extent that available literature has these elements, practitioners can be more confident in the findings. In addition to going to the published literature, practitioners may contact sources known for identifying and categorizing interventions based on available evidence. Several of these have been previously described, such as the National Standards Project and What Works Clearinghouse.

In addition to these compendiums of information about the accrual of research evidence, other practitioner resources also exist. Perhaps the most useful of these are position statements. Position statements are created by professional organizations to guide their members and consumers about treatment interventions. At times, these position statements are created to address interventions that have been shown to be ineffective and/or produce harm. For example, multiple organizations have created position statements about Facilitated Communication, including the ASHA (American Speech-Language-Hearing Association, 2018a), the Association for Behavior Analysis International (Association for Behavior Analysis International, 1995), and the American Academy of Pediatrics (Committee on Children with Disabilities, 1998). The American Academy of Pediatrics has also issued position statements about Auditory Integration Training (Committee on Children with Disabilities, 1998) and Sensory Integration (Section on Complementary and Integrative Medicine et al., 2012). ASHA has position statements on many different interventions, including auditory integration training and rapid prompting method (American Speech-Lanugage-Hearing Association, 2004; American Speech-Language-Hearing Association, 2018a, 2018b). ASHA has also provided follow-up position statements to update practitioners. In 2018, they updated the Facilitated Communication position statement (American Speech-Language-Hearing Association, 2018a). Additionally, some organizations are specifically calling for practitioners to practice within the confines of evidence-based practice, and several organizations are identifying pseudoscience as a threat to effectiveness. For example, Volkers (2019) wrote about the continuance of non-speech oral motor exercises in speech and language pathology intervention and cited it as evidence that clinicians' recommendations reflect state-of-the-art scientific understanding. Volkers also spoke broadly of the threats to scientific intervention recommendations, including the dramatic increase in misinformation, the presence of bias, and the tendency to value our own experiences over data. Within ASHA and other professional guild organizations, the importance of adhering to scientifically validated procedures has been emphasized. Several of the position statements across professions cite ethical mandates to engage in evidence-based practices, including ASHA's rapid prompting method and Facilitated Communication statements.

Another vital resource is the Treatment Guidelines from Autism New Jersey (Autism New Jersey, 2021). This user-friendly resource presents a framework based on the amount of evidence available for interventions, using a red light, yellow light, green light categorization (see https://www.autismnj.org/understanding-autism/treatment/). Red light interventions have been shown unequivocally to be ineffective and/or harmful. Examples include chelation therapy, Facilitated Communication, and auditory integration training. Yellow light interventions are those that await more data, and which may be considered for trial in individual cases, with data to support continuance. Examples include music therapy, art therapy, and animal-assisted therapy. Green light interventions are those that have been shown to be efficacious and are considered to be supported by research. Many procedures within ABA are listed in this category, such as discrete trial instruction, the Picture Exchange Communication System, and functional communication training.

Practitioners are often in a position to provide recommendations for the course of treatment and/or to respond to a recommendation made by a consumer or other professional. It is imperative in these contexts for all professionals to exude respect and to collaborate in the best interests of the client even when sources of contention are present (see Table 2.2). In this context, it is often possible to open a dialogue within the team about the potential intervention. Published literature may provide some context about the level of evidence that is known about the treatment. Resources that periodically track the available evidence and categorize interventions by the volume and quality of accrued data should also be consulted. In addition, resources by guild organizations, such as position statements, provide information about what practitioners are being advised to do regarding specific interventions. Finally, some organizations have created tools for consumers that may be of use in helping to navigate treatment options.

Table 2.2 Sources of contention for evidence-based practice

Sources of contention
Scope of practice, shared practice, or overlapping scopes of practice
Different worldviews (i.e., philosophical differences)
Differing definitions of evidence
Interpersonal injury (e.g., hurt feelings)

2.5 Conclusion

Evidence-based practice is highly valued across fields and is associated with improved intervention and improved outcomes. Different methods exist to categorize treatments, but all models rate interventions based primarily on the accrual of objective, well-designed research. Additional considerations include clinician expert opinion and client values. Across disciplines, these additional themes figure prominently into clinician decisions about treatment. Within ABA, there has been a renewed interest toward the integration of client values and the empowerment of clients to participate in treatment decisions (similar to the interests and statements of the founders in the field, e.g., Baer et al., 1968, 1987; Wolf, 1978). Clients can also be empowered with information about research evidence and about the evaluation of such research by trusted bodies and organizations. The analysis of position statements can ensure that the evaluation of interventions can be examined from the perspective of multiple disciplines, which may lead to a broader understanding of an intervention's merit and relevance. Strength of evidence must be considered in the selection of intervention, as wasted time leads to poorer outcomes (e.g., Howard et al., 2014; Zane et al., 2008). Practitioners must be trained to review evidence, to consult resources, to guide clients in the evaluation of extant evidence, and to individualize the application of interventions to clients, based on their profiles, preferences, and values.

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3 History of Non-Evidence-Based Practices for Individuals Diagnosed with ASD

Elizabeth M. Kryszak and James A. Mulick

3.1 Introduction

Few readers will be surprised by our asserting that the information environment in which we live is full of contradictions and sources of information that vary in credibility (Mihailidis & Foster, 2021). The modern information age is defined by a bewildering array of communication options. People, corporations, governments, organizations, interest groups, and individuals use communication tools for many purposes. We have been, nevertheless, cheerfully informed that the Internet makes us all heirs to nearly the sum of human knowledge. Two problems make this bounty a gift that bears a dose of caution. First, communicators communicate for reasons that go beyond simply sharing knowledge. The purposes for which people communicate include selling things, motivating specific actions, discouraging other actions, and exerting forms of social control. Sometimes these purposes conceal selfish or even malevolent intent. Second, none of us are able to tell the true motivation behind an assertion or the accuracy of something presented as true without additional information. The result has been called a fracturing of shared reality in modern society, in which people gravitate to media and people tending to match their preferences and prior beliefs to the exclusion of other or contradictory information and people who disagree. The result is a self-reinforcing and self-imposed formation of insular groups that share a reality that is narrow and not necessarily based on facts.

Science is a bulwark against competing truth claims about material nature. This is not because science contains truth but because science uncovers truth by its methods and the strong motives of its practitioners. The scientific method involves testing ideas against observable facts from every possible direction; from studies that confirm observations or the results of tests, repeatedly; and by independent scientists. The secret ingredient is the culture of science, in which scientists are trained to question everything offered as true, especially by other scientists who set themselves up as authorities (Rauch, 2013).

Scientific studies rely on repeatedly finding confirming evidence that a fact or an outcome is true no matter how it is tested, by whom, or under what circumstances. If some set of conditions gives different results, then attention turns to just how those new conditions could have accounted for the different results. As boundary conditions for a set of observations are discovered by repeated tests, reliable prediction or control of

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nature emerges. Science makes progress by these systematic attempts to show how something changes or stops working as expected, and every unexpected result leads to finding out if the unexpected will recur under similar conditions and so on until it all finally makes sense.

Science works because evidence builds up. If evidence from every approach is consistent such that no serious methodological attempt to discredit it is offered, then scientists conclude that they are dealing with the truth. In health sciences, treatments are developed based on ideas that have been suggested by the methods that have worked consistently in the past with similar problems. New treatments do not emerge out of the blue independent of the whole body of relevant science. The corpus of confirmed evidence in biology, chemistry, physics, and so on, both applied and theoretical, is *not* going to be overturned by a new effective treatment. When effective treatments are understood, they will be found to be consistent with the facts of established science even if they do lead to new understanding of how those established facts relate to each other. So, science can yield treatments that work because they are tested extensively, are consistent with how nature works generally, and have withstood the aggressive attempts of eager scientific peers who worked hard to find something wrong with them. Scientists doing science communicate about facts and about testing them.

There are other reasons that people communicate, and some of these reasons can lead to a distortion of reality, sometimes very much on purpose. Advertising is one venue that relies on communication, and its content is not always limited to facts. New and improved products might be pretty much the same but packaged differently. Politicians might appeal to values and emotions that have little to do with their past actions or future plans in order to gain votes. Public figures might hope for financial gain as a result of what they promote. Support for a plan in an organization might be motived by a desire for a promotion and not because the plan is a good one. People may assert things because they want to fit in or gain membership in a group. Science is rarely devoted to discovering the true motives for spreading falsehoods, but it is rather good in determining whether or not they are falsehoods. Scientists are not immune from such conflicts of interest, but the encouragement of routine disclosure of funding in scientific publication as well as the culture of independent replication and peer review tend to compensate.

Science-based evidence is the outcome of the application of scientific methods, and the evidence-based analyses of autism and of treatments for problems related to autism are found in research publications, journal articles that have been subjected to rigorous peer review. Peer review by other scientists makes sure that the methods reported are sound and that conclusions are warranted based on the evidence. Finally, each published finding is verified to be consistent with related previous research and makes sense with accumulated established facts. Non-evidence-based assertions are just that, assertions that have not been verified, often because they are asserted recklessly for an ulterior motive.

3.1.1 Why Do Non-evidence-Based Practices Exist?

Autism spectrum disorder (ASD) is considered a lifelong neurodevelopmental disorder (Steinhausen et al., 2016). While there is much known about this disorder, there is still much which we are still working to understand. Monumental gains have been made in the development of interventions for this disorder, but so far, the interventions that work best come with a heavy cost in resources including time, effort, and money. Gaps in knowledge and absence of a “quick cure” provide openings for the inception of “bad” ideas about the mechanisms of ASD and how to best address these symptoms. This leads to the creation and consumption of non-evidence-based practices, despite concerted efforts by professionals to debunk these practices and better educate consumers. There are now over 400 different treatments for ASD, most of which have little to no support (Frame & Casey, 2019; Matson et al., 2013), and less than half of families with a child with ASD choose a research-supported treatment (Miller et al., 2012). This chapter will next explore the history of non-evidence-based practices and the theories behind them, by first reviewing what it means to show an intervention truly works and why having some evidence that an intervention could work does not mean that the intervention is "evidence based." We will then explore how misunderstanding the mechanisms behind a disorder can lead to misinformed ideas on how to treat it and then how these interventions can spread despite little quality science to support them. This concept will be illustrated by reviewing examples of three different types of misunderstandings about autism and the non-evidence-based interventions they spawned, including misunderstanding how the environment effects behavior, extreme beliefs, and biological pseudoscience. The chapter will conclude with an overview of why families are so susceptible to non-evidence-based treatments and how providers can attempt to correct these misperceptions.

3.1.2 What Is Evidence?

Before we can define what a "non-evidence-based" practice is, we must first define evidence. The Oxford Dictionary defines evidence as "The available body of facts or information indicating whether a belief or proposition is true or valid" (Lexico, 2021a), while the Merriam-Webster definition is simply "Something that furnishes proof" (Merriam Webster, 2021). Neither of these definitions touches on the quality of the evidence being weighed. Based on these definitions alone, the majority of treatments out there actually would not qualify as having no evidence. Almost every intervention being marketed can at least boast a parent testimonial, a case study or two, or a poor-quality (but published) research study providing some support for the treatment being pushed. Therefore, when formally referring to "evidence-based" versus "non-evidence-based" interventions, we are not looking at the presence or absence of evidence. Rather, we are judging if the body of evidence available is of sufficient quality to confidently say that this intervention has a high likelihood of leading to meaningful change if the necessary time, energy, and cost are invested into its implementation. If the intervention does not have a body of evidence of sufficient quality to meet this standard, then we would say it is non-evidence based. But how do we define sufficient quality?

3.1.3 Quality Evidence Is Based in the Scientific Method

It is human nature to attempt to understand our world. We look for possible connections between events and then, hopefully, attempt to test whether these explanations, or theories, hold true. Over time, scientists have developed many methods to best test theorized connections. The scientific approach seeks to develop statements that are objective, testable, and replicable (Newsom & Hovanitz, 2015). When applying this approach to assessing a treatment, "objective" refers to describing explicitly and unambiguously what is being done and what is the expected outcome. A "testable" statement is one that can be verified or falsified by conducting an experiment. Variables with easily observed effects can be studied using single-case designs, where an intervention is applied and removed in a systematic fashion to show its effect on a defined behavior (e.g., ABAB designs). When a variable is theorized to have a weaker effect or there is more interest in the average result across many participants, randomized control designs are typically implemented, where participants are randomly assigned to a treatment or control group. Statistical analyses are then used to assess whether the treatment group differed significantly from the control group on an objectively defined outcome measure. In both methods, steps are taken to control other variables so that any changes can be attributed only to the treatment. The effects must then be *replicable*, meaning that there should be evidence that independent groups can conduct the same test, in the same way, and get the same result.

Efforts should be taken to use objective and direct outcome variables. Ideally the person measuring the outcome variable should be blind to the condition the participant is in. For example, if measuring the effect of a medication on cognitive skills, the person completing the IQ test should not know if the child they are testing is taking the medication or a placebo. There are times where blinding raters is not possible. For example, when comparing two different behavior interventions for decreasing self-injurious behavior, the person measuring the self-injurious behavior is likely going to be able to tell which intervention is being implemented. In these cases, it is important for the outcome measure to be clearly defined (e.g., number of times child hits head) to ensure the rater can stay as objective as possible. Parent and clinician report measures can provide valuable insight into whether others perceive an intervention is working and into factors such as how palatable an intervention is and ease of implementation in a real-world setting. Using parent and clinician measures solely to look at outcome of an intervention, particularly when the raters are not able to be blinded, can cause bias in results. Human observation is prone to bias (Mulick & Butter, 2015). Unfortunately, when parents, clinicians, and even scientists put a large amount of time, effort, and money into implementing a treatment, they are highly susceptible to seeing change, even when that change is not there.

Criteria have been offered to define when a treatment is considered evidence based (Chambless & Ollendick, 2001). Well established treatments (i.e., evidence based) are those that either have (1) two quality between group design experiments demonstrating that the treatment in question is better than a placebo or other treatment, or equivalent to an already established treatment, or (2) a large series of well-controlled single-case design experiments demonstrating efficacy compared to a placebo or another treatment. These experiments must also be conducted with well-defined treatment manuals or protocols; the characteristics of the sample must be well defined, and an independent group must be able to replicate the effects. *Probably efficacious* treatments are those that have: (1) two experiments that show the treatment is superior to a waitlist control; (2) one or more experiments that meet criteria for a "well-established treatment" but that have not yet been replicated by an independent team; (3) a small series of quality single-case design experiments. Finally, *experimental* treatments would include all other treatments under study. Most treatments start as experimental, often based on theory and first described in case studies or in a less-controlled experimental design. Further steps must be taken ultimately to reach the "well-established" criteria. Unfortunately, many widely used treatments never take these steps.

3.1.4 Why Do Non-evidence-Based Treatments Exist and Persist?

Our understanding of autism is incomplete. While we have some understanding of the genetic and developmental risk factors behind its etiology, we still do not have a good explanation for why many children develop autism. In addition, while evidence-based behavioral interventions have been created that can meaningfully improve learning and adaptive functioning, these interventions are resource intensive, take a long amount of time, and in many cases do not lead to full recovery or "typical" functioning (Jacobson & Mulick, 2000; Jacobson et al., 1998; Lovaas, 1987). Therefore, the pursuit of knowledge continues in order to better understand the etiological underpinnings of ASD and develop interventions that are more palatable and accessible to the public. Unfortunately, good science seems slow, especially when loved ones are involved. It takes time to develop and adequately test theories using rigorous experimental methods. Scientific nicety, however, does not stop eager practitioners and families from grasping onto new theories that sound good and then widely disseminating untested interventions. Widespread use can then lead to interventions being seen as "standard of care" despite the lack of quality supporting evidence. Then, when supporting evidence fails to materialize or when evidence showing a lack of effectiveness is published, it becomes difficult for people to change course.

It is imperative that scientists hold true to the fact that ideas that seem plausible at first may not be supported by scientific investigation. This can be difficult when a fair amount of time, effort, and money have been put into devising and testing a theory and when attainment of professional goals such as tenure or promotion depend on whether an idea is supported. There may be great reluctance to move on even when the evidence being gathered is not promising, leading many scientists with good intentions to cling to a theory or intervention despite the lack of support. Other practitioners may have had less noble intent from the beginning, recognizing that families with a child with an incurable developmental disability are particularly vulnerable to the promise of a miracle cure.

3.2 Misunderstanding Autism and the Non-evidence-Based Practices That Follow

The following section outlines several historical and current examples of how misunderstandings of autism have led to the creation and dissemination of a host of non-evidence-based interventions. Each section outlines a different set of theories about ASD that often seem initially plausible but upon further examination are not objectively stated, testable, or reproducible. This has not stopped these theories from becoming the basis for a range of "promising" interventions that become widely used, eating up valuable resources despite being non-evidence based.

3.2.1 Misunderstanding How Environment Affects Behavior

3.2.1.1 Getting It Wrong From the Start: The Scourge of the Refrigerator Mother

Misunderstanding autism started at its conception. Initial theories of autism put forth in the 1940s when psychodynamic theory dominated psychology, suggested an etiology based in psychogenic factors. Therefore, autism was originally thought to be caused by psychological or emotional factors in the early environment rather than neurobiological causes as we understand it today. Autism was first categorized as a subtype of schizophrenia, and Leo Kanner described his theory of "infantile autism" as "children's inability to relate themselves in the ordinary way to people and situations from the beginning of life" (Cook & Willmerdinger, 2015, pg 3). Given the popularity of psychodynamic theory at the time, these extreme social deficits were misattributed to poor parenting styles. Particularly popular at the time was the theory that autism was caused by "refrigerator mothers," who were seen as incapable of providing appropriate emotional warmth to their children. Bruno Bettelheim did much to popularize this theory in the general public and created treatments meant to rescue these children from parents who he likened to guards in a concentration camp (Cook & Willmerdinger, 2015). He advocated removing children with autism from their parents and putting them in schools and institutions that he thought would be better suited to providing needed care. Parents seeking help for children with autism in the 1950s and 1960s were often sent to psychoanalytic therapy to discover how they had somehow unconsciously rejected their child, causing their child to withdraw from the world (Baker, 2010).

Other interventions were created to more directly attempt to repair this "deficit" in attachment including play therapy and holding therapy. The theory behind holding therapy posited that the lack of bond between mothers and their autistic children created an emotional imbalance, which stopped the child being able to learn from interactions with others and led to social withdrawal (Barth et al., 2005). Holding therapy seeks to repair the mother-child bond by forcing a new emotional connection by provoking distress in the child, which then allows the mother to provide the needed comfort (Mercer, 2013b). Early iterations of this therapy provoked distress in a number of inhumane and dangerous ways including having multiple people forcibly hold a child down, wrapping the child in blankets or other material, and withholding food and access to bathroom facilities (Mercer, 2013b). Following several deaths and reports of lasting trauma, this form of holding therapy unsurprisingly fell out of favor. The next iterations of the therapy advocated for the holding to be carried out by parents with a therapist coaching. Parents are instructed to either hold the face of young children or lie on older children to encourage prolong and direct eye contact. There is no scientific evidence to support the use of any type of holding therapy, beyond a few case studies, and reports of emotional distress continue even for this "gentler" form of forced eye contact (Koocher & Gill, 2015). Given the documented physical and psychological dangers of using holding therapy, the American Psychological Association, the American Psychiatric Association, the National Association of Social Workers, and other groups have formally stated that they do not support its use (Mercer, 2013b). Several studies have also shown that, despite deficits in social skills, children with autism typically show a strong attachment to their parents, which discounts the underlying theory behind holding therapy and other psychodynamic-based interventions (Rutgers et al., 2004).

3.2.1.2 Making Robots: Misunderstanding ABA and Misguided Counter-Interventions

The rise of behaviorism and applied behavior analysis (ABA) in the 1960s and 1970s provided a new understanding of how the environment could shape learning and behavior (Arnold-Saritepe et al., 2015). While the neurobiological origins of autism were beginning to be better understood, those attempting to help individuals with autism also began to discover that the core social deficits and restricted and repetitive behaviors that were interfering with a child's ability to learn effectively could be changed through behavior modification principles. Unfortunately, like all technologies, when ABA techniques are misapplied, it can lead to poor or even adverse outcomes. The language used by behavior analysts can often be confusing or sound harsh to families and other professionals working with children with autism (Critchfield et al., 2017). Misapplications and misunderstandings of ABA have led to several false attributions including that ABA focuses only on compliance and external societal expectations, turning children into mindless robots and opening them up to be taken advantage of by others (Total Autism, 2020). Others have posited that ABA causes psychological trauma and can lead to post-traumatic stress disorder (Kupferstein, 2018), although the single published support for this misconception is riddled with methodological flaws (Leaf et al., 2018). The backlash of this misunderstanding of behavioral principles and ABA led many in the field of autism intervention to turn away from proven principles of behavior change and instead to create a host of interventions focused on building skills through more "natural interactions." Gentle teaching and developmental social-pragmatic (DSP) models are two examples of these types of therapies.

Gentle teaching, developed in the 1980s by Dr. John McGee, is a nonaversive strategy to reduce challenging behavior that purportedly focuses on making individuals feel safe, loved, and connected to their caretakers, not on changing behavior (McGee et al., 2009). It is thought that by creating these strong bonds with others in safe environments, individuals will be motivated to naturally make better choices. Interestingly, gentle teaching does still employ a number of behavioral techniques including errorless teaching, task analysis, environmental management, prompting, choice making, and fading assistance, yet they are sold in a package of promoting "bonding" and "valuing" which leads them to be more palatable to many who find the language describing ABA to be too harsh (Arnold-Saritepe et al., 2015). Unfortunately, because the focus is more on the bonding and less on the behavioral outcomes, the behavior principles often are not explained in enough detail or applied with the consistency needed to work. A review of several single-case design studies assessing the effectiveness of gentle teaching showed little positive change in behavior or even in measures of the "bond" between the child and their caregivers (Arnold-Saritepe et al., 2015). While few scientific studies of gentle teaching have been published in the twenty-first century, use of the method continues, with a few organizations continuing to promote use and provide training including Gentle Teaching International (https://gentleteaching.com/us/) and the Center for Education and Caregiving (https://www.gentle-teaching.nl/gentle/en/).

Developmental social-pragmatic (DSP) models (also called relationship-based, developmental, interactive, transactional, or interpersonal models) are another group of interventions meant to counteract the supposed sterile and impersonal nature of ABA. As the name implies, DSP models are based in developmental models and research exploring how mothers' interactions with their typically developing infants and toddlers during early communication and social skills acquisition shapes learning (Kryszak et al., 2018). These ideas reach back to early psychodynamic-based object relations theory, which posits that humans have instincts that must be fulfilled and, as infants, dependent on caregivers such as our mother to meet these needs (Zane et al., 2015). Our ability to learn and adapt to the environment is then based on these early relationships. While originators of DSP interventions have moved passed ideas of the "refrigerator mother" to acknowledge that autism is biologically based, they suggest that deficits in the individual's ability to develop the self in relation to others is the core deficit that must be corrected (Zane et al., 2015). Furthermore, they suggest that language is developed through "affect-ladened" interactions within strong relationships with caregivers, with a focus on the "function" of communication (e.g., requests, protests, sharing) rather than the "form" (e.g., eye contact, gestures, vocalizations, verbal language) (Ingersoll et al., 2005). Instead of deliberately focusing on teaching a set of skills or tasks based on the normal developmental trajectory as in ABA-based interventions, these interventions focus on "helping children to develop various capacities related to social communication in a pragmatically appropriate social context rather than targeting the behaviors themselves" (Casenhiser et al., 2013, p. 220). For example, instead of focusing on eye contact and pointing, DSP-based interventions focus on developing the "capacity" for joint attention (Casenhiser et al., 2013). Unfortunately, "capacities" are not observable, so specific behaviors must still be relied upon to know whether a capacity has been developed. Within DSP interventions, the clinician follows the child's lead and looks for intervention opportunities based on the child's interests or attentional focus. Manipulations of the child's environment to create interaction opportunities are allowed but targeting a specific response is not. Instead, all attempts at communication are responded to as if they were purposeful including "nonconventional" actions such as echolalia and jargon and "preintentional" actions such as crying, reaching, and grabbing (Ingersoll et al., 2005). Using exaggerated emotional expression, adjusting language, and indirect communication behavior (e.g., vocal imitation, descriptive modeling, self-talk, parallel talk, expansion) to match the child's developmental level are used to build reciprocity between the parent and child (Ingersoll et al., 2005). It is theorized that this more naturalistic teaching style will promote spontaneous and generalized communication skills (Ingersoll et al., 2005). This assumes that somehow the child will develop the functional communication without any direct instruction of these skills and in the absence of any prompting to use more functional communication skills. This model also assumes that the child would attend to caregivers without additional intervention in order to benefit from the exaggerated emotional expression and other modeled skills, which seems contradicted by research that shows that difficulties with imitation and observational learning are a hallmark deficit in ASD (Rogers et al., 2003). Further, the neurodevelopmental factors associated with ASD itself have already prevented the child from benefiting from the normal experiences associated with normal rates and types of learning (Lovaas, 2003). Development is the culmination of experience and growth. Development itself as an intervention concept is irrelevant because it merely describes a sequence of changes that happen, that is, in normal development in normal contexts and that result in normal development, all as statistically defined. While understanding a typical sequence of development is important for developing a sequence of appropriate treatment targets based on the child's age and current abilities, it does little otherwise to inform an intervention method. It also ignores the neurodevelopmental deficits that underlie the emergence of autism in otherwise normal family contexts.

There are several DSP-based models, with some of the most well-known being Developmental Individualized Relationships-based (DIR)/Floortime-based interventions (Greenspan & Wieder, 2006), Relationship Development Intervention (RDI) program (Gutstein, 2009), and Play and Language for Autistic Youngsters (PLAY) Project Home Consultation model (Solomon et al., 2014). The research body supporting DSP-based interventions, however, is unimpressive. A few randomized control trials (RCTs) and several smaller studies have shown differences between children receiving DSP-based interventions versus those receiving treatment as usual (TAU), but only on highly specific parent report or observational measures of social/emotional abilities often created specifically to measure the changes of DSP-based interventions (Carter et al., 2011; Casenhiser et al., 2013; Green et al., 2010; Pajareya & Nopmaneejumruslers, 2011; Solomon et al., 2014). No changes on standardized measures of language, adaptive skills, or IQ/cognitive abilities have been found with DSP interventions (Green et al., 2010; Smith & Iadarola, 2015; Solomon et al., 2014; Zane et al., 2015). This lack of evidence has not discouraged their use, however, with a recent survey indicating that about 25% of the study sample were using Floortime or RDI (Becerra et al., 2017).

3.2.2 Extreme Beliefs Lead to Extreme Interventions

3.2.2.1 Unclean to Unfit: Early Negative Beliefs About Disabilities Led to Mistreatment

Although ASD was first described in the 1930s and 1940s (Kanner, 1943), misperceptions about developmental disabilities have existed for centuries. As far back as Ancient Greece, evidence exists of cultures attributing disability as a punishment from a higher power for sins either in a past life or perpetrated by the family of the person with the disability (Albrecht et al., 2001). Mental illness and developmental disabilities have also been historically misinterpreted as possession by spirits or devils or related to witchcraft (Hemphill, 1966). These early extreme beliefs led to a number of horrible interventions from burning people at the stake to traumatic exorcism practices meant to "heal" the person (Mercer, 2013a).

Into the 1900s, those with disabilities were often seen as of "unfit" moral character (Conrad, 2020). Disability was framed as something intrinsically and unchangeably wrong with the person, and therefore there was no point in attempting to intervene. While some institutions focused on educating those with disabilities, many primarily existed for the confinement and management of those with developmental disabilities to keep them separated from the rest of society (Conrad, 2020). Children with disabilities including autism were often removed from their families at a young age and placed in institutions and segregated from society. They were also barred from public education because they were believed to be "uneducable." Lack of education compounded developmental disability to result in further learning deficit. Fortunately, with the deinstitutionalization movement in the 1970s and creation of laws such as the *Individuals with Disabilities Education Act* (IDEA), attitudes toward those with intellectual disabilities have generally improved, leading to broad public support for more inclusionary educational practices and better recognition of human rights for those with intellectual disabilities (Scior et al., 2013).

3.2.2.2 A Road Paved with Good Intentions: Unrealistic Positive Beliefs Lead to Poor Intervention

Not all extreme beliefs about children with autism are negative, but hopeful, positive misconceptions can be even more insidious because they are often harder to discredit. We all want to believe in miracles at times. This is especially true for families told that their child has a lifelong neurodevelopmental disability that could significantly impair prospects for achievement and independence. People with autism vary significantly in their cognitive and adaptive functioning as adults, ranging anywhere from successful professionals living independently to having a marked intellectual disability and needing one-on-one support for the majority of daily tasks. While many factors play a role in how severely a person is affected, it can seem unfair to families who are trying to create the best life possible for their child. This has led some to grasp on to the belief that all children with autism have high underlying cognitive and verbal abilities, but that some people's abilities are somehow "locked" away, a belief shamelessly promoted by purveyors of miracle cures. According to this belief, the person with autism has the same abilities as everyone else but is unable to communicate their thoughts and abilities in the same way as a typical person. Some have gone so far as to suggest that those with ASD not only have average abilities but that they actually have paranormal powers such as telepathy. Initially, it may seem harmless to allow people to think that their children can do more than they are actually capable of, and it may even feel cruel to crush these dreams by challenging such beliefs. Such extreme beliefs, however, are fertile breeding grounds for the creation and promotion of non-evidence-based treatments.

Introduced in Australia during the 1980s (Crossley et al., 1980), Facilitated Communication (FC) has become one of the most well-known controversial treatments for ASD. Starting from the idea that all autistic people want and are able to communicate, proponents of FC vaguely described that autistic people suffered from a "praxis" that stops them from being able to communicate both verbally and nonverbally (Biklen, 1990; Jacobson et al., 1995). The intervention then is to "facilitate" the person's communication by taking their hand or arm and guiding them to spell out what they want to say on a keyboard, letter board, or adapted communication device. The facilitator is supposedly not moving the individual or cuing them in any way. Somehow (through a mechanism never fully explained) the facilitator is "supporting" the person's hand or wrist or touching them on the shoulder, which then miraculously allows the person with autism to type out full sentences, complete college, write elaborate poems, and express political opinions. All this was sometimes said to occur without any history or opportunity of prior learning by the individual, as if such skills just appear instead of resulting through gradual learning and practice (Biklen, 1990). Like many non-evidence-based interventions, support was initially provided through a set of papers by a limited number of authors describing the miraculous results of FC through emotionally charged accounts of nonverbal individuals suddenly communicating in full sentences (Biklen, 1990, 1992; Biklen et al., 1992, 1995). What the articles did not include was any convincing scientific evidence. The authors explained that the only way the therapy worked was if the individual felt supported by the facilitator and that the best facilitators were those who had an unshakable *core belief* that every individual could communicate. This suggests that FC only works for those who believe it works, a position that many found suspect (Jacobson & Mulick, 1994).

Several studies followed debunking FC using experimental methods such as asking people to name pictures that their facilitator could not see or showing the person with ASD and the facilitator a series of picture sets that sometimes matched and sometimes did not (Jacobson et al., 1995; Wheeler et al., 1993). The only "correct" answers typed were for the pictures the facilitator could also see, showing clearly that the facilitators were unknowingly determining what was being typed (Jacobson et al., 1995; Wheeler et al., 1993). Proponents of FC were not deterred by such glaring evidence indicating the therapy was a sham, arguing that those using FC were unable to perform in these "confrontational naming" tasks because they challenged the person to prove their ability to communicate. Some went even further to suggest that people with autism were confused during these studies because they were really reading the minds of their facilitators at the same time as they were attempting to type (Haskew & Donnellan, 1993). This argument continued, with several more quality experimental studies published that showed no support for FC being countered by a handful of qualitative and mixed methods studies attempting to support FC validity. A review of FC studies from 1995 to 2000 (Mostert, 2001) comes to the firm conclusion that there was never any valid evidence to support FC.

Despite clear evidence indicating it is not a real treatment, FC continues to live on. The **Inclusion and Communication Initiatives** (formerly the Institute on Communication and Inclusion, which was formerly the Facilitated Communication Institute), housed in the Syracuse University's Center on Disability and Inclusion, continues to provide training for those who would like to be facilitators of FC (https://disabilityinclusioncenter.syr.edu/). Articles also continue to be published in support of FC, although still grossly lacking in any empirical evidence to back these claims. Instead they focus on case studies (Faure et al., 2021), facilitator opinion (Sipilä & Määttä, 2011), and the *facilitated* testimonials of the people with ASD (McKee & Gomez, 2020). This persistence of FC illustrates an all too common pattern with unsupported interventions, where they continue to live on despite a lack of actual evidence supporting their use. Therefore, there continues to be a need to publish updated research papers (Saloviita, 2018) and professional statements, such as those by the American Psychological Association (1994), American Academy of Child and Adolescent Psychiatry (2008), and American Psychiatric Association and the American Speech-Language-Hearing Association (2018), continuing to debunk and denounce the use of such treatments to help keep families and clinicians from falling for treatments making promises too good to be true.

Believing that animals can cure autism is another extreme belief that sounds so nice on the surface. Many people like animals. Many people with autism also like animals. Being around animals causes many people, including many autistic people, to feel good. This has unfortunately led to the leap in logic that animals can be used as a way of treating autism. Animal-assisted intervention (AAI) is a broad term to refer to any intervention using an animal to provide therapeutic benefit based on a positive relationship between the client and the animal. The theory behind AAI is that animals are a source of calming, nonjudgmental support. Therefore, interaction with animals can help with communication and social interaction. AAI includes both animal-assisted therapy, where an animal is employed in a treatment protocol with set therapeutic goals, and animal-assisted activities, which involves pairing an animal with a person with the goal of general positive benefit but with no set activities or goals. It has been difficult to compile a unified set of results regarding AAI, as the treatment is difficult to quantify due to a large amount of variation in practice (Davis et al., 2015). It can be provided by a range of clinicians (e.g., psychologists, occupational therapists, speech therapist) and non-clinicians (e.g., animal trainers, riding instructors, "dog-guides") using a range of different animals including dogs, horses, dolphins, guinea pigs, llamas, and rabbits. How often the therapy takes place and what activities are done also vary widely, with durations varying from a few weeks to several years. Reviews of the literature report some positive and many mixed findings (Davis et al., 2015; Marino & Lilienfeld, 2007; O'Haire, 2013; Trzmiel et al., 2019). More importantly, the vast majority of studies were found to have a host of methodological flaws including nonexperimental designs, use of anecdotal evidence, outcome measures designed for the specific intervention, lack of control for the effect of other concurrent interventions, no measurements of treatment fidelity, and lack of detail describing the independent variables. Concerns were also noted for safety risks to both participants and animals.

This mixed bag of poor evidence purporting positive outcomes leads to a conundrum seen with many unsupported treatments. A lay person looking at the research literature would see numerous studies suggesting that AAI has positive to "mixed" results. Significant methodological flaws, however, mean that none of these studies show convincing evidence that AAI leads to any objective changes in social or communication variables related to ASD. Therefore, despite decades' worth of research resulting in no conclusive evidence supporting AAI, this treatment continues to be referred to as "unproven" (Marino

& Lilienfeld, 2007), in need of more evidence (Davis et al., 2015; Trzmiel et al., 2019), or even "promising" (O'Haire, 2013) because there are also no published experimental studies showing firmly that it does not work. As a result, many families continue to invest their limited time and money into this unsupported intervention, which makes sense, as one conclusion that can be drawn from parent and clinician reports is that most children like interacting with animals (Marino & Lilienfeld, 2007) even if this interaction does not lead to any meaningful change in symptoms related to ASD.

3.2.3 Biological Pseudoscience

Pseudoscience is defined as "a collection of beliefs or practices mistakenly regarded as being based on scientific method" (Lexico, 2021b). Pseudoscience explanations often appear when there is an incomplete understanding of a disorder. Our current understanding of ASD indicates that the disorder is caused by a combination of genetic and environmental factors affecting neurodevelopment (Loke et al., 2015), but we still lack understanding into the biological processes that are behind this interaction. In pursuit of these answers, researchers turn to exploring all the possible ways people with ASD vary from typically developing people and then develop theories on how these biological differences may explain ASD. These theories then are tested often starting with animal models and human studies with very small sample sizes and then in controlled experiments with larger human samples to aid in generalization. This process takes a long time. In the meantime, these theories often get taken up prematurely by those overeager for answers or looking to make money off a vulnerable population, who go on to develop treatments based on these unproven possibilities. These theories and their related treatments often sound plausible and "scientific," leading to families desperate for a "cure" to try them out, despite the lack of any convincing scientific evidence that they are worth the investment. The next few sections will outline some of the most well-known examples of pseudoscience in practice.

3.2.3.1 Sensory Processing Disorder and Related Pseudoscience Interventions

A large and prevalent group of pseudoscience interventions revolve around the idea of "sensory integration" or "sensory processing" problems. Sensory processing broadly (and vaguely) refers to the neurobiological organization and interpretation of sensory stimuli coming from the body and the environment (Borkowska, 2017). Therefore, atypical sensory processing involves inappropriate responses to sensory stimulation. Sensory processing disorders (SPDs) are then defined as a lack of ability to use information received by the senses in order to efficiently function in everyday life. This can include any combination of an extremely wide array of possible symptoms including: being overly sensitive or under-reactive to touch, movement, sights, or sounds; being easily distracted; having social and/or emotional problems; having an activity level that is unusually high or unusually low; showing physical clumsiness or apparent carelessness; being impulsive and lacking in self-control; having difficulty making transitions from one situation to another; having the inability to unwind or calm oneself; having a poor self-concept; and/or having delays in speech, language, or motor skills (Jacobson et al., 2015). While diagnosing SPDs is common in the field of occupational therapy, it remains unrecognized in the most well-known and widely used medical, psychiatric, or psychological nomenclatures including the *Diagnostic and Statistical Manual, fifth edition* (DSM-5), and the *International Classification of Diseases, tenth edition* (ICD-10). This is because, while the long list of symptoms captured under SPD often do occur and can be quite debilitating, they are already well explained by other diagnoses, such as attention deficit hyperactivity disorder (ADHD), ASD, or anxiety disorders. SPD is rarely diagnosed independently of another diagnosis (Borkowska, 2017). There is also no empirical evidence to suggest that most of these behaviors are "sensory" in nature or have anything to do with "integration," either within or of the nervous system (Jacobson et al., 2015). Unfortunately, that has not prevented the creation of a host of interventions meant to treat these sensory problems.

Sensory integration therapy (SIT) was first put forth by Jean Ayres in the 1960s and 1970s (Ayres, 1963), and it has gained significant popularity in school settings and with occupational therapists. SIT suggests that physical activities and exercises can help children learn to interpret and use sensory information more effectively. The focus is not on changing learned associations by modifying the environment, as in behavioral interventions, but on modifying how the central nervous system processes all problematic sensory input. Specific interventions include deep brushing, swings for vestibular input, access to different textures, bounce pads, scooter boards, weighted vests, and generally increasing or decreasing the "sensory diet," depending on the presumed needs of the child. Many studies have been published attempting to show the effectiveness of SIT therapies, although systematic reviews continue to be published that conclude that there is little to no evidence supporting actual changes in behavior (Hyatt et al., 2009; Lang et al., 2012; Weitlauf et al., 2017). Direct comparisons of SIT and behavior therapy show that behavioral interventions reliably decrease challenging behavior, while SIT has no demonstrable effects on the same behaviors (Addison et al., 2012; Cox et al., 2009; Devlin et al., 2011; Devlin et al., 2009; Lydon et al., 2017). Despite a vast body of evidence showing little effect, sensory integration remains one of the most frequently used interventions available for children with ASD, with an estimated 95% of occupational therapist using this intervention (Schaaf et al., 2018).

Another group of treatments with roots in the sensory differences seen in ASD are audio integration treatments (AIT), which posit that behavior can be influenced by how we hear, and hypersensitive hearing can limit people's ability to learn and pay attention. AIT was first developed in France in the 1960s and became popular in the United States for the treatment of ASD in the 1990s (Mudford & Cullen, 2015). Classic AIT attempts to reduce hypersensitive or hyperacute hearing of children with autism through exposure to recorded music played at loud volumes, from which the sound frequencies supposedly identified as being associated with "hyperacuity" have been removed (Sinha et al., 2011). The Tomatis Method attempts to achieve the same aim using a device called the "electronic ear" to deliver an electrically modified human voice (Sinha et al., 2011). Finally, Samonas Sound Therapy uses a combination of modified human voices, music, and sounds of nature to reduce sensory difficulties (Sinha et al., 2011). While this theory and treatment mechanism make no sense in the light of present knowledge of auditory functioning, a few controlled studies have attempted to illustrate therapeutic benefits from the use of AIT (Edelson et al., 1999; Edelson & Rimland, 2001), although outcome measures have been primarily behavior checklists completed by parents or therapists. A few case studies have reported changes in language and behavior functioning, although there was no control to account for other therapies or maturation (Gerritsen, 2010). Comprehensive reviews of the AIT literature concluded that AIT showed no meaningful change in any outcome including language, cognitive skills, or behavior (Sinha et al., 2011; Villasenor et al., 2018). Furthermore, there were some concerns that the therapy could actually harm hearing if done inappropriately (Sinha et al., 2011). Like many non-evidence-based treatments, however, AIT continues to be repackaged and presented as something new, with the most recent iteration titled Integrated Listening Systems (Schoen et al., 2015). This treatment combines both the hallmark modified sounds with other movement-based sensory interventions. So far only one uncontrolled pilot study has been published looking at the use of this treatment in ASD (Schoen et al., 2015), but that has not stopped it from already being widely marketed to families as a possible intervention.

3.2.3.2 Neuroinflammation Theory and Related Pseudoscience Treatments

Neuroinflammation theory of ASD suggests that autism is caused by the prolonged inflammation of the central nervous system that leads to changes in brain functioning (Matta et al., 2019). Support for this theory remains slim at this time, with proponents primarily relying on data from postmortem studies in people with autism and animal models (Matta et al., 2019). Despite this paucity in support, several treatments applied to children with ASD focused on decreasing this supposed inflammation.

Supporters of cranial osteopathy claim that through gentle manipulation of the bones of the skull, cranial osteopathy can restore the “rhythm” of the cerebrospinal fluid and help its circulation, which will in turn reduce inflammation (Levy & Hyman, 2008). What and where this “disruption in rhythm” is varies across people and is supposedly determined as the therapist becomes familiar with each client’s various tensions, vibrations, and natural rhythms through touching and massaging the person’s head. While the therapy has been around since the early 1900s, it was introduced as a treatment for ASD in the 1970s despite very little research looking into its safety and effectiveness. In the four decades that this treatment has been used with countless children with ASD, there have been no randomized control trials showing any definitive support for this treatment reducing symptoms related to autism (Kratz et al., 2017; Levy & Hyman, 2008). There have been a number of case studies, however, summarizing that the families and practitioners who invest their money and energy into doing the therapy like it (Kratz et al., 2017), despite the lack of evidence of actual behavior change.

Another therapy focused on reliving neuroinflammation, this time by relieving irritation to the spinal nerves through proper spine alignment, is chiropractic care. This treatment also remains unsupported for treating symptoms of ASD. While there are several case studies, cohort studies, and even a supposed “randomized control” study stating that chiropractic care led to positive changes in children with ASD (Alcantara et al., 2011), these studies were all significantly flawed. The primary outcome measure in the majority of studies was parent or clinician *unblinded* report and none of the studies included a control group. Therefore, there was no way of accounting for the effect of other interventions that the child may have been receiving during the time each study was conducted or even the effects of natural maturation. Even in the RCT, the only groups compared were two different chiropractic treatments, and there was no objective measure of behavior change.

A third treatment with the goal of reducing neuroinflammation is hyperbaric oxygen therapy (HBOT). HBOT involves enclosing an individual in a pressurized chamber, which allows the person to inhale up to 100% oxygen at a pressure greater than one atmosphere. This pressurization of oxygen allows high concentrations of oxygen to be delivered deeper into tissues than would normally occur. HBOT is validated for use in treating a variety of conditions including decompression sickness, as well as inflammatory conditions such as chronic diabetic ulcers. Advocates of using HBOT to treat ASD theorize that HBOT can decrease neuroinflammation and therefore reduce symptoms of ASD. As with many pseudoscience treatments, several initial case studies and uncontrolled pilot studies indicated some possible benefits (Rossignol et al., 2012). As more rigorous studies were published, however, no support for this therapy was found in the treatment of autism symptoms (Goldfarb et al., 2016). Furthermore, the US Food and Drug Administration has put out consumer updates warning families that HBOT is not approved for treating autism and could be potentially harmful (United States Department of Health and Human Services, Food and Drug Administration, 2019). Despite the lack of evidence, concern for harm, and the high cost, HBOT is relatively easy to find through an Internet search and continues to be pushed as a miracle cure for autism and a host of other developmental disabilities.

3.2.3.3 Poor Gut Health, ASD, and Related Pseudoscience

For the last several decades, various theories have come about attempting to link ASD to poor gut health. Gastrointestinal (GI) distress appears to be a common complaint in children with ASD, with almost half of individuals with ASD reporting some level of GI distress (Holingue et al., 2018). Given this high occurrence, researchers have begun exploring this connection, and multiple theories attempting to link various GI concerns as possible causes of ASD have appeared.

One well-known pseudoscience theory based on poor gut health in autistic people is the opioid excess theory of ASD. This theory posits that ASD could be caused by excess opioid activity in the brain, which is related to digestive problems with particular proteins in food (Mari-Bauset et al., 2014). It is known that certain types of proteins are related to opioid activity in the intestines. Based on this, it has been theorized that the intestinal mucosa in autistic people could be more permeable. Having such a "leaky gut" could possibly allow proteins associated with opioid activity to move intact into the bloodstream. If these proteins were then transported across the blood-brain barrier in large enough quantities, it could affect brain functioning. Multiple studies have shown no support for this theory by highlighting that people with ASD do not have a higher concentration of opioid peptides in plasma, the nervous system, or urinary excretion (Mari-Bauset et al., 2014). Despite lack of support for the underlying mechanisms of the opioid excess theory, multiple popular dietary interventions have been created around this pseudoscience explanation.

Elimination diets are one such intervention that has grown particularly popular. In particular the gluten-free and casein-free diet continues to be a popular alternative medicine option, with a recent study indicating that about 20% of families with ASD are using this intervention (Akins et al., 2014). This diet involves not eating any food containing gluten (e.g., wheat, oats, barley, rye flours, bread, cereals, pasta) and eliminating the intake of dairy products, which all contain casein. The concern is that gluten and casein could be sources of "exorphins," the peptides with opioid activities that concern proponents of opioid excess theory. While there is plenty of testimonial evidence from families and providers purporting changes in children after the introduction of such diets, these diets remain unsupported in RCTs using objective measures of behavioral change (Mari-Bauset et al., 2014; Millward et al., 2008; Piwowarczyk et al., 2018).

Digestive enzyme therapy also has its roots in opioid excess theory. Supporters of digestive enzyme therapy believe that taking particular enzymes, which reportedly break down exorphins into smaller peptides that do not have opioid activity, can improve the digestion of proteins like gluten and casein (Saad et al., 2015). This in turn could reduce the characteristics of autism. So far, two RCTs have focused on evaluating the effectiveness of digestive enzyme therapy. The first found no evidence of improvement in symptoms and skills related to ASD (Munasinghe et al., 2010). The second did find a small but significant improvement in scores on the childhood autism rating scale (Saad et al., 2015), although both articles have been noted to have a moderate risk for bias (Sathe et al., 2017). Given this and the mixed results of these two trials, there is little support for the wide use of these enzymes.

Several other vitamins and dietary supplements have also been put forth as possible treatments for ASD under even vaguer theories related to correcting poor gut health, including secretin, Vitamin D, Vitamin B6 and magnesium, antifungal agents, and probiotics. These treatments follow a similar cycle often seen in non-evidence-based interventions. They tend to gain popularity based on a few initial studies, often case studies done by a small group of authors documenting miraculous results. Use then becomes widespread, long before quality studies have been completed. Years later, controlled, double-blinded research studies with quality outcome measures show no support for the treatment of ASD, but by then it is difficult to battle the flood of testimonial evidence and marketing touting the intervention as the miracle cure families have been waiting for.

One example of this cycle is the rise and fall of secretin supplementation to treat ASD. Secretin is an endogenous gastrointestinal polypeptide composed of 27 amino acids that stimulates the secretion of digestive fluids from the pancreas. Porcine secretin injections are used by gastroenterologists during diagnostic tests to determine the etiology of intestinal complaints. Secretin receptors have also been found in the brain, although their function is not well understood. Secretin supplementation to treat ASD became popular after a case study was published in 1998 documenting large improvements in the language and social skills of three children with ASD after they received porcine secretin injections as part of routine gastrointestinal diagnostic tests (Sokolski & Wachtel, 1998). Sokolski and Wachtel (1998) theorized that these improvements were related to a brain-gut interaction involving the secretin receptors in the brain, although they did indicate that more research was needed to better understand this mechanism. Use of secretin supplementation quickly became widespread following this study, with estimates indicating that thousands of children were receiving secretin a year later (Esch & Carr, 2004). Unfortunately several years later, the completion of multiple randomized controlled studies showed no evidence of symptom improvement on several measures of core ASD symptoms, as well as no improvement in communication, behavior, affect, and visuospatial skills (Krishnaswami et al., 2011; Williams et al., 2012). The evidence was so compelling that the reviews concluded that there was no need for further study of secretin as a treatment for ASD barring any drastically new evidence. It does appear that this evidence has also been compelling enough to actually curb use of this supplement for now with only one family (i.e., 0.2% of the sample) indicating use in a recent survey (Akins et al., 2014).

Systematic reviews show a similar lack of quality evidence for the use of probiotics (Ng et al., 2019), Vitamin B6 and magnesium (Li et al., 2018; Nye & Brice, 2005), and omega 3 fatty acids (James et al., 2011; Li et al., 2018) to treat the core symptoms of ASD. Vitamin D seems to be making its way currently through this cycle with a small group of researchers showing initially highly promising results in a case study and further studies using parent report or *unblinded* clinician ratings of behavior. This group also attempted to publish a randomized control study; however, several inconsistencies in the results led to an examination of the data by the journal's editors. The results found in the paper were unable to be replicated by the editors, and so the article was officially retracted (Saad et al., 2019). Unfortunately, this retraction came after a review of the connection between vitamin D and ASD was published by some of the same authors in which they cite this article as key support for this intervention (Jia et al., 2018), illustrating how bad science can continue to proliferate even when steps are taken to correct it.

Prevalence of elimination diets and the use of vitamins and dietary supplements to attempt to treat ASD remains high despite the lack of evidence supporting these interventions, with 25% of a recent sample of families endorsed using some sort of dietary supplement to treat their child's autism (Akins et al., 2014). Continued high use is likely due to a feeling of "what's the harm in trying?" Diet is something many families feel like they have more control over, and diet-based interventions have no waitlist. Unfortunately, these interventions are not cost-free. Supplements and special foods are expensive, and money wasted on these interventions is money that cannot be more effectively invested in other supported treatments. Second, given that many children with ASD are already picky eaters, they can be at an even higher risk for malnutrition when large groups of foods are eliminated from their diet (Mari-Bauset et al., 2014). Similarly, the side effects of many dietary supplements are not well understood, particularly on the developing brain of a child. Finally, special diets could further limit certain social opportunities or lead to further stigmatization from peers (Millward et al., 2008). The ease of access to these interventions, however, makes them irresistible to some families, at least to try initially. Then, given the amount of effort and resources that go into sticking to a difficult diet or following a daily supplement regimen, it is not surprising that families would be susceptible to placebo effects, seeing change when it is not actually there.

3.2.3.4 Heavy Metal Poisoning and the Vaccine Controversy

Perhaps one the most insidious pseudoscience theories related to autism is the idea originally put forth by Andrew Wakefield that autism is caused by common childhood vaccines (Wakefield et al., 2010). Wakefield's exact theory of how vaccines cause ASD has changed over time. His initial research was an extension of the opioid excess theory, positing that the measles part of the measles mumps, and rubella (MMR) vaccine was causing ASD by creating a “leaky gut” (Wakefield et al., 2010). This original work was shown to be largely falsified, and the original article was retracted due to severe methodological flaws including not having approval of an Institutional Review Board (Caplan, 2009). The idea that autism was caused by the vaccines has persisted, however, with concern then turning to thimerosal, a preservative contained in several common childhood vaccines. The worry was that the thimerosal would somehow stay in a child’s body after the vaccine was given and cause mercury poisoning. One of the most likely reasons for this persistence is timing of childhood vaccines with the presentation of ASD symptoms. A subgroup of children with ASD goes through a period of apparently typical development and then loses skills such as language and eye contact around 18 months of age, which happens to be when the MMR vaccine is given. While there have been several studies done showing that this timing is an unfortunate coincidence (related to the fact that clear symptoms of ASD are difficult to discern until then) and that vaccines do not cause autism (Madsen et al., 2003), this fear has led to a sizable minority of people choosing not to vaccinate their children.

Despite the lack of evidence connecting heavy metal poisoning and autism, enterprising individuals have devised interventions focused on treating this fake problem. One such treatment is chelation. Chelation treatment uses various chemical substances injected into the bloodstream for the purpose of binding and then withdrawing specific metals from the person’s body, which are then excreted in the urine (Davis et al., 2013; James et al., 2015). Unfortunately, these chemical substances that are supposed to rid the body of potential poisonous metals are also associated with several potential serious side effects, including fever, vomiting, diarrhea, loss of appetite, hypertension, hemorrhoid symptoms, metallic taste, hypotension, cardiac arrhythmias, and hypocalcemia, the latter of which can in turn cause fatal cardiac arrest (Davis et al., 2013). Reviewing the research studies looking at chelation also shows that it is unsupported. The research body consists of a few case studies and poorly designed experimental studies (i.e., no control group, no control for additional interventions such as behavior therapy), which primarily used anecdotal parent report as an outcome measure, and even the majority of these poor studies showed mixed results (Davis et al., 2013; James et al., 2015). Given the lack of evidence and the high potential for danger, the FDA has issued statements warning consumers away from using chelation to treat autism (United States Department of Health and Human Services, Food and Drug Administration, 2019). It appears that use of this therapy is now minimal, with only 4.4% of families endorsing using this treatment for their child with autism (Akins et al., 2014), although given the dangers even this seems like far too many.

3.3 Stopping the Use of Non-evidence-Based Practices

The battle against non-evidence-based practices is ongoing. It is the duty of all practitioners who work with individuals with ASD and their families to continue this fight. In order to do this, we must first understand why families might choose non-evidence-based treatments. Next, we have to develop strategies for successfully disseminating information of evidence-based treatment while combating misinformation in a way that changes opinions rather than alienates those we are trying to help.

3.3.1 Why Do Families Choose Non-evidence-Based Practices?

Research is mixed on whether there are specific factors that influence families’ choice of non-evidence-based practices, although much suggests that parents from a variety of financial, educational, and familial backgrounds are all equally likely to choose unsupported treatment options (Miller et al., 2012). Families report that the amount of information on autism and related interventions is overwhelming and often conflicting (Frame & Casey, 2019), and the average parent does not have the time, resources, or expertise to review all available information to make good decisions (Matson et al., 2013). Families often do not weigh information in the same way as clinicians or researchers. Families frequently rely on testimonials and recommendations from other parents and parent support groups more than scientific sources (Matson et al., 2013; Miller et al., 2012). For example, a parent doing research on ABA may be weighing a research study in a peer-reviewed journal showing the effectiveness of ABA against a video posted on social media of another parent saying ABA causes a child to be "a robot" or caused their child to have PTSD symptoms. Such accounts would lead many parents to see the evidence for ABA to be mixed at best. Further adding to the confusion, professionals including physicians, educators, psychologists, and speech, occupational, and physical therapists often recommend unsupported treatments (Frame & Casey, 2019; McCormack et al., 2020; Miller et al., 2012).

Good treatment is also hard to get, and outcomes are incremental, long term, and unpredictable. Accessing ABA often takes incredible resources and organizational skills to identify possible providers and work out funding possibilities. A full ABA program is expensive, and insurance coverage is often suboptimal, leading to families having to cobble together funding from scholarships and waivers or even having to fund treatment out of pocket. Waitlists are also often very long and provider turnover is high (Frame & Casey, 2019), and there are many areas of the county, such as more rural areas, where access to ABA is nonexistent (Matson et al., 2013). These barriers leave many families feeling understandably frustrated and lead to them giving up on accessing quality treatment. Even for those families who can access ABA, the lure of non-evidence-based treatments is often too tempting. Families want to do everything they can to help their child. Therefore, they often start multiple treatments at once and then have difficulty determining what is actually working (Matson et al., 2013).

All of these factors create space for non-evidence-based treatments, particularly those offering quick fixes for much less effort. Unfortunately, this leads to families wasting precious resources including their time, effort, and money on intervention that at the very least will lead to little to no positive change. At their worst, these interventions can lead to harm. Therefore, it is the responsibility of all those who work with families with children with ASD to take steps to advocate for better access to treatment and help counter misinformation to help families make the best choices for their children.

3.3.2 How to Address Misinformation

We have explained the difference between plausible, science-based information on autism and approaches that have either not panned out or that never made sense to begin with. There are many more that we have not mentioned. Families and even non-specialist professionals are often tempted to attend to the promise of new, attractive ideas that seem promising. There is a saying worth remembering, "if something seems too good to be true, it probably isn't." Obviously, that is not enough to protect us from well-meaning but wrong-headed or outright fraudulent offers of ineffective help. But where should people look for information about approaches we have not covered or those yet to come? And how do we correct misinformation and best guide families to make informed decisions? Given our current cultural climate of mis- and dis-information, many national organizations are putting together guidelines on how to identify and correct misinformation (e.g., https://ethicalleadership.nd.edu/news/how-to-stop-the-spreadof-misinformation/, https://www.hhs.gov/sites/default/files/surgeon-general-misinformation-advisory.pdf, https://www.npr.org/2021/07/21/1018874736/how-to-correct-misinformation). Here is a summary of some of the main points.

Inoculate families before they encounter misinformation. This is ideally done close to when a child receives a diagnosis but can also be used as an introduction at any time when treatment options are being discussed. Give families a shortened overview of what constitutes good evidence. It can also be helpful to give an overview of some of the common misperceptions they will likely hear as they explore social media or talk to other families and professionals and then evidence for why these treatments are unsupported.

Start with listening. When families state incorrect information or suggest that they are about to make a bad choice on treatment, we naturally want to correct them as swiftly as possible. Unfortunately, immediately arguing with families or discounting misinformed treatment choices will often lead to them doubling down on their beliefs rather than being open to change. Instead, ask them to explain why they have chosen a particular non-evidence-based treatment or why they might not be interested in an evidence-based treatment option. Once you understand their reasoning, you can better present correct information that targets those specific concerns.

Give families better options to find information. Much of the vast resource of the Internet is devoted mainly to marketing of products, whether or not any specific item of content is labeled as such. YouTube, Twitter, and Facebook are not good places to do medical research. Public health and other government agencies like the Center for Disease Control and the National Institutes of Health often have a great deal of information about the things that are well understood and scientifically validated. These agencies take some time to consider a given topic or treatment, necessary time needed to accumulate information based on solid and repeated scientific findings, and will not be found to have reacted to the very latest fads or claims. Similarly, main line scientific and professional societies like the National Academy of Science, the American Academy of Pediatrics, the American Psychological Association, or the Association for Behavior Analysis International all present useful evidence-based information on their web sites and in publications.

Misinformation is not easy to identify short of access to a university library and the skills necessary to understand how to check claims against the relevant background and methodological standards of valid evidence. There are some watchdog groups that do try to assist consumers of autism information in this regard. The Cambridge Center for Behavioral Studies (https://behavior.org/) has extensive information about autism in the form of Internet postings and publications. A similar group devoted specifically to autism-related information is the Association for Science in Autism Treatment (https://asatonline.org/).

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4 Ethical Decision-Making and Evidenced-Based Practices

Videsha G. Marya, Victoria D. Suarez, and David J. Cox

4.1 Introduction

To implement an evidence-based practice (EBP), behavior analysts practicing within the autism intervention field (hereafter referred to as applied behavior analysts) must first select one EBP from all available EBPs. Selecting an EBP requires at least three sets of behaviors. One set of behaviors are those that produce information about the current context and the relevant EBPs. A second set of behaviors are those related to evaluating the obtained information to determine what is "best" or "right" for the client in the current context. A final type of behavior is selecting the EBP to implement. Thus, to understand how an applied behavior analyst selects the right EBP for a client requires that we understand theoretical and empirical work spanning decision-making (i.e., the chain of behaviors that alter the probability of a terminal response; Skinner, 1953), ethics (i.e., what is the right decision), and choice (i.e., the act of selecting the EBP).

There are many ways that researchers attempt to aggregate empirical findings and theoretical arguments spanning multiple areas. A common approach to aggregating research findings and theory is to develop models of the phenomenon of interest. Many different types and approaches to model building exist; however, models typically allow the model user to describe, predict, and control some phenomenon of interest more succinctly, efficiently, and parsimoniously than if the model components were considered independently (e.g., Frigg & Hartmann, 2020). Here, we are interested in models related to decision-making, ethics, and choice from available EBPs.

The content of models varies depending on the function of the modeler's behavior (e.g., Cox, 2019a). In this chapter, we focus on two types of practical models of ethical decision-making with EBPs: causal models and decision models (Table 4.1). Causal models help the model user to describe, predict, and control a phenomenon of interest. Causal models do this by explicitly labeling the variables that influence the phenomenon of interest as well as the relationships between those variables. Practically, causal models describe why the phenomenon occurs, the independent variables that can be manipulated to influence the dependent variable, and the

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Table 4.1 Purpose and components of causal and decision models for decision-making

Model type	Purpose	Components	Use
Causal	Identify and outline *how* and *why* behavior is evoked, maintained, increased, or decreased	Variables known to influence decision-making (e.g., rules, experienced contingencies, available alternative behaviors, effort, delay, and likelihood of reinforcement/punishment)	Describe, predict, or control decision-making
Decision	Identify and outline *what* behaviors the user should emit to answer a question the model user is not fluent in answering	Questions and statements that guide the user through the chain of behaviors necessary to make a decision	Help the user make an optimal decision based on available information

expected direction of change in the dependent variable when those independent variables are manipulated.

Decision models help the model user to make a decision. Decision models help the model user to choose between the available alternatives in a situation so that all potentially relevant information is considered before making a choice. The findings of researchers in behavioral economics over the past several decades suggest that many organisms fail to consistently make the optimal decision (e.g., Fantino et al., 1997; Pattison & Zentall, 2014; Sofis et al., 2015; Zentall, 2016). The purpose of decision models, then, is to help the model user avoid making a suboptimal decision. Stated differently, accurate decision models reduce the probability of bias decisions and increase our sensitivity to relevant environmental variables that indicate what consequences are likely to result from our decision.

Causal models and decision models are interrelated when ethically making decisions about EBPs. To accurately predict and control which EBP is selected, the causal modeler likely needs to know whether the decision-maker has access to a decision model as well as the decision-maker's learning history with the decision model. That is, the presence and learned history relative to decision models would be an independent variable in the causal model. Similarly, to reduce the probability that a suboptimal decision is made, the decision modeler would need to understand what current and past contingencies influence decisions with EBPs and what contingencies may need to be arranged to avoid a suboptimal decision. That is, the independent variables from the causal model would need to be accounted for in the decision model, otherwise the decision model would likely fail to meet its function – to help the decision-maker avoid a suboptimal decision.

The purpose of this chapter is to provide and describe models of ethical decision-making related to implementing EBPs. To do this, we start by reviewing a causal model of ethical decision-making. After outlining some of the variables known to influence ethical decision-making, the chapter reviews decision models as they relate to EBP and the points wherein ethics likely plays a role in shaping decision-making and which EBP is selected. We then combine the causal and decision models to create an ethical decision model for implementing EBPs. The chapter closes by demonstrating how the reader can use the combined causal and decision models to analyze and make ethical decisions related to EBPs.

4.2 Causal Model of Ethical Decision-Making

The goals of scientific research are often description, prediction, and control. Specifically, scientists seek to: accurately describe the phenomenon of interest, identify principles and processes that allow for the prediction of the phenomenon of interest, and then use the understanding of the principles and processes to control the phenomenon of interest (Cooper et al., 2020). The ideal outcome of research, then, is to understand the cause of a phenomenon so that researchers can control the presence, absence, or degree to which the phenomenon occurs in the future. Researchers often use causal models to succinctly describe the variables that are causally related to the phenomenon of interest.

Causal models are legion in the experimental and applied analysis of behavior. For example, researchers in the experimental analysis of behavior often use models to describe and predict behavior such as the Rescorla-Wagner model of respondent conditioning (e.g., Rescorla & Wagner, 1972), the generalized matching equation for response allocation (e.g., Baum, 1974; McDowell, 1989), delay or probability discounting for reinforcer value (e.g., McKerchar & Renda, 2012; Rachlin et al., 1991), or the demand equation for the impact of effort on reinforcer consumption (Hursh & Silberberg, 2008).

The above-referenced causal models of behavior consist of precise mathematical relations between independent and dependent variables (e.g., Dallery & Soto, 2013), but not all models in behavior analysis use math. For example, the three-term contingency is a model that describes covariance relationships between stimuli and behavior (e.g., Ribes-Inesta, 1997; Skinner, 1953). Thousands of applied behavior analysts have used this verbal causal model to describe, predict, and control behavior (e.g., Iwata et al., 1982; Paclawskyj et al., 2000). Similarly, the four-term contingency is a model that allows the user to describe, predict, and control behavior that changes dynamically as a function of context and time since contacting various reinforcers and punishers (Michael, 1993). This four-term contingency has also been used by applied behavior analysts to effectively predict and control behavior (e.g., Endicott & Higbee, 2007; Sundberg et al., 2001). In sum, causal models are used extensively in behavior analysis, and, regardless of whether the model uses mathematics or words alone, causal models are instances of human behavior (Baum, 2018; Marr, 2015).

To develop a causal model of ethical decision-making relative to EBPs, we must understand the components that go into the model. There are several ways to categorize and identify the components for a causal model of ethical decision-making relative to an applied behavior analyst's decision about EBPs. One categorization is relative to perspective: that of the applied behavior analyst compared to that of the profession-labeled applied behavior analysts. Below we discuss how perspective plays a causal role in ethical decision-making using the distinction between morality and ethics. A second categorization is relative to the ethical behaviors under consideration: claims about what is right compared to claims about why it is right. We discuss these components of ethical decision-making in the second part of this section on descriptive and normative ethical behavior. A final categorization can be made regarding the environmental variables and behaviors involved in decision-making more generally. We discuss these components in the final part of this section titled *Decision-Making*.

4.2.1 Morality and Ethics

Behavior analysts are required to make ongoing decisions about the treatments they implement for individuals with autism spectrum disorder (ASD). The *Ethics Code for Behavior Analysts* (hereafter referred to as the Code; BACB, 2020) provides guidance on ethical behavior and the use of effective treatments. However, ambiguity in situations inevitably arises wherein an applied behavior analyst still must select between treatments. Each applied behavior analyst has a unique learning history that is somewhat similar to other applied behavior analysts as well as different from other members of the profession. Included in these similar and different learning histories are claims about what is right and wrong professional behavior. For example, the behavior of applied behavior analysts is likely to be influenced by their individual history with rules about right or wrong (e.g., from school, local lab or clinic lore, religion, culture, familial) as well as their shared history with other applied behavior analysts with rules about right or wrong (i.e., the rules in the Code). Historically, the difference between right or wrong at the individual level versus the professional level has been captured by a distinction between morality and ethics.

At its root, morality comes from the Latin word *moralis* which refers to the proper behavior of a person and one's individual disposition (Cox, 2020; MacIntyre, 2003). When many people adopt the same pattern of "proper individual behavior," *moralis* takes the plural form and becomes *mores* – customs and manners of a group of people. Thus, in total, morality can be defined as focusing broadly on what individuals should consider to be right and wrong behavior and why an individual person should believe that is true for them in their daily lives. Note that this leaves the door open for individuals to develop their own unique systems of moral rules that they live by and of which everyone else may disagree (e.g., Borum, 2010; Harper, 2009; Monestes et al., 2017).

In contrast, ethics comes from the Greek word *ethos* which refers to the proper behavior that characterizes a culture, era, community, or profession (Cox, 2020). Ethics aims to answer the question of, as a group of people with some shared goal or skill set, what are the rules about right and wrong that are relevant to us all? Even though ethics is defined as rules relative to what is right or wrong for individuals behaving as members of a collective group, this does not mean that the group is the ones who decide the rules. For example, the Pope and the Cardinals of the Catholic church largely decide what is right or wrong for the group of people known as Catholics, the Supreme Court decides the right way to interpret the law, and small working committees often determine the rules espoused in professional codes of ethics such as the American Medical Association (AMA) Code of Ethics (AMA, 2016), the American Psychological Association (APA) Code of Ethics (APA, 2017), and the BACB Code (BACB, 2020). Stated succinctly, morality is concerned with what is right or wrong for me as an individual separate from the profession to which I belong, and ethics is concerned with what is right or wrong for all members of a group or profession.

Morality and ethics as behaviors are similar in many ways. For example, both involve behaviors labeled as *values*, emitting behavior relative to labels of right and wrong, and emitting behaviors tacted as "compassion," "respect," and "self-control" (Haidt et al., 2009). In addition, writers often assume that emitting moral and ethical behavior includes the ability to anticipate the consequences of one's actions (i.e., verbally state the probability of specific consequences), to make value judgments (i.e., accurately tact the stimulus relations between an event, behavior, or outcome, and defined values), and to choose between alternative courses of action based on those anticipated consequences and value judgments (Ayala, 1987).

Morality and ethics also include behaviors that are established, maintained, increased, or reduced through the same processes as all other behaviors (e.g., Baum, 2005; Skinner, 1953, 1971). Past writers have typically theoretically extended research in the experimental analysis of behavior to argue that morality and ethics are broadly maintained by socially mediated consequences delivered based on the similarity of a group members' behavior with the cultural standards of what is *right* versus *wrong* for that group of people (Skinner, 1953). More recently, research has begun to emerge that demonstrates these functional relations empirically (Cox, 2020).

More specific functions of moral and ethical behavior have been discussed in greater detail in other areas of the psychology literature. For example, Kohlberg & Kramer (1969) identified six potential functions of moral or ethical behavior which we can translate behaviorally (Skinner, 1945). One function might be avoidance. When young, humans may contact punishment for engaging in immoral or unethical behavior and thus learn to emit moral or ethical behavior to avoid punishment. A second function could be socially mediated reinforcement wherein one learns that behaving morally or ethically leads to higher rates of reinforcement for the individual and for others (i.e., social reciprocity; Carpenter & Matthews, 2004). A third function might be generalized social reinforcement for adhering to rules specifying societal norms about what is acceptable versus unacceptable. A fourth function might be generalized social reinforcement for adhering to rules claimed by perceived authority figures. A fifth function follows recognition that groups and authorities often differ on what is claimed to be right behavior, and, without an objective way to decide between the two, societal rules and authority claims are viewed relatively. Once viewed relatively, Kohlberg (1971) argued that personal values and individually derived rules play a larger role in what is claimed as right. Finally, a sixth function of ethical behavior outlined by Kohlberg might be considered as adhering to a defined response class tacted as "ethical principles." That is, for some, ethical principles such as justice, honesty, and compassion become the primary method for deriving and ranking rules for what is considered right behavior. Each of these ethical principles, when followed, leads to consistent patterns of behavior and changes in the environment. For example, justice leads to the equitable allocation of opportunity and resources which can be observed and measured, honesty can be captured with say-do correspondence, and compassion might be observed and measured as behaviors leading to the reduction in behavioral patterns indicative of pain or suffering in others.

Despite many similarities, the distinction between morality and ethics is practically important as one's personal rules (morality) can conflict with the rules of one's profession (ethics). For example, consider an applied behavior analyst who adheres to personal, moral rules that discourage handling pork. However, this same applied behavior analyst works with a client whose most preferred edible reinforcer is bacon. In this example, handling bacon would violate the applied behavior analyst's moral rules, but refusing to handle the bacon would violate the applied behavior analyst's ethical rules to advocate for the services "designed to maximize desired outcomes" (Guideline 2.01; BACB, 2020). As another example, consider an applied behavior analyst who has the education and supervised clinical experiences to teach and provide training surrounding sexual behavior. This applied behavior analyst may personally believe that their designed interventions are in the best interests of a client and feel morally obligated to help their client in this area. However, applied behavior analysts also have the obligation to use only scientifically supported treatments (Guideline 2.01, 2.13, 2.14; BACB, 2020). Here, failing to implement a lesson on sexual behavior may violate their moral rules, whereas implementing a lesson on sexual behavior may violate their ethical rules given the limited experimental literature on teaching sexual behavior for individuals with ASD (Solomon et al., 2019).

Conflicts between a clinician's morality and ethics are referred to as *conflicts of conscience* in the bioethics and medical ethics literatures (e.g., Adams, 2007; Ford & Austin, 2018). Conflict of consciences are rarely discussed in the applied behavior analysis (ABA) literature despite the common reported occurrence of conflicts of conscience in other areas of healthcare and education (e.g., American College of Obstetricians and Gynecologists, 2007; Curlin, 2008; Ford & Austin, 2018). Whether the applied behavior analyst is more justified to follow their moral rules or to follow the ethical rules of the profession to which they belong could be a chapter itself. Here, the main takeaway is that morality and ethics can be distinguished, the potential for conflict between morality and ethics exists, and the potential for conflict between morality and ethics is an important variable that may influence ethical decision-making with EBPs.

4.2.2 Descriptive vs. Normative Ethical Behavior

Historically, philosophers have made a topographical distinction between *what* is considered to be right behavior (descriptive ethical behavior) and *why* that behavior is considered to be right behavior (normative ethical behavior). For example, one might argue that using Behavior Skills Training (i.e., BST; Miltenberger, 2012) is the right approach to train Registered Behavior Technicians (RBTs). Phrased differently, we can ask, "What is the right way to train RBTs?" Answer: "Using BST." Note here that our dialogue with you – the reader – is restricted to words on a page. So, "the right way to train RBTs" is not simply by someone saying, "Use BST." Rather, "the right way to train RBTs" is by actually engaging in the behavioral patterns that an observer might tact as, "you are using BST." Summarizing this example, the descriptive ethical behaviors for training RBTs are the behavioral patterns one might tact as "BST."

We can also ask the question, "Why is implementing BST the right thing to do?" The behaviors involved in answering this question would be historically labeled normative ethical behavior. Different people may answer this question differently. For some, we should use BST because the Code says we should use EBPs, and BST has the most published evidence to support its effectiveness (Kirkpatrick et al., 2019; Schaefer & Andzik, 2020). Others may view a particular author in the behavior analytic literature as an expert in staff supervision and training and, if that author says BST is the right way to train RBTs, then that is the right way to train RBTs. As a final example, others might argue that BST is the right way to train RBTs because it leads to the fewest errors when the RBT subsequently implements an intervention, and fewer errors are more likely to lead to the best client outcomes.

Justifying why someone should implement BST to train RBTs is verbal behavior and is topographically different from the behaviors of actually implementing BST. More generally, descriptive ethical behavior is topographically distinct from normative ethical behavior. Though historically treated topographically in the philosophical literature, recent research suggests that descriptive and normative ethical behaviors are also functionally distinct (Cox, 2020). Thus, the distinction between descriptive and normative ethical behavior is important to consider within a causal model of ethical decision-making related to the implementation of EBP as accounting for both is needed.

4.2.2.1 Descriptive Ethical Behavior and Decision-Making with EBPs

If descriptive ethical behavior is *what* the right thing to do in a given situation, a question that naturally follows is where the applied behavior analysts learn descriptive ethical behavior. The most likely influence on descriptive ethical behavior is the Code, as it outlines the behaviors that are required by applied behavior analysts, generally, as well as specific to EBP. For example, the Code states that applied behavior analysts should educate clients and stakeholders on effective, evidence-based treatments (Guideline 3.12; BACB, 2020). When applied behavior analysts must choose between multiple scientifically supported treatments or teaching procedures, the Code states that other factors should be considered such as client preference and clinician experience or training (Guideline 2.14; BACB, 2020). As another example of descriptive ethical behavior related to EBP, the Code states that applied behavior analysts should provide the appropriate amount and level of supervisory hours necessary to meet treatment goals (Guideline 3.12; BACB, 2020).

Applied behavior analysts can also learn descriptive ethical behaviors from other sources such as mentors, organizational policies, clinical settings, and the published literature. For example, rules might be passed down from supervisors or organizations in the form of policies and procedures for the right way to conduct assessments and implement services. Also, rules about what is right and wrong may not always be formally outlined or written down. Instead, they might be passed down via conversations and interactions with colleagues via so-called lab-lore or clinic-lore.

Formal and informal rules about what is right can contribute functionally to what applied behavior analysts claim as ethical assessment and implementation of ABA services. For example, a service provision organization may train behavior analysts to use an interview-informed synthesized contingency analysis (IISCA; Hanley et al., 2014), while another organization may provide training in functional analyses (FA; Iwata et al., 1982). Similarly, a behavior analyst may be encouraged by their organization to specifically conduct indirect functional assessments (e.g., Iwata & DeLeon, 1996; Paclawskyj et al., 2000), whereas another behavior analyst may be encouraged to conduct direct functional assessments (e.g., Hanley et al., 2014; Iwata et al., 1982). In turn, behavior analysts working at different organizations and with different educational histories may disagree on what is considered the right EBP based on their organizational policies, training, and prevailing contingencies (Cox, 2020).

Conflict between statements about correct implementation of EBP may occur within the same person as well. Behavior analysts who hold other professional titles (e.g., licensed psychologist, speech-language pathologists, medical doctors, teacher certification) have additional experience with claims about what is right via those professions' ethical standards, education and training, and published literature. All of which may influence descriptive ethical statements about what might be the right thing to do in a given situation. For example, the Association of American Educators (AAE) explicitly recognizes the important role of educators in the "moral education" of students (AAE, 2013). Additionally, applied behavior analysts are obligated to conduct assessments before developing behavior-change programs (Guideline 2.13; BACB, 2020), involve clients in the planning of the behavior-change program (Guideline 2.09; BACB, 2020), and practice only within the boundaries of their competence (Core Principle 4; Guideline 3.03; BACB, 2020). However, as discussed in more detail below, interesting questions quickly arise as to how moral behavior will be assessed, whose moral framework should be taught, and what competence or expertise in moral education looks like (e.g., Brummett & Ostertag, 2018; Ho, 2016; Iltis & Rasmussen, 2016; McClimans & Slowther, 2016). In these situations, it seems plausible the prevailing contingencies will determine which code of ethics predominates (Cox, 2019b) – but we can also ask whether this is right.

Lastly, behavior analysts have individual and personal experiences that contribute to descriptive ethics. Basic research suggests that verbally competent humans can derive rules for what to do in situations and then adhere to those self-derived rules (e.g., Matthews et al., 1985; Ninness & Ninness, 1999; Rosenfarb et al., 1992). There is no reason to suspect ethical behavior is unique in this regard. For example, an applied behavior analyst may have heard about a colleague's experience with an individualized education plan (IEP) team in a particular school district. Though never explicitly stated, the applied behavior analyst may derive a rule that it will take more effort, be a more aversive experience, and hinder the implementation of treatment if they recommend that a direct functional assessment be conducted before intervention design as opposed to beginning intervention more quickly following an indirect functional assessment. Here, the right approach to recommending which EBP to choose might be influenced by an individually derived rule.

In sum, descriptive ethical behaviors are the patterns of behavior which are considered to be right. For applied behavior analysts, descriptions about what is the right thing to do may come from the Code, mentors, colleagues, textbooks, published research literature, organizational policies and procedures, other scientific literatures, or we may create them ourselves. These descriptions about what is the right thing to do can play a causal role in the behavior we emit. Also, this includes the decisions we make about which evidence-based assessment or intervention we choose to implement.

4.2.2.2 Normative Ethical Behavior

Behavior analytic writings have primarily been explicit in what the right thing to do might be. However, historically, why those behaviors are the right thing to do has been discussed more implicitly. Verbal behavior tacted as "justifying why a specific behavior is right" can be grouped into theories of normative ethical behavior – patterns of verbal behavior that provide rationale or justification for why something is right. Theories of normative ethics provide benchmarks for measuring whether one's choices are justified as being right versus wrong. That is, when we agree on why something is right, we can measure whether the results of our behavior meet the agreed-upon benchmark.

In ABA, there currently is not an agreed-upon approach for how applied behavior analysts should justify claims about right or wrong behavior. However, understanding the normative ethical theory one uses as a benchmark for correct ethical decision-making is important for resolving ethical dilemmas (Brodhead et al., 2018), making ethical decisions in contexts not covered by existing ethical rules (Brodhead et al., 2018; Cox, 2020), and because different ethical theories lead to different behaviors labeled as right (e.g., Brodhead et al., 2018; Cox, 2020). To aid applied behavior analysts in identifying an ethical theory they can use to consistently make ethical decisions, we briefly outline five ethical theories commonly found in modern Western medical ethics literature and how they causally relate to ethical decision-making for the implementation of EBPs.

One theory of normative ethics is consequentialism (a.k.a. utilitarianism). Consequentialism argues that labels of right or wrong are determined by the consequences that follow the ethical decisions, and behaviors that result in the greatest good for the greatest number of people are considered right (Alexander & Moore, 2016). For example, a person justifying EBP using consequentialism might argue conducting an indirect functional assessment is better than descriptive functional assessments because there is more evidence to indicate an effective intervention can be implemented more quickly (e.g., Tarbox et al., 2009).

Another theory of normative ethics is deontology. Unlike consequentialism, deontology argues that behaviors cannot be assessed by the consequences that follow from an ethical decision but are determined as right or wrong based on conformity to a group's ethical norm (e.g., a code of ethics; Alexander & Moore, 2016). For example, a person justifying EBP using deontology might justify using edible reinforcers because the Code states behavior analysts should use effective treatments, rather than justifying using edible reinforcers because edible reinforcers result in quicker and greater behavior change (consequentialism).

Virtue theory holds that some behaviors are right or good simply because they are right/good by nature, regardless of the consequences that follow or any rules espoused by authority figures (Annas, 2006). For example, honesty is typically considered a virtuous behavior and people should always emit (e.g., Carr, 2014; Gachter & Schulz, 2016; Wang et al., 2011). As another example, the principle of justice (i.e., treating everyone fairly based on established criteria for comparison) is often considered a virtuous behavior (e.g., Huang, 2007). Extended to ABA service delivery, each client a behavior analyst agrees to provide services for has a certain number of hours for which the behavior analyst receives reimbursement. The principle of justice might require that applied behavior analysts only work the agreed-upon hours for that individual so as not to unfairly provide more time to one client compared to others. Alternatively, the applied behavior analyst may develop a set of criteria under which they would work more hours than specified in the contract with the understanding that all clients would have access to that potential for extra attention.

Contract theory holds that certain behaviors are right or good because they adhere to a social contract (Dienstag, 1996). For example, an applied behavior analyst may sign a contract with a client and a third-party payer wherein they promise to reduce the self-injurious behavior of a client, teach them to communicate their wants and needs in a socially acceptable manner, and accomplish both using 10 hr per week at a reimbursement of $85 per hour.[1] The behaviors that are ethically right in this scenario are the set of behaviors that allow the behavior analyst to efficiently reduce self-injurious behavior and teach functional communication while increasing the probability of generalization and maintenance.

Lastly, feminist approaches to normative ethics argue that determining right or wrong through mathematical adherence to logical principles is misguided. Rather, natural caring relationships between humans should provide the basis for right and wrong behavior (e.g., Gilligan, 1982;

[1]Note that under this arrangement the client (and their caregivers) and the third-party payer also have ethical obligations resulting from the agreed-upon contract. The client is ethically obligated to show up for the agreed-upon number of hours each week, to participate in their sessions, and to engage in the behaviors necessary to generalize the skills to the home environment. The third-party payer is ethically obligated to pay the provider at the designated rate and for a maximum amount of $850 per week (10 hr × $85/hr).

Larrabee, 1993; Noddings, 1984). In our context, applied behavior analysts have a responsibility to care for the clients or students on their caseload. Also, through their interactions with clients or students, applied behavior analysts identify ways they can best care for their clients or students in the particular social circumstances in which they live. EBPs then become a vehicle for which we can demonstrate our care for clients or students.

The history of writings on ethics and morality provides definitions of ethical and moral behavior that are useful for claiming what is right behavior and why this may be the case. Moreover, theories of normative behavior are useful for understanding ways in which behaviors are classified as right or wrong to create measures of success. Nevertheless, definitions of ethics and ethical theories are stated at a general and high level. Thus, by themselves, definitions of ethics and ethical theories do not always lead to practical solutions when making ethical decisions regarding EBPs. To make ethical decision-making related to EBPs more tractable, it may help to include operant and respondent behavioral processes and principles that play a causal role in ethical decision-making.

4.2.3 Decision-Making

Decision-making involves engaging in behaviors to manipulate relevant variables needed to evoke a decision (Skinner, 1953). As with past definitions of ethics, the definition of decision-making provides a general, high-level description of behavior but does not necessarily allow for the description, prediction, and control of decision-making. A more practical approach is to consider the behavioral processes involved. Decision-making appears to involve the interaction between behavioral processes that control choice in addition to verbal behavior. Further, to evaluate whether people make the right decision, it is necessary to include the notion of optimality toward a stated goal. Thus, to understand what causes ethical decision-making with EBPs, we need to understand the interaction between choice, verbal behavior, ethics, and optimality.

4.2.3.1 Choice

Choice and decision-making have been extensively researched within behavior analytic basic research (e.g., Fantino, 1997; Herrnstein, 1970; Williams, 1994). Concurrent schedules of reinforcement used in basic research have demonstrated that organisms will allocate more behavior to responses that result in increased contact with reinforcement and less behavior to the responses that result in less contact with reinforcement (i.e., matching law). For example, when considering whether to include a response cost (punishment) component in a token economy intervention, an applied behavior analyst's decision will be influenced by their past experiences achieving behavior reduction in the presence and absence of including response cost.

Choice research has also focused on self-control (i.e., delay discounting). Self-control is typically studied by having participants choose between a smaller, more immediate reinforcer and a larger, more delayed reinforcer (Fisher & Mazur, 1997; Green & Myerson, 2013). The general findings are that the relative comparison between amount and delay to two alternatives will uniquely determine which response humans make. Translated to our current context, consider a situation where an applied behavior analyst must decide whether to use punishment procedures with a client displaying severe self-injurious behavior (SIB). Using punishment may decrease the delay to minimal rates of SIB but also includes the use of an aversive stimulus. In contrast, refraining from using punishment may increase the delay to minimal rates of SIB but does not include the use of an aversive stimulus. Importantly, a robust finding from the self-control literature is that individuals are differentially influenced by delay (e.g., Green & Myerson, 2013). Thus, different applied behavior analysts are likely to choose differently in the above scenario when considering only how delay to minimal rates of SIB should determine the right EBP.

4.2.3.2 Verbal Behavior

The relationships between stimuli and verbal behavior are important in ethical decision-making for several reasons. First, as noted above, descriptive ethical behavior is often described using verbal behavior, and normative ethical behavior is verbal behavior. Furthermore, different ethical situations involve the presence and absence of a variety of stimuli within the environment, relations between those stimuli and behavior, and relations between those stimuli and the likelihood of various consequences occurring. Many decision-making models require the model user to verbally tact these relations so as to make the "right" decision based on all available information in the decision context (more details below). Thus, understanding how verbal stimuli interact to control decision-making is important for describing, predicting, and controlling ethical decision-making with EBPs.

4.2.3.3 Optimality

The outcomes that result from a decision are rarely binary (i.e., yes/no). Rather, the outcomes that result from a decision often occur at some level of a continuous gradient. For example, applied behavior analysts are unlikely to claim an intervention successfully reduced SIB if it decreased from 100 times per day to 98 times per day. Technically, it decreased, but a simple "yes" or "no" as to whether the behavior reduced is likely insufficient for determining whether our decision to use an EBP was the right choice. Instead, the applied behavior analyst would determine whether their decision was the right choice by measuring how much the SIB reduced (i.e., between 100 and 0 times per day) and how quickly the reduction occurred. Measuring and determining the "right" or the "best" ethical decision with EBPs therefore requires measurement of transitions between stable responding during a baseline period and during intervention and the analysis of how to most efficiently transition between the two.

4.2.3.4 Causal Model of Ethical Behavior

In sum, the previous sections have outlined how causal models can be used to describe and identify variables known to control choice and decision-making in humans. If we assume that ethical behavior is just behavior, then those same variables would also apply to ethical behavior and ethical decision-making. Figure 4.1 provides an example visual depiction of a causal model of ethical behavior and ethical decision-making.

4.3 Decision Models

In this section we focus on decision models relative to ethical decision-making, clinical decision-making with EBPs, and how ethical and clinical decision-making with EBPs can interact. Throughout, we assume that ethical decision-making is behavior and is susceptible to the same laws and principles that apply to all other behavior. In particular, we focus on the choice point faced by applied behavior analysts dozens, or perhaps hundreds, of times every week: Which intervention is the right choice in this situation and for this client?

Decision-making models are prevalent across a wide range of scientific and professional disciplines. For example, decision models have been published in physics related to quantum reinforcement learning (e.g., Li et al., 2020), biology related to decision-making in animals (e.g., McFarland, 1977), political theory related to public administration (e.g., Simon, 1977), and even in behavior analysis related to risk assessment in functional analyses (e.g., Deochand et al., 2020). Broadly, decision-making models are designed to help the model user make the best decision in the situation toward meeting a pre-defined goal. Decision-making models accomplish this by serving as a textual prompt to help the model user consider the relevant variables and options which may have gone unconsidered without the model prompt. The use of decision-making models results in a chain of behaviors that (ideally) leads to an outcome as close to the pre-defined goal as possible.

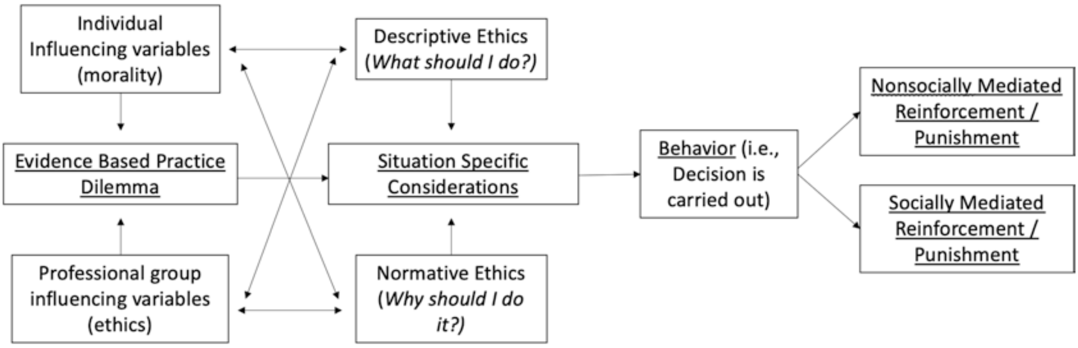

Fig. 4.1 Causal model of ethical behavior and ethical decision-making related to evidence-based practice. Underlined text indicates the behavioral chain of making an ethical decision with evidence-based practices. Arrows indicate interactions between variables

4.3.1 Function of Ethical Decision Models

Decision models help the model user engage in a chain of behaviors that leads to an outcome as close to the pre-defined goal as possible. For example, Geiger et al. (2010) outlined a decision model to help applied behavior analysts decide between function-based interventions for challenging behavior maintained by escape (Geiger et al., 2010). The goal of the model user might be to identify and tailor an intervention that efficiently and effectively reduces the escape-maintained behavior. The function of the decision model is to prompt the model user to consider variables relevant to current environment-behavior relations that allow the model user to identify an intervention that efficiently and effectively reduces the challenging behavior (i.e., to meet their goal).

But what is the goal of applied behavior analysts who are using an ethical decision model? Ethical behavior is defined as the set of rules for conduct that all applied behavior analysts should follow, and ethical decision-making refers to the chain of behaviors that lead the model user to emit ethical behavior. Thus, the consequences that maintain ethical decision-making might be attaining the right or desired consequence wherein right or desired is defined by the normative theory one uses to justify ethical behavior. Specifically for EBPs, the function of ethical behavior and ethical decision-making might then be used to identify the intervention that leads to the best outcomes for the patient (consequentialism); fulfills our duties to the client and the field of behavior analysis as outlined in the Code (deontology); is aligned with accepted virtuous behaviors (virtue theory); meets the goals of behavior change set forth in the contract the client, the payer, and the behavior analysts agreed to (contract theory); or displays genuine care for the client and their situation (feminist ethics). All of which may center on the behavioral definitions of what the client or their caregiver states leads to a meaningful life. The function of ethical decision models, then, is the state of environment-behavior relations that meet the predetermined goal derived from the interaction between client values and the normative theory an applied behavior analysts uses to determine their ethical claims.

4.3.2 Ethical Decision-Making Models

Hundreds of ethical decision-making models have been published and span dozens of professional disciplines and specific ethical decisions (e.g., Ford & Richardson, 1994; Lau, 2003). Outside behavior analysis, scholars and researchers have published on ethical decisions in fields such as medicine (e.g., Greipp, 1992; Meyer-Zehnder et al., 2017), education (e.g., Green &

Walker, 2009; Shapiro & Stefkovich, 2016), psychology (e.g., Cottone & Claus, 2000; Grace et al., 2020), and even astronomy (e.g., American Astronomical Society, 2017; Hoeppe, 2018). In behavior analysis, ethical decision-making models have been proposed to help the user identify key stakeholders and Code guidelines relevant to the ethical decision (Bailey & Burch, 2016), to navigate professional collaboration related to interventions published outside the behavior analytic literature (Brodhead, 2015), and to incorporate experiences and variables outside the Code into the decision-making process (Rosenberg & Schwartz, 2019).

Ethical decision models published within and outside behavior analysis often have similar components. Figure 4.2 shows the generally prominent components of ethical decision-making models. The first step to ethical decision-making involves recognition that a situation involves ethical behavior. Once a situation is identified to involve ethical behavior, the second step is for the applied behavior analyst to identify the precise ethical problem. Once the specific problem is known, ethical decision models often recommend the decision-maker gather information about professional, organizational, or personal rules of right conduct that are relevant to the current situation and what response options are plausible. Next, decision models often recommend that the decision-maker prioritize and clarify the gathered information and conducts a risk-benefit analysis for the different response options that are plausible. Once the information has been synthesized and the values and potential options ranked, the decision-maker then decides the action that is "best" and implements it. Finally, some ethical decision-making models recommend the decision-maker follow-up to evaluate whether action taken was, in fact, the "best" action or if further action is warranted.

4.3.3 Evidence-Based Practice Decision Models

Historical accounts of EBP can be traced back to the 1800s and a nurse named Florence Nightingale who used evidence to promote reform in healthcare (Aravind & Chung, 2010). More recently, the concept of EBP was introduced to the field of medicine in the 1990s by Sackett and colleagues. Sackett et al. (1996) proposed a definition of EBP to be practice that integrates "individual clinical expertise with the best available external clinical evidence from systematic research" (p. 71). This definition was later refined to "Evidence-based practice is the integration of best research evidence with clinical expertise and patient values" (Sackett et al., 2000, p. 170). The American Psychological Association (APA, 2006) adapted the definition proposed by Sackett et al. (2000) and stated that EBP in psychology (EBPP) is the integration of the best available research with clinical expertise in the context of patient characteristics, culture, and preferences.

Several authors within the field of behavior analysis have also offered definitions of EBP. Kazdin (2008) describes EBP as clinical practice based on the integration of the best available evidence regarding interventions, clinical expertise, and patient values, needs, and prefer-

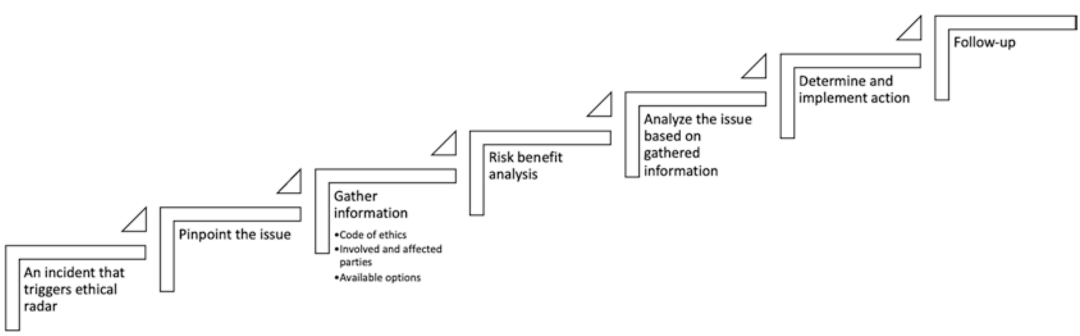

Fig. 4.2 Decision model for ethical decision-making

ences. Smith (2013) defined EBP as "a service that helps solve a consumer's problem...[that] integrates a package of procedures, operationalized in a manual, and validated in studies of socially meaningful outcomes" (p. 27). Finally, Slocum et al. (2014) defined EBP in ABA to be "a decision-making process that integrates (a) the best available evidence with (b) clinical expertise and (c) client values and context" (p. 44). The definition presented by Slocum and colleagues stresses that EBP is a process of decision-making that involves the integration of three components which are also present in the definitions used by other fields like medicine and psychology. Even before the concept of EBP was introduced within the field of ABA, the tenets of the field emphasized the importance of relying on interventions based on evidence and creating goals and implementing treatments which have high social validity (Baer et al., 1968; Slocum et al., 2014).

One framework for EBP has been suggested by Spencer et al. (2012) in which the authors suggest that in the process of selecting, adapting, and implementing interventions, practitioners have to continually make decisions, and the three components of EBP are influencing the decisions throughout the process. Although the framework is presented in a linear form, the authors suggest that the process might not always be linear. For a full treatment of the history of EBP and EBP decision models, we refer the reader to Chap. 2 of this book.

4.3.4 An Ethical-EBP Decision Model

Despite different authors treating ethical decision-making and decisions with EBP separately, some authors from medicine have argued that EBPs are integral to clinical ethical decision-making and vice versa (e.g., Borry et al., 2006; Tyson, 1995). That is, clinical ethical decision-making requires careful consideration of current best-available evidence to make the "right" decision about how to treat individual clients. In ABA, ethical decision models and EBP decision models also are interrelated. This is implicitly captured in the Code which has several subsections directly related to the three elements of EBP such as best available evidence (e.g., Guidelines 2.13, 2.14; BACB, 2020), consideration for client values and context (e.g., Guideline 2.14; BACB, 2020), and clinical expertise (e.g., Core Principle 4; BACB, 2020). Additionally, the interrelatedness of ethics and EBP was implicitly captured by Slocum et al. (2014) who referenced the Code to justify their claims.

Descriptive and normative ethical behaviors are influenced by the process of decision-making with EBPs. For example, consider an applied behavior analyst who is considering verbal behavior interventions for a minimally vocal child with autism. To make the "right" decision on intervention selection (descriptive ethical behavior), the applied behavior analyst would evaluate the research literature to identify interventions with the best evidence for individuals similar to the client and their presenting skills. Additionally, the applied behavior analyst would likely consult the family for their preference (i.e., incorporate client values) of alternative and augmented communication systems (e.g., sign language or picture based) to ensure the designed intervention will be implemented and lead to optimal intervention outcomes. Lastly, the applied behavior analyst would tailor the intervention procedures and behavior change targets based on their past history with successful behavior change (i.e., incorporate clinical expertise within their scope of competence).

The process of decision-making with EBPs is influenced by descriptive and normative ethical behavior. For example, applied behavior analysts are currently ethically obligated to implement assessments and interventions with empirical backing (Guidelines 2.01, 2.13, 2.14; BACB, 2020). Additionally, applied behavior analysts have an obligation to avoid interventions that may have empirical backing based on potential short-term or long-term harm to the individuals they serve (e.g., Core Principle 1; BACB, 2020). For a child with life-threatening challenging behavior, conducting a gold standard functional analysis (best available evidence) may not minimize short-term harm to the client. In this situation, different descriptive ethical claims suggest incompatible behavior with simply “choosing the intervention with the most evidence.” Depending on the normative ethical theory one prefers, choosing among available EBPs might mean placing greater weight on the clinical expertise component or the client preferences component of EBP decision models.

In sum, ethical decision-making and decision-making with EBPs are necessarily interrelated. “There is nothing in a methodology which determines the values governing its use” (Skinner, 1971, p. 148). Figure 4.3 highlights how ethical decision-making and decision-making with EBPs might interact by combining the common components ethical decision-making models with the common components of EBP decision models. The main steps of a clinical decision-making process are shown in rectangles. Between each step, we highlight how components of ethical decision-making (circles) and components of decision-making with EBPs (triangles) factor into the clinical decision-making process.

4.4 Applying Ethical Causal and Decision Models to EBP in ABA

To summarize the chapter to this point, ethics for applied behavior analysts can be defined as the descriptive and normative rules about right and wrong behavior analytic professional and research practices. Decision-making can be defined as the chain of behaviors that lead to a defined terminal environmental state. When an applied behavior analyst has a sense of what the terminal environment should be (e.g., to reduce SIB in the classroom to near zero rates), decision models can help the applied behavior analyst emit a chain of behaviors that will increase the likelihood of reaching that ideal terminal state. For applied behavior analysts, ethical behavior and the implementation of EBP are intertwined. Also, because ethical behavior, ethical decision-making, and decision-making relative to EBP are all just behaviors, they can be described, predicted, and controlled by the same laws and principles as all other behavior: principles such as those described in the research literature on choice, verbal behavior, and optimality. Thus, in total, ethical decision models for implementing EBP in ABA should involve prompts regarding the variables that should be considered when selecting an EBP for a client or student and the many ways that our learning history can bias us into choosing a suboptimal EBP.

Figure 4.4 shows a decision model for ethically selecting from multiple EBPs while accounting for known causes of descriptive and normative ethical behavior and ethical decision-making. For practical use, we have turned the decision model into a checklist that applied behavior analysts can use to ethically decide between two EBPs in situations where multiple options exist (see Fig. 4.5 for an example of a completed worksheet). In the final section below, we discuss how all that we have covered to this point might practically coalesce into ethical decisions to implement EBP in ABA. As Engels reportedly stated, “an ounce of action is worth a ton of theory” (Bohan & Kennedy, 2002). We have discussed the ton, now we can get to the ounce.

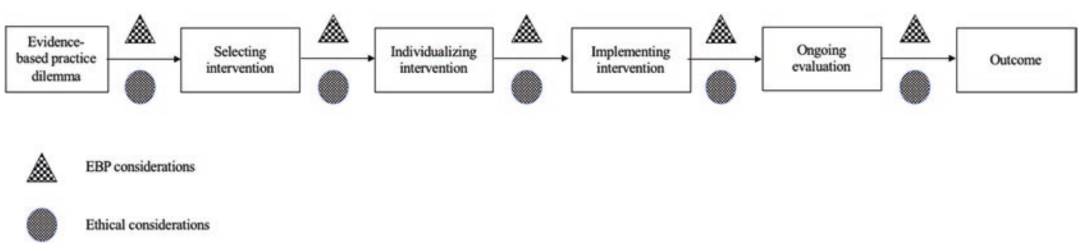

Fig. 4.3 Decision model showing the interaction between ethical behavior, ethical decision-making, and the implementation of evidence-based practices in clinical and educational settings

STEPS IN ETHICALLY NAVIGATING EBP DILEMMA				
DESIRED OUTCOME	Identify goal of behavior-change program			
State goal of behavior-change program				
Rule out any medical causes				
Is the desired behavior amenable to behavioral treatment?				
TARGET BEHAVIOR	Consider the target outcome, target setting, client/caregiver values			
Define target behavior				
ASSESSMENT	Conduct assessment to inform behavior-change program (Obtain consent, consider contextual variables)			
Identify relevant assessment				
Obtain consent to conduct assessment				
Implement assessment and synthesize results				
SEARCH AVAILABLE EVIDENCE	Conduct a literature review of interventions and evaluate the results using professional judgement			
	Intervention 1	Intervention 2	Intervention 3	Intervention 4
Is intervention based on science and behavior analysis				
Is the intervention commensurate with education, training, or supervised experience				
Is the intervention suited for the client based on their values and context? If not, is there an opportunity to obtain training, supervision, and/or consultation from someone who is competent?				
Long-term and short-term benefits to the clients				
Efficiency and cost-effectiveness				
Risks and side-effects				
Consider any potential biases				
Does the intervention include punishment or other restrictive procedures?				
Are there any environmental conditions that would prevent implementation of the intervention				
Are there opportunities for collaboration?				
Consider client preferences				
Is there evidence supporting likelihood of behavior maintenance and generalization?				
SELECTED INTERVENTION				
JUSTIFICATION STATEMENT	The intervention < *insert intervention name* > was chosen because... This intervention will best help us meet our intervention goals because...			
ADAPT INTERVENTION				
Tailor intervention based on client's unique behavior, environment, and goals				
Discuss with client/client's caregivers				
IMPLEMENT INTERVENTION				
Training for those who will implement intervention				
Ongoing monitoring and evaluation				
EVALUATE OUTCOME				

Fig. 4.4 Worksheet to aid ethical decision-making when selecting among EBP in clinical and educational ABA settings

4.4.1 Discrete Trial Teaching vs. Natural Environment Training

So how does an applied behavior analyst ethically choose between the two EBPs of discrete trial teaching (DTT) and natural environment training (NET)? Consider the two cases of Athina and Gia. Athina and Gia are 4-year-old children with an ICD-10 CM diagnosis of F84.0 – autistic disorder. Both were referred for services due to

STEPS TO ETHICALLY NAVIGATING EBP DILEMMA			
DESIRED OUTCOME	Identify goal of behavior-change program		
State goal of behavior-change program	**Teach Athina to follow one-step instructions**		
Rule out any medical causes	**Consulted with medical doctor; no biological issues found**		
Is the desired behavior amenable to behavioral treatment?	**Yes**		
TARGET BEHAVIOR	Consider the target outcome, target setting, client/caregiver values		
Define target behavior	**Athina will independently and willingly follow 10 varying discriminated instructions. She will initiate following the presented instruction within 5 seconds of SD presentation.**		
ASSESSMENT	Conduct assessment to inform behavior-change program (Obtain consent, consider contextual variables)		
Identify relevant assessment	**VB–MAPP and parent interview**		
Obtain consent to conduct assessment	**Parent consent obtained**		
Implement assessment and synthesize results	**VB–MAPP results and parent report showed absence of skill**		
SEARCH AVAILABLE EVIDENCE	Conduct a literature review of interventions and evaluate the results using professional judgement		
	Intervention 1: **NET**	Intervention 2: **DTT**	Intervention 3:**Word Retrieval**
Is intervention based on science and behavior analysis	**Yes (Sundberg & Partington, 1998; Weiss, 2014).**	**Yes (Smith, 2001; Tarbox & Najdowski, 2008; Lerman et al., 2016),**	**Not based on behavior analysis**
Is the intervention commensurate with education, training, or supervised experience	**No prior experience, but has the opportunity for supervision and guidance from experienced Clinical Director.**	**Yes.**	
Is the intervention suited for the client based on their values and context? If not, is there an opportunity to obtain training, supervision, and/or consultation from someone who is competent?	**No, discussed intervention with the family. Intervention is not suitable for the client based on their values and context (parents report a more structured approach is best for Athina's learning).**	**Yes, discussed intervention with the family. Intervention suitable for the client based on their values and context.**	
Long-term and short-term benefits to the clients	**Both long-term and short-term benefits**	**Both long-term and short-term benefits**	
Efficiency and cost-effectiveness	**Based on parent report, Athina will not be as efficient with learning via a more naturalistic / play-based approach.**	**Based on parent report, Athina will be more efficient with learning via a more structured approach.**	
Risks and side-effects	**Given parent report, a naturalistic teaching approach poses a risk for not achieving optimal outcomes.**	**A more structured approach presentes a benefit to achieving optimal learning based on parent reports of Athina's learning style.**	
Consider any potential biases	**Consulted with a colleague about biases and biases have been ruled out.**	**Consulted with a colleague about biases and biases have been ruled out.**	
Does intervention include punishment/other restrictive procedures?	**No.**	**No.**	
Are there any environmental conditions that would prevent implementation of the intervention	**Environmental conditions support intervention.**	**Environmental conditions support intervention.**	
Are there opportunities for collaboration?	**Yes.**	**Yes.**	
Consider client preferences	**A more structured approach is preferred.**	**A more structured approach is preferred.**	
Is there evidence supporting the likelihood of behavior maintenance and generalization?	**Yes, there is literature to support this.**	**Yes, there is literature to support this.**	
SELECTED INTERVENTION	**DTT**		
JUSTIFICATION STATEMENT	The intervention **DTT** was chosen because **it better suits the client's preferences. Also, the applied behavior analyst has experience using DTT.** This intervention will best help us meet our intervention goals because **it will suit Athina's unique learning needs and be acceptable to caregivers.**		
ADAPT INTERVENTION			
Tailor intervention based on client's unique behavior, environment, & goals	**This intervention will be tailored as needed.**		
Discuss with client/client's caregivers	**Client and caregivers consented to intervention**		
IMPLEMENT INTERVENTION			
Training for those who will implement intervention	**Behavior technicians are trained**		
Ongoing monitoring and evaluation	**Continuous assessment will be completed**		
EVALUATE OUTCOME	**Data are monitored to evaluate outcome**		

Fig. 4.5 Example completed worksheet for Athina

concerns regarding their current levels of language and social skills. Specifically, both did not respond to their names when called, were not observed to follow simple instructions, and had limited language skills (i.e., defining the desired outcome; Fig. 4.4).

The first step toward determining which EBP to choose is for Amir to more specifically define the target behavior relative to the desired outcome for both Athina and Gia (i.e., target behavior; Fig. 4.4). Once defined, Amir then needs to conduct an appropriate assessment to inform more specifically what responses need to be taught and what stimuli should be included in training. Based on the information to this point, Amir chooses to conduct the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP; Sundberg, 2008), and Athina and Gia both score in Level 1 for all skills.

Next, Amir discusses the results of the assessment with the families and recruits their priorities regarding goals and outcomes for their children. Both families express that they would like for their children to respond when called, follow instructions (e.g., go get your shoes, sit down, close the door), and expand their language repertoire. Based on the results of the assessment and the parents' preferences, Amir plans to design acquisition programs to: (a) teach tacts of common items relevant to the children's daily lives, (b) respond to their name when emitted by others (e.g., parents, teachers, peers), and (c) follow basic instructions commonly encountered in their daily lives (e.g., "come here," "pick up toy," and "put in box").

The next step is for Amir to search the empirical literature to understand what available interventions have empirical support (i.e., search available evidence; Fig. 4.4). People working directly with clients or students can arrange the presentation and covariation of environmental stimuli to teach a new response in many different ways. After searching the archives of the *Journal of Applied Behavior Analysis, Behavior Analysis in Practice,* and *Behavioral Interventions*, Amir finds that DTT (e.g., Lerman et al., 2016; Smith, 2001; Tarbox & Najdowski, 2008), NET (e.g., Sundberg & Partington, 1998; Weiss, 2014), and word retrieval strategies (e.g., McGregor & Leonard, 1989; Wing, 1990) are used in the literature to teach the target behaviors defined for Athina and Gia.

In DTT, the individual working directly with the client or student explicitly arranges instructional trials of similar duration and that comprises a definite beginning and end (Leaf et al., 2016). These discrete trials are often delivered repeatedly in sets of 3 or more trials while focusing on a specific set of responses (Cummings & Carr, 2009; Najdowski et al., 2009). The timing of antecedent and consequence stimulus delivery using a DTT approach differs from the timing of antecedent and consequence stimulus delivery using NET. In NET, learning trials may vary in duration, what defines the beginning and end of a trial, and may involve one-to-many learning trials before moving to something else. Word retrieval strategies differ from DTT and NET in the timing of antecedent and consequence stimulus delivery. Here, the individual working with the client may have the participant say or read aloud 5–10 words phonologically similar to the tact they want the student to emit when finally asked the question, "What color is this?" (e.g., James & Burke, 2000; Linebaugh et al., 2011).

DTT, NET, and word retrieval strategies have extensive empirical support as a successful method for teaching new skills to individuals with ASD and related developmental disabilities. For example, DTT has been shown to effectively teach new forms of behavior and new discriminations and to manage disruptive behavior (e.g., Smith, 2001). Similarly, NET has been shown to effectively teach manding and other motivationally dependent behavior skills (e.g., Sundberg & Partington, 1999; Weiss, 2014). Lastly, word retrieval strategies have also been shown to successfully result in improved naming performance, generalization to untrained stimuli, and emit recall behaviors (e.g., James & Burke, 2000; Linebaugh et al., 2011). Further, in reviewing this literature, Amir finds that DTT and NET are based in science and behavior analysis. However, word retrieval strategies – though scientifically based – are not based on an operant analysis of verbal behavior. Thus, Amir (via Guideline 2.01; BACB, 2020) no longer considers this intervention in the selection process.

The next step is for Amir to consider whether the identified EBPs are commensurate with Amir's education, training, and supervised experience. Amir remembers reviewing DTT and NET in the *Intervention Design* class from graduate school and fondly remembers the excited group discussion in class on the conditions to choose DTT over NET and vice versa. Amir also remembers his supervised practicum training experience binder and the many documented instances of implementing and supervising other staff-implemented DTT procedures and NET procedures. However, those clients were a bit older, and, since the practicum finished, the organization that hired Amir requires new applied behavior analysts to follow a set of programs designed by the clinical director. For individuals aged similar to Athina and Gia, this has involved only DTT. Nevertheless, Amir also knows that the clinical director wrote her dissertation on NET, and NET is widely used with other clients in the company. So, Amir can get guidance from a competent applied behavior analyst, if needed. In total, Amir is confident he has the education, training, and supervised experience for DTT and NET, though less so for NET.

The next step is to determine whether DTT and NET are suited for the client based on their values and context. Given that Athina's and Gia's performance on the VB-MAPP indicated their receptive language skills are limited, their parents can help inform Amir of their likely values. In conversations with the parents of Athina, Amir discovered that they prefer the ABA sessions to be heavily structured as Athina would get easily distracted with past RBTs who used more of a play-based approach. In contrast, conversations with the parents of Gia indicated that Gia has struggled in the past with RBTs who tried to make her sit for long stretches at a time and have read stories that too much rote learning trial presentations can lead to "robot-like behavior" in children who receive ABA-based interventions. Thus, Gia's parents would prefer a more natural and play-based approach to ABA-based intervention.

The next step in the process for ethically deciding between two EBPs might be considered the consequentialist steps. Here, Amir must evaluate DTT and NET based on their long-term and short-term benefits to the clients, the larger community, and society as a whole (Guidelines 2.09a and 2.09c; Fig. 4.4). From his literature review, Amir learned that some of the benefits of DTT are efficient rates of response acquisition under tight stimulus control (Smith, 2001). However, DTT has also been shown to have the drawbacks of lower generalization across settings and specialized training to implement (Smith, 2001). Similarly, Amir learned from the completed literature review that NET has the benefits of increased engagement with the learning trials and greater generalization of learned skills across contexts, but NET also has the drawbacks of potentially less efficient rates of acquisition for non-motivationally related targets and specialized training to capture naturally occurring, momentary changes in motivation.

At this point, Amir has likely identified what the ideal EBP would be for Athina and Gia. In total, the best EBP for each client was determined based on the desired outcome, the assessment results, a review of the empirical literature, client values and preferences, Amir's past experience and training, and a consequentialist analysis of intervention efficiency and safety. Amir has one final step to complete before turning the ideal intervention into a practical intervention – self-reflection.

Ethical decision-making about EBPs is a chain of behaviors shaped and determined by respondent and operant processes. Thus, it is possible that the interventions Amir has determined as being ideal for Athina and Gia is the result of Amir's bias for those approaches. In behavior analysis, bias refers to a pattern of choice that cannot be predicted by the schedules of reinforcement and punishment specific to the choice context (e.g., Baum, 1974). For ethical decision-making between EBPs, we might assume that what ought to reinforce Amir's choice is whatever leads the client to reach their desired outcome. Thus, bias toward one intervention would be any preference in choice for one EBP that differs from the optimal intervention that allows the client to reach their desired outcome. To test for potential bias, Amir can ask a trusted colleague, mentor, or supervisor to play "devil's advocate" and review his ethical decision-making process and to question all assumptions.

After testing for biases, Amir is likely confident that he has ethically chosen the ideal EBP for Athina and Gia. Now, Amir can shift toward practically implementing the EBP. Here, Amir must determine how environmental conditions may hinder implementation of the EBP (Guideline 2.16; BACB, 2020). When entering this stage of ethical decision-making with EBPs, Amir should decide how much hindrance would lead him to either abandon this EBP or switch to a different EBP or that would potentially require training to those implementing the interventions that are not covered by the payer. Stated differently, there is likely a point wherein the environmental conditions are such that the EBP cannot be implemented effectively as supported by the empirical literature. Understanding what this point looks like will help Amir identify when those conditions have been met and a new approach taken.

Once the cutoff point for reconsidering the chosen EBP is known, Amir can begin assessing the environmental conditions that may prevent implementing the intervention. These conditions might be the amount of training and supervision required for the intervention to be implemented with fidelity (e.g., Smith, 2001), requirements for collaborating with other professionals based on the service-delivery context (e.g., Brodhead, 2015; Cox, 2012, 2019b), the ease with which behavior change can be generalized and maintained (e.g., Sundberg & Partington, 1999; Weiss, 2014), and what empirical support may exist to support that any tailoring required for Athina or Gia would not mitigate the effectiveness of the intervention. Succinctly, Amir must determine that the intervention continues to be supported by evidence once sufficiently tailored to meet the client's unique situation.

Once the above steps have been completed, Amir can select the EBP ethically justified based on the client's values, preferences, and desired outcome; the available empirical evidence, considering his own clinical expertise, training, and past experiences; and considering the context within which the intervention must be implemented. Though not required, it may help with case-review and record-keeping for Amir to document the result of the above steps as a justification statement. This will allow anyone to quickly understand why the EBP was chosen and how the EBP aligns with the desired outcome and professional standards of applied behavior analysts.

Finally, come the multiple steps which applied behavior analysts are probably most familiar. Once, Amir has determined that DTT is best suited for Athina and NET is best suited for Gia, Amir then (a) writes adapted EBP programs for each client, (b) supervises the implementation of those behavior change programs, and (c) evaluates how close the programs are resulting in behavior change toward the originally stated desired outcome.

4.5 Summary

Before one can implement EBPs, applied behavior analysts must choose among the available interventions with empirical evidence that are related to the desired behavior change outcome for which they have been contracted. Choosing among EBPs necessarily involves ethics – statements about the right or wrong way applied behavior analysts go about choosing among EBPs. Thus, to ethically make decisions about EBPs, applied behavior analysts would need to consider (a) the variables that influence ethical decision-making (captured by causal models), (b) the information and potential points of error that may lead to "wrong" decisions with EBPs (captured by decision models), and (c) how causal models and decision models can be practically combined for use in the contexts and settings within which applied behavior analysts practice.

The first section of this chapter discussed causal models of ethical behavior and ethical decision-making. In the first section, we discussed how morality differs from ethics and how each may influence ethical decision-making. We then discussed two types of ethical behavior in descriptive ethical behavior (what is the right thing to do) and normative ethical behavior (why is it the right thing to do). For our conversation, that would be the difference between the behavior of selecting and implementing the right EBP (descriptive ethical behavior) and the behaviors of providing evidence and argument to support why that EBP was chosen (normative ethical behavior). Finally, we closed the first section by highlighting some of the many areas of basic behavioral research that are known to influence decision-making generally and how these combine into a causal model of ethical decision-making with EBPs.

The second section of this chapter discussed decision models. Specifically, we discussed how the function of decision models is typically to help the model user avoid making the wrong decision. Making the wrong decision means that we have a desired outcome that we are optimizing for and ethical benchmarks against which we can measure our effectiveness. Many decision models have been published specific to ethical decision-making and decision-making with EBPs. In the second section, we reviewed the primary characteristics of these models and how they combine into a single ethical decision-making model for EBP.

Finally, we closed the chapter by showing how the theoretical and basic research on causal and decision models of ethical decision-making with EBPs can be collapsed into a practical decision tool. We also walked through the use of this tool in a hypothetical situation wherein an applied behavior analyst had to choose between implementing DTT and NET for two clients with similar clinical presentation and intervention contexts. In short, applied behavior analysts can practically leverage a functional ethical approach to decision-making with EBPs. In so doing, applied behavior analysts are likely to systematically identify the variables that influence ethical decision-making with EBPs, control for biases in decision-making, and implement EBPs that optimize the likelihood of obtaining the positive outcomes for which clients sought our help.

This chapter highlights several areas ripe for future research related to the topic of ethical decision-making with EBPs. First, only a handful of experiments have directly examined the variables that predict and control ethical decision-making or clinical decision-making in applied behavior analysts (e.g., Cox, 2021; Cox & Brodhead, in press). Second, though many decision models have been put forth in the published behavior analytic literature, few have been rigorously tested to determine whether they lead the model user to consistently optimize the outcomes for which the model is being used – including the tool put forth in the current chapter. This does not mean that existing tools and decision models should not be used. However, it does suggest that the models might need to be modified and improve to avoid model users from making less than optimal decisions. As a model user, this also suggests they should: understand why they are using the model, objectively define the client outcome they are trying to achieve, and consistently collect data and critically examine their decision-making processes to ensure that their clients receive the best care possible.

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5 Evidence-Based Practices for Students with Autism Spectrum Disorder and the Individuals with Disabilities Education Improvement Act

Melissa L. Olive

5.1 Evidence-Based Practices for Students with Autism Spectrum Disorder and the Individuals with Disabilities Education Improvement Act

In December of 2004, President George W. Bush signed into law the Individuals with Disabilities in Education Act (Samuels, 2004). This reauthorization of the 1997 law added an extra word, *improvement*, in the title resulting in the Individuals with Disabilities Education Improvement Act (IDEIA, 2004). One of the improvements in the 2004 reauthorization included § 300.320 (4) "a statement of the special education and related services and supplementary aids and services, based on peer-reviewed research to the extent practicable, to be provided to the child, or on behalf of the child" (IDEIA, 2004, p. 63). In 2006, the US Department of Education published the Code of Federal Regulations Commentary which elaborates on the implementation of the IDEIA law (USDOE, 2006). In these regulations, peer-reviewed research was defined and elaborated upon. Specifically, "Peer-reviewed research generally refers to research that is reviewed by qualified and independent reviewers to ensure that the quality of the information meets the standards of the field before the research is published" (IDEA, 2006). However, the regulations went on to note that due to many definitions of peer-reviewed research (PRR), a specific definition would not be included.

Fast forward to 2008 in the No Child Left Behind Act when the term scientifically based research (SBR) appeared. IDEIA Final Regulations occurred in 2008, and while these regulations referenced both PRR and SBR, no definitions were provided. Please see Zirkel and Rose (2009) for a complete discussion of these terms, including the term evidence-based practices (EBPs), as well as the definitions and use of those terms within various education laws.

For the purposes of this chapter and based on the work of Zirkel and colleagues (c.f., Zirkel & Rose, 2009; Zirkel, 2013) and that of Yell et al., (2016a), I will use the term EBPs throughout this chapter as defined by the Every Student Succeeds Act (ESSA, 2015). Note that ESSA replaced the No Child Left Behind Act. ESSA uses tiers to

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establish evidence with the terms strong, moderate, and promising. Strong evidence includes the use of at least one peer-reviewed study with randomized controlled trials. Moderate evidence includes at least one peer-reviewed study with a quasi-experimental design. Promising research includes at least one well-designed correlational study. For readers who appreciate single-subject design and establishing evidence with single-subject research, please refer to the papers by Horner et al. (2005) and Odom and Strain (2002) for a thorough understanding of the rigor required when designing single-subject research studies.

Now that the main terms have been defined, the remaining portion of this chapter will be organized by first providing an overview of IDEIA law and its basic procedural requirements. This will be followed by a description of areas in special education where evidence has already been established. Case law regarding EBP will be reviewed, and, finally, thoughts regarding services provided by behavior analysts practicing in schools will be provided.

5.2 Overview of IDEIA

The IDEIA is comprised of four parts: A, B, C, and D. Part A consists of definitions of terms and established the Office of Special Education Programs. Part D has a list of national activities to improve services for students. These activities include training grants, research grants, and funding for technical assistance centers where EBP may be employed through training and dissemination. Parts B and C will be described in greater detail below.

5.2.1 Part C

Part C of the IDEIA focuses on very young children ages birth through two years. Some also refer to it as services for birth up to three years of age. Services in this age group have a stronger emphasis on the family due to the unique needs of serving very young children, as it is difficult to serve very young children without also serving their families. The major difference between Part C services and Part B services is that focus on the family. In fact, the family is such a focus that the document that is developed for very young children is called the Individualized Family Service Plan (IFSP). Eligibility criteria for Part C are also very different than Part B as evaluators may use their professional judgment to determine if a very young child requires services. The other difference is that the timelines are different because very young children change quickly as they develop. Specifically, very young children may begin receiving services immediately, even if the IFSP is not finalized. Very young children must be evaluated every year, and their IFSP must be reviewed every 6 months. Very young children begin transition services at least six months prior to their third birthday. Services for very young children must be offered in the natural environment which has been defined as settings that are natural for very young children without disabilities (IDEIA, 2004). This may include home or community settings but could also include the hospital for children born prematurely or with other complications. Procedures for very young children, however, must occur in the same order as the procedures under Part B. For example, children should be identified and evaluated and eligibility determined in that order. Finally, under Part C, children must receive services that meet the definition of scientifically based research (SBR; USDOE, 2011).

5.2.2 Part B

Part B of the IDEIA provides educational services for students ages 3 years up through 21 years. In order to be eligible for services, students must meet the classification criteria for at least one of 14 conditions defined by each state. These classifications include autism, developmental delay (up to age 9), and intellectual disabilities. Multiple disabilities may be used when 2 or more classifications apply. It is important that students with a medical diagnosis of ASD be classified appropriately to ensure that their IEP is designed to meet their unique needs. However, in addition to having a disability classification, the student must also have a need for services in order to benefit from the education being provided. The major principles of IDEIA will be briefly discussed below.

5.2.3 Major Principles of IDEIA

All services under IDEIA are based on Free Appropriate Public Education. Services must be free for families and appropriately based on the Individualized Educational Program (IEP). Students may not be rejected from services if they are eligible; this is often referred to as zero reject. Services must be provided in the least restrictive environment (LRE) with the appropriate supports and services required prior to placement in a more restrictive educational setting. Students have a right to be identified and then evaluated to determine eligibility for services. Once eligibility has been determined, a team of individuals, including the parents, develop the IEP. Other principles of IDEIA include the requirement for confidentiality and technology-related assistance. IDEIA includes detailed information regarding discipline, but this will be discussed in more detail later in the chapter. Finally, both Part B and Part C of IDEIA include procedural safeguards. These safeguards were designed to protect the rights of the students and their parents. These rights include the right to be notified timely of meetings; the right to attend the meetings at a date, time, and location of mutual agreement; and the right to examine all the educational records for their child. If the parent disagrees with the team, additional rights are afforded such as the right to an independent educational evaluation, mediation, and even due process. Readers who are interested in this topic in more detail are encouraged to see Laviano and Swanson (2017) for additional information.

5.2.4 Supreme Court Case Endrew F

In 2017, the US Supreme Court heard a case now commonly referred to as Endrew F (2017). In this case, the court ruled that schools must enable special education students to make meaningful progress. This ruling overturned a standard that was previously referred to as de minimis benefit, meaning that students only had to make minimal progress. Prince et al. (2018) summarized the Endrew F case and identified implications for educators. Specifically, they noted that IEP team members should take care to address all areas of need for eligible students. For example, children with autism spectrum disorder (ASD) may have grade level academic skills, but due to their diagnosis, they may have delays in social skills. IEP teams should address the social skills needs of the student, even though the student's academic skills are appropriate. Prince and colleagues also noted that IEP teams should develop ambitious, measurable goals for both academic and functional areas and that the services within the IEP be targeted to ensure improved performance in those areas. Finally, they noted that IEP teams should include strategies for monitoring student progress and methods for reporting that progress to parents. Endrew F, when combined with the IDEIA requirement for students to receive services based on EBP, ensures that students should be making meaningful progress year after year.

5.3 Areas of Established Evidence Base

What do we currently know about EBP? The answer is that it is complicated. Readers are encouraged to read the entire second issue of Volume 2 of *Exceptional Children* (2013) for a thorough discussion of the issues around EBP in Education. In particular, Cook and Odom (2013) discuss the issues facing special educators, and they note, "no practice will work for every single student" (p. 137). However, they also note that EBP must be combined with effective implementation. Measures of fidelity of implementation will be needed to ensure that the EBPs are being implemented as developed (c.f., Sutherland et al., 2019; Sutherland et al., 2013; Yell & Rozalski, 2013). Educators and related service providers such as behavior analysts must attend to each student's IEP and ensure that meaningful, ambitious goals are written and that services based on EBP are provided (Sayeski et al., 2019). When a student fails to make progress, the team should first assess the fidelity of implementation (Sam et al., 2021). If the intervention is being implemented as planned, then the team should modify the EBP used until the student begins making meaningful progress.

Yell and Rozalski (2013) identified tips for educators during the IEP process. First, educators should remain current in research related to academic and behavioral interventions. Second, during the IEP, educators should be prepared to discuss EBPs and the science behind their proposed instructional strategies. Third, if parents propose EBPs during the meeting, the educators should acknowledge and discuss the practices, including being able to refute any research or to describe a lack of research on the practice.

5.3.1 Child Find

One area validated by research for many years is the need for early identification and early intervention for children with disabilities. For example, it is widely known that early intervention for children with behavior disorders (Conroy & Brown, 2004) and children with learning disabilities (Lange & Thompson, 2006) will result in a decrease of challenges associated with the disability. This is especially true for young children with autism (e.g., Filipek et al., 2000; Koegel et al., 2014; Shaw et al., 2020).

Two areas of focus are needed to ensure that children with ASD are identified as early as possible. First, we must have coordinated community-based developmental monitoring to ensure that very young children are screened, identified, and evaluated for ASD (Barger et al., 2018). For example, agencies such as Autism Speaks have been sharing the early warning signs through commercials and websites. Pediatricians will continue to need training to recognize the red flags of ASD during well-checks because the average age of an ASD diagnosis is just over 4 years (Lord et al., 2006). This number decreased to just under 4 years when children over 10 years are excluded from the analysis (van't Hof et al., 2021).

A second area of focus is on early identification of students once they begin services at school, if they were not diagnosed prior to school. Zirkel (2017) notes that educators must take action when they have reasonable suspicion that the child may be eligible for IDEIA services. Educators may not look the other way when the red flags of ASD appear in students in their classrooms. In fact, once an educator has reasonable suspicion, then the evaluation must be initiated within a reasonable amount of time (Zirkel, 2017). Note that individual states may have definitions or timelines specified for the evaluation process. For example, in Texas, the evaluation must be completed within 60 days of obtaining written parent consent (Texas Education Agency, 2017).

5.3.2 Assessment and Evaluation

Once the student has been identified and referred for evaluation, educational teams need to ensure that the initial evaluation is individualized and assesses every area of need (IDEA, 2014). Because the assessment drives the development of the IEP, it is essential for teams to have a full understanding of each student's unique strengths and needs.

In addition to the initial and full evaluation required by law, IEP teams should ensure that they complete appropriate evidence-based assessments. Arguably, one of the most important assessments for children with ASD is the functional behavior assessment (FBA). An FBA is needed prior to antecedent-based interventions, prior to implementation of interventions to address challenging behavior, and prior to the implementation of Functional Communication Training (FCT). Additional information regarding evidence-based approaches to the FBA will be discussed later in this chapter.

Preference assessment is also an established EBP (Chazin & Ledford, 2016). Preference assessments consist of direct observations and or trial-by-trial measures of a student's preferences. Many types of preference assessments exist, but they most commonly result in a hierarchy of preferences for the student. These include multiple stimulus with (MSW) and without replacement (MSWO; DeLeon & Iwata, 1996), paired stimulus (Fisher et al., 1992), single stimulus (Pace et al., 1985), free operant (Roane et al., 1998), and in the moment reinforcer analysis (Leaf et al., 2015).

Another assessment that is needed to ensure that EBPs may be implemented effectively is the Autism Program Environment Assessment Rating Scale (Odom et al., 2018). In this assessment, the environment is first evaluated to determine the overall quality of the classroom. Classroom modifications may be necessary first before EBPs are implemented effectively.

Ongoing assessment and evaluation of progress is likely the most important assessment that should be done for students. Each and every domain in the IEP should be monitored for progress (Yell et al., 2016b). Moreover, the assessment should include a measurement of baseline performance (Yell et al., 2016a). This requires that the goal be written as a measurable goal, measured, and then monitored (Bateman & Linden, 2012). The IEP team should identify who will be responsible for progress monitoring for each component of the IEP to determine if progress is being made (Etscheidt, 2006; Sayeski et al., 2019). Finally, changes are made based on student progress or the lack thereof (Yell et al., 2016a).

5.3.3 Intervention

A number of formal reports on EBPs for intervention have been published by a variety of agencies and authors. A comprehensive review of those publications is beyond the scope of this chapter. Each review has strengths and limitations. For example, one of the most commonly cited EBP report is that of Steinbrenner et al. (2020). However, Leaf et al. (2021) published a paper summarizing their concerns and critiques of that report. What we can glean from these publications is an identification of the practices that appear to be deemed as EBPs by more than one publication (e.g., Chazin & Ledford, 2016; National Autism Center, 2015; Steinbrenner et al., 2020). These include antecedent-based interventions, augmentative and alternative communication, behavioral momentum, cognitive behavior therapy, direct instruction, and various strategies of applied behavior analysis (ABA) such as chaining, differential reinforcement, discrete trial training, extinction, FBA, FCT, modeling and video modeling, prompting, reinforcement, response interruption and redirection, self-management, task analysis, and time delay.

5.3.4 Functional Behavior Assessments, Behavior Intervention Plans, and Positive Behavior Interventions and Supports

An area that has been well-established in EBP is within assessment and treatment of challenging behaviors. In the 1997 reauthorization of the IDEA (IDEA, 1997), educators first learned of requirements regarding FBA. This was only 3 years after the Iwata et al. (1994) seminal article on functional analysis was reprinted following its first publication in 1982. As policy requirements moved faster than research to practice, educators scrambled to better understand the science behind FBAs and positive behavior interventions and supports (PBIS). This resulted in a number of legal cases regarding appropriate assessment and intervention. Specifically, in 2001, Drasgow and Yell summarized 14 case decisions regarding functional behavior assessment. In 13 of those cases, the hearing officer ruled in favor of the parents. In 11 of those cases, school districts simply failed to conduct an FBA when it was required by IDEA. Drasgow and Yell went on to note that school teams should initiate an FBA at the first sign of serious problem behavior.

In 2020, Zirkel reported on a review of 46 cases regarding FBAs and BIPs. Zirkel described a case wherein the school developed a BIP outside of the IEP process resulting in the parent being unable to participate. The court sided with the family due to this procedural error. Zirkel also described a case wherein the district failed to collect high-quality data as part of the FBA. The court ruled against the district in this example as well. In summarizing, Zirkel noted that educators should go beyond the minimum legal requirement and instead lean on professional norms of EBPs. Finally, Zirkel noted that educators should not just complete FBAs and BIPs to comply with legal standards but rather that by completing quality FBAs and BIPs that students would benefit from effective intervention services.

Losinski et al. (2014) outlined the minimum requirements of an FBA. First, the evaluator should include a clear description of the behavior. Second, they should identify the antecedent and consequences that surround the challenging behavior. Next, a hypothesis or hypotheses should be developed to describe why the challenging behavior is occurring. Finally, data should be included in the FBA to support the hypothesis statement. Drasgow and Yell (2001) recommended procedural steps of the FBA that should be completed. This included interviews of teachers, parents, and others, multiple direct observations of the student, and experimental manipulation of variables, if necessary.

Once a quality FBA is completed, the FBA is then used to develop an appropriate BIP. At a minimum, the BIP should include antecedent strategies for preventing challenging behavior, a plan to teach replacement behaviors, and a plan for reinforcing replacement behaviors and responding to challenging behaviors (Hirsch et al., 2017). Effective EBPs to be included in the BIP may consist of antecedent-based interventions, behavioral momentum/high probability response sequences, FCT, non-contingent reinforcement, and reinforcement (Chazin & Ledford, 2016; National Autism Center, 2015; Steinbrenner et al., 2020).

5.4 Behavior Analysts in Schools

The field of behavior analysis has seen an explosive increase of board-certified behavior analysts (BCBA) in recent years (BACB, 2021). This has resulted in a concomitant increase in behavior analysts practicing in public schools (McMahon et al., 2021). For example, the Pennsylvania Department of Education (2018) created a document on the role of behavior analysts in public education. More specifically, between 2012 and 2014, 28% of the jobs for BCBAs specifically fell in education (Burning Glass Technologies, 2015). Because the demand for behavior analysts in schools is a recent trend, additional commentary is needed to fully understand the application of EBPs and IDEIA Law.

The Council of Autism Service Providers (CASP) produced a document called Applied Behavior Analysis Treatment of Autism Spectrum Disorder: Practice Guidelines for Healthcare Funders and Managers (CASP, 2020; hereafter CASP ASD Guidelines). This document describes tiered intervention services as well as direct and indirect services. The document also discusses focused and comprehensive intervention. Of utmost importance is the discussion of caseloads for behavior analysts. In the CASP ASD Guidelines, it is recommended that BCBAs supervising comprehensive caseloads without assistance of an assistant behavior analyst should have between 6 and 12 students, while the caseload for focused students without the help of an assistant would include 10–15 students.

One limitation of the CASP ASD Guidelines is that they were not written to address services in the schools. Another limitation is that the title of the document specifically states that the guidelines are for healthcare funders. Therefore, some argue that those guidelines are not appropriate for school-based services. Finally, the document is specifically called "guidelines" which means they are merely recommendations and not necessarily enforced.

On the other hand, on the ABA Ethics Hotline, Syed (n.d.) has described appropriate caseloads for behavior analysts practicing in schools. While the ABA Ethics Hotline is also not enforceable, it is led by Dr. Jon Bailey, a leading expert on ethical issues for behavior analysts. Syed does not provide a specific headcount of students for behavior analysts in schools. Instead, Syed recommends that a percentage of supervision hours be provided based on the total hours of ABA services the student receives. Therefore, it is up to the individual behavior analyst to determine if they have the time to take on new case assignments based on existing case load. It is also up to the individual behavior analysts to self-advocate when their caseloads are too high. The only way students with ASD will obtain EBPs in schools is to ensure that behavior analysts have caseloads that allow them to provide appropriate quantity and quality of services.

The other area of importance for behavior analysts practicing in schools is the BACB Code of Ethics for Behavior Analysts (BACB, 2020). So as not repeat what is covered in other chapters in this book in more detail (e.g., Chapter 4), only a brief summary is provided here. Readers are encouraged to review the information with more detail in the chapter on Ethical Considerations and Dignity for Adults with ASD. Under #2.01, #2.13, and #2.14, BCBAs must provide assessment and intervention services that are effective and conceptually consistent with behavior analysis and based on scientific evidence. Practicing in schools must be in the BCBA's scope of competence (#1.05). The IFSP and the IEP serve as the contract for behavior analytic services (#3.04). As with adults, BCBAs should rule out underlying medical conditions (#2.12). Consistent with IDEIA law, BCBAs should include parents and students throughout the assessment and intervention planning (#2.09), and they should keep all client information confidential (#2.03 and #2.04). Also consistent with IDEIA law, BCBAs should collect and graph data regularly (#2.17). Finally, under #2.18, BCBAs continually evaluate the effectiveness of their interventions, and they make changes to those interventions based on data to ensure the student makes progress. Making adequate progress is consistent with Endrew F requirements as well.

In summary, students with ASD under 21 years of age have a right to services that are considered EBPs. Universities need to continue to train teachers and paraeducators to fidelity in the implementation of EBPs. Schools need to ensure that teachers are implementing EBPs and ensure that teachers are engaging in continuing education, so teachers stay abreast of new EBPs as they emerge in research. BCBAs need to maintain appropriate caseloads to ensure they are delivering EBP to their students. Parents need to demand that their children receive EBPs, and they should see weekly graphs of their child's progress toward annual goals. Those goals need to be lofty, consistent with Endrew F. When students with ASD have access to EBPs, they are more likely to make progress resulting in them being active participants in the communities where they live and work.

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6 Evidence-Based Practice in Schools

Ilene S. Schwartz, Alice Bravo, Robin Finlayson, Jessica Flaherty, and Adriana Luna

6.1 Evidence-Based Practice in Schools

In 1975, President Gerald Ford signed PL 94-142 into law, now referred to as the Individuals with Disabilities Education Act (IDEA, 2004), changing the lives of people with disabilities in the United States forever. This law entitles all students with disabilities to a free appropriate public education (FAPE). Although IDEA has never been fully funded or implemented, the promise of IDEA is alive and well in public schools across the country. In this chapter, we will review the use of evidence-based practice and the components of IDEA and discuss how the context of public schools impacts the delivery of services and the practice of applied behavior analysis and the development and implementation of IEPs for students with autism spectrum disorder (ASD).

Before we discuss evidence-based practice, we want to discuss person-first language, which we will use throughout this chapter. Person-first language, the practice of identifying a person before their disability, was an outgrowth of the disability rights political movement of the 1960s and 1970s and is supported by many advocacy groups, governmental agencies, and journalists. Many in the ASD community advocate for the use of "identity-first" language, that is, using the terms "autistic," "autistic person," or "autistic individual," rather than the person-first usage of a person with ASD. Identity-first language is aligned with the identity model of disability, which asserts that disability is a typical human experience and an intrinsic part of one's identity. Advocates for identity-first language see ASD as an inherent part of an individual's identity—the same way one refers to "African-Americans," "lesbian/gay/bisexual/transgender/queer," "gifted," "athletic," or "Jewish"—and suggest that identity-first language celebrates the neurodiversity of all members of society. As nondisabled people, we believe that we need to use person-first language until we are invited by individuals with disabilities to use identity-first language. Once an individual with a disability expresses a preference about the type of language they prefer, we honor that request. In general, however, and in this chapter, we continue to use person-first language.

6.1.1 Evidence-Based Practice

Evidence-based practice (EBP) plays an important role in the services for students with ASD in public schools and behavior analysts working in

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schools. The use of EBP is not only mandated by IDEA; it is also mandated by the Ethics Code for Behavior Analysts (BACB, 2020). Sackett et al. (1996) defined the practice of evidence-based medicine as "the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients" (p. 71). This practice involves the integration of individual practitioner expertise with the best available evidence from systematic research.

In the past two decades, many definitions of EBP have emerged, and although there are differences in the definitions across professional disciplines, there is general agreement that EBPs are an attempt to use replicated, quality research outcomes to make decisions about what intervention strategies should be used with students (e.g., Slocum et al., 2014; Smith, 2013; Steinbrenner et al., 2020). Most professional organizations include practitioner experience, client preferences, client characteristics, and client values into the rubric that is used when identifying and evaluating EBP. As behavior analysts, we would like to add another characteristic to the definition—consideration of the context in which the intervention is implemented and the effectiveness of the intervention within that setting (Fig. 6.1).

By definition, EBPs are actuarial. They are developed by compiling research and determining which interventions have enough research evidence to suggest that they are most likely to be effective, with most of the students, most of the time. They do not, and cannot, determine a priori that a specific EBP will be an effective intervention for a specific individual at a specific time to teach a specific skill. Therefore, EBP should be considered as a starting point for intervention. Once an educational team decides to implement an EBP, the team needs to evaluate and document the effects of treatment. If an EBP is implemented and the anticipated change in behavior is documented, fantastic; continue with the treatment and progress monitoring. A behavior analyst may then add this example to their professional experience about the effectiveness of the practice. If, however, an EBP is implemented with fidelity and does not result in a positive change in behavior, it is incumbent upon the behavior analyst and/or the educational team to change the intervention. The change may be in regard to the intensity of the intervention, the type of reinforcer used, or perhaps an entirely different intervention strategy altogether. The important lesson is that an instructional strategy cannot be said to be evidence-based for an individual until we have collected data demonstrating its effectiveness in this specific situation, with this specific behavior, and in this specific context. To be accountable to our students, we need to conduct these treatment evaluations, one learner at a time, one behavior at a time. For behavior analysts working in schools, the practice of frequent data collection and analysis can help educational teams implement and document the effectiveness of EBPs selected for individual students.

Fig. 6.1 Conceptualization of evidence-based practice

6.1.2 Individuals with Disabilities Education Act (IDEA)

Public education is the one great service to which all children and youth in the United States are entitled. Public education is charged with providing access to education and promoting equal opportunities for all students while preparing individuals for civic participation and post-school life (Kober, 2007). Public education provides opportunities for students to access evidence-based instruction and intervention regardless of race, ethnicity, socioeconomic status, gender, or disability status. Until 1975, however, almost 1.8 million children with disabilities were excluded from public schools (Duncan, 2015). Many of these students were placed in segregated learning settings, residential centers, or educated at home. IDEA is a comprehensive federal law comprising six major components, each of which are outlined below.

6.1.2.1 Free Appropriate Public Education (FAPE)

The foundation of IDEA is the entitlement of all students with disabilities to a free appropriate public education (FAPE) that is designed to meet student's unique needs, support them to access the general education curriculum and environment, and prepare them for further education, employment, and independent living (Yell et al., 2020). The primary measure for providing a student with a FAPE is through an Individualized Education Program (IEP) that establishes a student's present levels of achievement and performance, the impact of the student's disability on participation and learning, and the student's progress within the general education curriculum. A FAPE mandates that IEP goals be aligned with grade-level content standards.

6.1.2.2 Least Restrictive Environment (LRE)

IDEA mandates that students with disabilities access a FAPE in the least restrictive environment (LRE), meaning that all students should participate and receive instruction within inclusive, general education classrooms alongside typically developing peers to the greatest extent possible. For students with disabilities, this includes opportunities to participate and succeed in learning communities with their typically developing peers and to engage in meaningful learning in inclusive settings where all students' identities are welcomed, affirmed, and supported. The National Council on Disability (2018) defines inclusion as "…not a place, but rather a systemic approach to uniquely addressing student learning and social engagement within the same instructional frameworks and settings designed for the whole school community" (p. 11). Access to effective instruction and access to the general education classroom are not synonymous; one can sit in the general education classroom, experience isolation, and not receive the specially designed instruction to which they are entitled. Learners should not need to earn their entry into general education. All learners are general education students first, with special education serving a function of supporting access to learning and to success with the general education curriculum. Student placement and participation in general education should be based on meeting the student's individual needs for optimal growth and meaningful development. This highlights the importance of using high-leverage EBPs within classrooms and schools to create systems designed for the whole school community.

6.1.2.3 Appropriate Evaluation

Under IDEA, every student suspected of having a disability has the right to receive an appropriate evaluation via an Evaluation Team Report (ETR) in order to establish the presence of a qualifying disability, or disabilities, for special education services. The evaluation must:

- Evaluate all areas of suspected disability
- Be completed by a team trained in the use of the relevant and selected assessment measures
- Employ evaluation materials that are neither racially nor culturally discriminatory
- Avoid subjecting a student to unnecessary tests and assessments
- Include the gathering of relevant information from a variety of sources

The written ETR must include a summary of information obtained during the evaluation process; the names, titles, and signatures of each team member (including the parent); and an indication of whether they are in agreement with the eligibility determination. The school district must provide a copy of the ETR and the documentation of eligibility or continued eligibility to the parents prior to the IEP meeting and no later than 14 days from the date of eligibility determination.

An evaluation will determine whether a student receives an educational classification within 1 of the 13 disability categories: specific learning disability, other health impairment, ASD, emotional disturbance, speech or language impairment, visual impairment (including blindness), deafness, hearing impairment, deaf-blindness, orthopedic impairment, intellectual disability, traumatic brain injury, or multiple disabilities (IDEA, 2004). Educational classifications for a disability are different from medical diagnoses, as they are solely used to determine eligibility for special education services and are unrelated to services received outside of public school settings. If a student arrives at school with a medical diagnosis of ASD, they will still need to participate in the school evaluation process to qualify for special education services.

6.1.2.4 Individualized Education Program (IEP)

Once the ETR is complete, the student, family, and educational team participate in a collaborative process to develop an IEP. The IEP is a document that describes a student's strengths and needs and the specially designed instruction, accommodations, modifications, and special services (e.g., services from a Board Certified Behavior Analyst [BCBA] or speech-language pathologist [SLP]) a student needs to optimize their education and learning. See Table 6.1 for a description of the required components of an IEP. A collaborative team is developed to identify the services and supports that will allow the student to best participate in the school environment. The team should consist of the student's caregivers; at least one general educator; at least one special educator; a representative of the school system who is knowledgeable about specialized instruction, the general education curriculum, and the availability of school resources; an individual who may interpret evaluation results (e.g., school psychologist); the student themselves, as appropriate; and other individuals

Table 6.1 Components of an IEP

Student's present level of performance	The IEP specifies the results of the initial or most recent evaluation and the academic, developmental, and functional needs of the student. It should state the student's current level of performance, student's strengths, and caregiver concerns for enhancing the student's education
Ambitious and measurable goals	Short- and long-term goals are operationally defined, contain appropriate objective criteria, address individualized student needs, address access to appropriately ambitious education plans, and specify criterion for change
Functional behavior assessment and behavior intervention plan	If warranted, an IEP will include an FBA and a BIP. The school district is tasked with assigning a practitioner with behavioral expertise to conduct the FBA (e.g., school psychologist, behavior specialist/BCBA, special educator). BIPs specify intervention agents, measurement systems, and criterion for change
Description of special education and related services	The IEP defines individualized instruction, supports, and services required for the student to benefit from their public education. It defines services provided, team members responsible for IEP implementation, and the time and place instruction will be delivered
Coordination of care	Providers should work as an interdisciplinary team to collaborate on creation, implementation, and assessment of student goals. These teams may include, but are not limited to, occupational therapists, SLPs, BCBAs, special education coordinators, general education teachers, social work services, etc.
Teacher/staff training	If warranted, the IEP may include a plan for additional teacher and staff training
Placement	The IEP specifies the extent to which the student will participate in the general education classroom, and if it is less than 100% of the time, an explanation is required

Transition plan	Once a student turns 16, the IEP includes a transition plan that details the transition out of the public education system and into the next stage of their life
Plan for continuous evaluation of IEP	The IEP specifies the date services are to begin and states the anticipated frequency, location, and duration of services. This includes a plan to meet yearly, or more frequently if needed, to continuously evaluate progress and make necessary changes
Caregiver approval	The IEP must be agreed to and signed by the student's caregiver. Caregivers may request an IEP team meeting at any time and reserve the right to request amendments to the proposed plan

with knowledge of the student as desired by the caregivers and/or school, such as related service providers (Yell et al., 2020). Interestingly, students are required to participate in their own IEP planning process once they turn 14 years of age, but including them earlier is an opportunity to teach self-advocacy and listen to advocates with ASD who suggest that the phrase "Nothing about us without us" should guide intervention. Each team member brings important information about the student to the collaboration process.

The resulting IEP not only mandates the services and supports allocated to the student but also specifies how collaboration is going to happen within the delivery of those services. The services specified within the IEP are not implemented in a vacuum or in one predetermined location but instead follow a student throughout their school day across settings and educators. The IEP planning process, described below, encourages the educational team to ask "How are we going to work together to implement and target all goals?". It offers educators, caregivers, and related service providers a space to consider how they will collaborate, request help and support, and learn from one another. IEPs are written annually, and every student needs to have a comprehensive evaluation every 3 years to determine if they continue to qualify for special education services.

The *Endrew* case (Endrew F. v. Douglas County School District, 2017), ruled on in 2017 by the US Supreme Court, significantly impacts how IEPs are planned, written, and evaluated for students with disabilities and especially students with ASD. In this decision, a unanimous supreme court ruled that IDEA must provide students with an education program that is "reasonably calculated" for the student to make progress on their individualized goals (Yell & Bateman, 2019). The family at the center of this case argued that their son, "Drew," should be making more progress than he was on his IEP goals. The court agreed, stating that a student's IEP should be made "appropriately ambitious." This standard aims to be individualized to each student entitled to an IEP and extends beyond meeting the bare minimum requirements, thus making the *Endrew* decision a landmark case in the field of special education.

6.1.2.5 Parent and Student Participation

IDEA (2004) mandates that parents have the right to participate in decisions about their child's education and the IEP process. The importance of parental participation has been emphasized in courtrooms since the seminal Rowley decision (Board of Education v. Rowley, 1982). For instance, the US Court of Appeals for the Ninth Circuit in *Amanda J. v. Clark City School District* (2001) stated that "procedural violations that interfere with parental participation in the IEP formulation process undermine the very essence of the IDEA" (p. 878). Indeed, parents have a unique and important perspective on their child's strengths and needs and are a critical part of the IEP team. The IEP team must ensure that a student's parents, educators, and administrators work together to make important decisions for eligible students with disabilities throughout the special education process (Yell et al., 2020).

The student must be invited to attend IEP team meetings if the meeting will include transition planning and consideration of post-secondary goals, which should begin by the age of 16 years (IDEA, 2004). At the same time, students can be invited to attend IEP meetings at any age, and there are immense benefits in doing so. Student participation in IEP meetings supports the development of self-determination and self-advocacy skills (Diegelmann & Test, 2018). These skills are important across the lifespan and are particularly relevant as students consider post-secondary options, wherein the student will have to request their own accommodations.

6.1.2.6 Procedural Safeguards

Parents and students have legal protections during the evaluation and IEP process, known as procedural safeguards. Districts are required to share a written copy of these safeguards with families annually. These safeguards include the legal right to be notified of and participate in all meetings, access to educational records, translation and interpretation services provided free of charge, documents that are jargon-free, the confidentiality of information as outlined by the Family Educational Rights and Privacy Act (Privacy Act, 1974), and a specified process of how to state their disagreement on issues of evaluation, placement, and other provisions of the IEP (Yell et al., 2020).

6.1.3 The IEP and Students with ASD

6.1.3.1 IEP Planning

The goal of the IEP planning process is to ensure that the IEP team develops a document that outlines the specially designed instruction, supports, and accommodations that a student with a disability needs to access learning opportunities and succeed at school. As a result of the Endrew Supreme Court case (Endrew F. v. Douglas County School District, 2017), IEPs must result in an educational plan that is appropriately ambitious and will result in meaningful learning for the student. Assessment, the use of an IEP planning form, and IEP meetings are all components of the IEP planning process.

Assessment Assessment is a broad term referring to the systematic gathering of information to inform decisions. A formal assessment is administered via the school district prior to the creation of an IEP, and accurate and up-to-date information on a student's current level of performance across academic and functional areas is the foundation upon which the IEP stands (Bateman, 2017). Assessment should refrain from relying on a single instrument to identify a disability and to inform educational programming and, as such, should include a variety of strategies and measures (Yell et al., 2020). For a student identified as having ASD, the assessment may include tools focused on the core characteristics of ASD, such as social skills, communication skills, and executive functioning. However, measures included in the assessment process should be individualized to the student to address their specific academic and functional needs (Yell et al., 2020). Within the context of the general education environment, assessment is ongoing and occurs for all students regardless of ability labels. Formative and summative assessments evaluate students' progress within the general education curriculum and contribute to ongoing student progress monitoring. These are imperative assessments to consider during the IEP planning process as access to and progress within the general education curriculum should always be a primary consideration. A functional behavior assessment (FBA; discussed later in this chapter) should be incorporated for a student exhibiting challenging behavior so that functionally based supports can be included in the student's plan. The school district is tasked with assigning a practitioner with behavioral expertise to conduct the FBA (e.g., school psychologist, behavior specialist/BCBA, special educator). Finally, family priorities and student input (when possible) should be solicited to inform the selection of goals and objectives. Families may also obtain outside evaluation and bring that information to the IEP team for consideration (Yell et al., 2020).

IEP Planning Form The IEP planning form (see Table 6.2) can be used by all IEP team members to brainstorm and document their knowledge of the student's current levels of performance and ideas for individualized goals and instructional strategies across multiple domains, including academics, motor, communication, social interaction/relationships, executive functioning, self-

Table 6.2 IEP planning form

	Current status (please include levels of independence for different skills and behaviors)	Proposals for IEP goals, instructional strategies, programming
Academics Literacy Math Other subjects		
Motor		
Communication		
Social interaction/relationships		
Executive function (e.g., organization, planning, problem-solving)		
Self-determination		
Recreation/leisure		
Self-care		
Participation in inclusive environment		
Barriers to participation/learning		
Transition issues (e.g., move to new school, post-school planning, employment)		
Other		

determination, recreation/leisure, self-care, participation in general education, barriers to participation/learning, and transition issues. Under “Current Status,” team members may include formal assessment data (e.g., an SLP may include data from a communication assessment) and/or informal data (e.g., caregivers may include data from observations at home). Using this knowledge, team members may then complete the “Proposals” column by considering priority areas for instruction, strategies to promote authentic participation within inclusive settings, and areas of strength or need that are not represented within the domains specified on the form.

We recommend that all members of the IEP team come to the first meeting with the form completed. This facilitates a productive team meeting in which all team members are prepared to share their knowledge and recommendations. Following this meeting, the IEP case manager should take all planning forms and team meeting feedback and write the IEP. Following this, the case manager distributes the draft IEP to all team members, including the family, for review prior to the formal IEP meeting.

IEP Meeting IEP meetings can be stressful and intimidating for parents (Tucker & Schwartz, 2013). Some parents report that it can be scary to enter a conference with professionals that they do not know and listen to those professionals tell them about their child’s skills and behavioral challenges. Rather, the IEP meeting should be a time when the educational team, including the family and student, take time to celebrate the students’ accomplishments over the past year and make plans for the next year. All members of the educational team should have had the opportunity to review the IEP prior to the meeting. The purpose of the actual meeting should be to ask questions about the document and how it will be implemented (Table 6.3).

The IEP is an important document, and family input and opinion are valuable. The IEP should be a living document, used to inform curricular decisions and individualized programming for a student. The selected meeting time should aim to accommodate as many team members as possible; full team collaboration is a key component of a strong IEP. Families may invite whomever they want to an IEP meeting, and many advocates rec-

Table 6.3 Suggestions for implementing an IEP in inclusive settings

Themes	Guiding questions
Participation in an inclusive environment	*Does the program provide the learner with ASD opportunities to interact with typically developing peers?* *Does the program staff use appropriate classroom activities, room arrangement, and instructional strategies to promote positive social interactions between children with ASD and typically developing children?* *Does the program use master schedule and activity matrices to optimize instructional opportunities in general education settings?*
Access to an appropriately ambitious and QoL-influenced curriculum	*Are family members involved in setting the goals for intervention?* *Do intervention goals align with parents' values, preferences, and identity?* *How will the targeted skills and behaviors increase the child's independence and increase his or her overall quality of life?*
Use of EBPs and data-based decision-making	*Is the data collection system likely to be implemented and does it provide a measure of progress for the particular skill?* *Are data being collected on a frequent enough basis to determine progress on a particular skill?* *Are the data reviewed frequently (at least twice monthly) and are instructional decisions made, communicated to the team, and implemented as a result of the data reviews?*
Functional approach to challenging behavior	*Has there been a functional behavior assessment (FBA) conducted to determine the function of the challenging behavior?* *Is there a behavior intervention plan (BIP) in place?*
Training and coaching for staff	*Has there been ongoing training and coaching between the educator and a qualified coach?* *Did coaching entail the coaching "cycle" (i.e., didactic instruction, modeling, observation, feedback, reflection)?*
Technical and social support for families	*Has the family's input during the assessment process been solicited?* *Has the family's need for technical support (e.g., parenting classes) been assessed and have these services been provided?* *Have the family's needs regarding social support been assessed and suggestions provided?*

ommend that parents bring someone they trust who can act as a notetaker and provide moral support during their child's IEP meetings. Another idea to support families in this process is to encourage them to bring a picture of their child, if the child is not attending, to put in the middle of the table to remind the team about the real purpose of the meeting. Others remind parents that they should not attend an IEP meeting if they have not had the opportunity to review the documentation ahead of time. Interestingly, a positive outcome of the COVID-19-related school shutdowns is that most IEP meetings have been moved to an online format. Parents report (Bateman & McKittrick, 2021) that they prefer the convenience of online meetings and feel more comfortable participating in IEP meetings using this format. Hopefully, school districts will adopt this strategy as an option to support family engagement.

6.1.4 IEP Implementation

The IEP team is collectively responsible for implementing the IEP. While IEP goals are generally domain-specific and may be drafted or suggested by team members with relevant expertise, this does not mean that the goals themselves must be implemented by a specific team member. IEP implementation should be collaborative with professionals from different disciplines working together to select the most appropriate EBP to address the skill/behavior and the best time of the day to provide the specially designed instruction. An example of this includes supporting a student in the development of communication skills. While an SLP may draft goals targeting communication based on their discipline-specific knowledge, other professionals such as special educators, BCBAs, and paraprofessionals who have relevant expertise may draft goals or contribute additional input and feedback about where and when instruction will be provided. Once IEP goals are finalized, it is the entire team's responsibility to implement the IEP and ensure all goals are being consistently targeted by determining who will address each goal, when, and how often. School professionals may contribute to targeting goals across multiple developmental domains. For example, a student who has communication goals targeting the use of an augmentative and alternative communication (AAC) device or behavioral goals surrounding the reduction of challenging behavior will likely work on these goals across the school day. It is unrealistic to have only one IEP team member responsible for implementing the communication goal targeting AAC device use or implementing the behavior intervention plan. Rather, the entire team is responsible for determining when, how often, and by whom each goal will be addressed.

The support that facilitates success for one student with ASD will look different from those needed for another student. It is axiomatic that there is not an "average" student with ASD and that the diagnosis or educational determination of ASD is a description, not a prescription. The individualized planning associated with writing and implementing an IEP is not a suggestion; rather, it is a legal requirement upon which public schools must educate and support their students. Strategies that support students with ASD in public schools include student participation in an inclusive environment, access to a quality of life-influenced curriculum, the use of EBPs and data-based decision-making, a functional approach to challenging behavior, training and coaching for staff, and technical and social support for families (Schwartz et al., 2017).

6.1.4.1 Participating in the Inclusive Environment

Education teams must ensure that students are receiving instruction within the LRE. The basic premise of LRE is that all students with disabilities are general education students first and must be assigned a seat in general education. The important question to ask is what is happening while the student is sitting in their general education seat and what accommodations, modifications, and specially designed instruction do students need to be successful. Being in the LRE enables students to have access to typically developing peers and the general education curriculum. IDEA requires that students with disabilities be educated alongside their typically developing peers to the maximum extent possible (IDEA, 20 U.S.C. 1412). It is incumbent on education and IEP teams to decide what settings will be most appropriate for the student's learning. Specifically, the team must specify how the student will access the general education curriculum and their typically developing peers. Supporting interactions across ability levels and supporting students with and without disabilities to interact meaningfully promotes key social and communication skills (Schwartz & Davis, 2014).

Students with disabilities have the right to be educated in the LRE alongside their typically developing peers. For the most successful planning, educational teams should not ask *if* students can be included in general education; the more appropriate question is *what supports and services* do students need to be successful in general education?

Scheduling Scheduling is one type of structural support that enables instruction in the general education environment to occur. Schools are complex environments with many adults and students moving at different times and going to different places. In order for students with disabilities to participate in and benefit from the interactions and instruction in the general education environment, they need to spend time in that environment. One strategy that many schools use is to develop a master schedule (Villa & Thousand, 2016). The purpose of a master school schedule is to ensure that services and instructional time across the school are coordinated to provide the most efficient and effective instruction for students of all abilities. A well-designed master schedule will ensure that students are not removed from general education during core instructional time and that the services that students need, to the greatest extent possible, are provided in the general education environment alongside their typically developing peers.

This type of scheduling also provides grade-level teams (e.g., general and special education teachers, related service providers) time to assess student needs and plan together. This joint planning and frequent progress monitoring is key to supporting student achievement in general education.

Planning/Activity Matrices Activity matrices guide personnel in determining by whom, when, and where supports and services will be delivered. They help ensure that all goals within a student's IEP are being targeted across educational activities over the course of the school day or school week (Sandall et al., 2019; Schwartz et al., 2017). To create an activity matrix for an individual student, an educator develops a table that lists the academic schedule on the left-hand side and IEP domains in which the student has goals across the top of the table. The matrix is then filled in with the students' goals within domains indicating where in the academic schedule each goal will be specifically targeted. To create an activity matrix for a group of students, an educator develops a table that lists the academic schedule on the left-hand side and student names across the top of the table. The matrix is then filled in to indicate where in the academic schedule various student goals will be targeted. Activity matrices increase the likelihood that each IEP goal will be worked on during at least one school activity by serving as a visual reminder for staff.

6.1.4.2 Access to an Appropriately Ambitious and Quality of Life-Influenced Curriculum

Improving the quality of life (QoL) of students with whom we work should be the primary outcome variable of applied behavior analysis and special education (Carr & Horner, 2007; Schwartz & Kelley, 2021). This, along with the mandate from the *Endrew* court decision requiring that IEPs be appropriately ambitious, must be considered when planning and implementing educational programs for students with ASD. A QoL-influenced curriculum focuses on functional and culturally relevant skills. Functional skills are those skills that, if a student cannot do independently, someone has to do for them. Frequently, educational teams limit their list of functional skills to activities of daily living (ADL) such as dressing, tooth brushing, and toileting. Although ADL skills are important and necessary for independence, functional skills extend far beyond this domain. Schalock (2004) identified eight critical domains that impact QoL: emotional well-being, interpersonal relations, material well-being, personal development, physical well-being, self-determination, inclusion, and rights (Schalock, 2004; Schalock & Verdugo, 2002). This breadth of programming and the interaction of selected programming with student and family values and priorities must be considered when implementing an educational program.

6.1.4.3 Selecting Appropriate Evidence-Based Practice to Meet the Needs of Students and Families

Selecting an EBP to support an IEP goal should consider individual student characteristics and implementation factors. Student characteristics include aspects such as the student's age, learning history, family priorities, gender, cultural background, whether or not the student is an English language learner, and disability status (Slocum et al., 2014). Implementation factors include aspects such as the context in which the instruction will be provided; the size of the instructional group (e.g., 1:1 instruction, small group instruction, whole class instruction, embedded across the school day); the length, frequency, and location of instructional sessions incorporating the EBP; characteristics of the individual(s) implementing the EBP; and the amount of training required to implement the EBP with fidelity (Schwartz & Davis, 2014). These student and implementation factors help guide EBP selection as IEP team members consider for whom and under what circumstances intervention strategies have shown meaningful gains for students. Using this information, team members can identify the research behind (or lack thereof) practices that fit or approximate the aforementioned characteristics.

When selecting EBPs, IEP team members should consult reputable information sources such as the What Works Clearinghouse, the National Center on Intensive Intervention, and the National Professional Development Center on Autism Spectrum Disorder. The What Works Clearinghouse (https://ies.ed.gov/ncee/wwc/) is funded by the Institute of Education Sciences within the US Department of Education and reviews and disseminates research on educational programs, products, practices, and policies to support educators in making evidence-based decisions. The National Center on Intensive Intervention (https://intensiveintervention.org/) is also funded by the US Department of Education through the Office of Special Education Programs (OSEP) and works to build the capacity of education agencies, universities, practitioners, and relevant stakeholders in the implementation of academic and behavioral interventions by sharing research-based information, professional development, and implementation support. Finally, the National Professional Development Center on Autism Spectrum Disorder (https://autismpdc.fpg.unc.edu/evidence-based-practices) releases reports that review the literature to date and identifies EBP specifically for individuals with ASD.

6.1.4.4 Data-Based Decision-Making

While the rigor of the research supporting an EBP should be considered when selecting instructional strategies to use in practice, continual progress monitoring is required to determine whether or not the practice is effective and resulting in positive outcomes for a specific student. Current best practice indicates that ongoing data collection and analysis to inform data-based decision-making are critical components to intervention for students with ASD. Without this, professionals are unable to determine an intervention's effectiveness for an individual student (Schwartz & Davis, 2014). To support progress monitoring, IDEA requires that students' IEPs contain measurable annual goals, a description of how these goals will be measured and monitored, and a statement indicating when reports on the student's progress will be provided (Yell et al., 2020).

Data should be collected, evaluated, and analyzed frequently. The frequency is individually determined by the skill and student. In other words, the data should be collected with enough frequency that progress is monitored at an appropriate pace (Schwartz et al., 2017). Collecting and graphing data are associated with increased student academic achievement, providing educators with the information they need to make data-based decisions (e.g., Fuchs & Fuchs, 1986; Sandall et al., 2004). In order to collect and analyze data effectively, IEP team members must determine whose responsibility it is to collect data for a particular goal and how often these data will be collected. These data inform the IEP team whether the specified interventions, instructional practices, and accommodations are allowing the student to make reasonable progress. If it is determined that the student is not making adequate progress toward their IEP goals, it is the responsibility of the IEP team to make changes to the student's instruction to ensure progress is attained.

Although educators and related service providers believe that data collection is essential to student progress, research suggests that data collection and evaluation are inconsistent and/or considered cumbersome by educators (Sandall et al., 2004). BCBAs and other professionals have extensive training in data collection but need to be aware of the contextual demands of collecting data in a classroom setting as compared to a clinic or treatment room. It is recommended that the intervention team determine a data collection system that is functional, realistic, and useful. There are many suggestions for collecting data, using both high-tech and low-tech tools.

Data collection strategies can include applications on tablets and smartphones, paper and pencil data sheets, golf counters, 3x5 cards clipped to therapist's waistband, and even masking tape on the pants of the therapist to keep track of behavior (e.g., Dunlap et al., 2019; Hojnoski et al., 2009; Lingo et al., 2011; Schwartz et al., 2017). The best data sheet is the data sheet that gets used frequently and yields information that can be used to monitor student progress. Once the data are gathered, they must be graphed and analyzed in a timely manner (e.g., at least weekly). Engaging in these behaviors will allow the educational team to determine which behaviors are responding positively (or not) to intervention. An activity matrix, discussed above, can also be useful in determining when and where data will be collected and provide a simple strategy to keep track of which data have been collected every week.

6.1.4.5 Functional Approach to Challenging Behavior

Over the past 30 years, there has been a plethora of research demonstrating that challenging behavior serves a communicative function (e.g., Andzik et al., 2016; Chezan et al., 2018; Durand & Moskowitz, 2015). In developing interventions for a particular behavior, extant research indicates that the intervention must target the same function as the challenging behavior (Carr, 1988; Carr & Durand, 1985). To do this, behavior must be analyzed in the context that it occurs in order to determine a pattern between what happens before and after the behavior (Carr, 1994; Heckaman et al., 2000). There are multiple ways to describe challenging behavior. For example, one may describe what *form* the behavior takes, or what it looks like (e.g., reading, jumping, playing). One may also take a *functional* approach to describing behavior, or what effect that behavior has on the environment and people around them (e.g., pointing to receive a toy). Behavior analysts approach challenging behavior by determining the function, or the "why" behind the student engaging in that behavior, through an FBA. In this functional approach, our goal is to describe what is motivating, or maintaining, the behavior. In the example of pointing, the child points in order to request the toy that they want—a clear example of the communicative aspect of behavior.

In the context of schools, IDEA mandates that an FBA be conducted when a student's challenging behavior significantly interferes with their learning (IDEA, 2004). Conducting an FBA refers to the process of gathering behavioral data from the student that will inform the development of a functional hypothesis (i.e., why the behavior is occurring). Different school districts may have various required forms for their FBAs; however, it is considered best practice to have a clear, observable definition of the behavior, observe multiple instances of the behavior in context, and interview multiple stakeholders (e.g., teacher, parents, student if possible). This process will involve determining patterns in the reinforcing consequences of that behavior (Lewis et al., 2017; Steege et al., 2019), as well as environmental variables such as the antecedents. From there, the school team, including a behavior analyst or school psychologist, will develop a behavior intervention plan (BIP) that outlines the proposed method of responding to the challenging behavior and how the team will teach replacement behaviors. At the core of an FBA is the behavior analytic assumption that this student's behavior meets one of four functions: escape, attention, tangible, or automatic (e.g., sensory). Within school settings, school psychologists frequently conduct FBAs. Other professionals with behavioral expertise and knowledge (such as special educators or behavior analysts) may also be the professional leading the team to conduct an FBA. Given that behaviors may serve different functions in different contexts, communication and data sharing within the team are crucial.

Increasingly, schools are implementing School-Wide Positive Behavior Interventions and Supports (SWPBIS) by using systems-wide changes in their expectations, culture, and overall school environment (Sugai & Horner, 2006). SWPBIS is a multi-tiered system of support (MTSS) designed to provide a preventative approach to challenging behavior in schools by creating support at the primary (school-wide), secondary (class-wide), and tertiary (individual student) levels (Sugai & Horner, 2009). Students with ASD, because they are general education students first, must be included in SWPBIS and any other school side interventions and supports.

6.1.4.6 Training and Coaching for Staff

The educational team should assess team members' needs for implementing EBP specified within the student's IEP. Training and coaching should be provided to any staff member who works with the student who does not have adequate experience, knowledge, confidence, or skills regarding the selected EBP(s). Training and coaching may be provided by qualified team members, other members of the school community, or outside consultants. The need for training and/or coaching should not stand in the way of implementing an EBP that is a necessary part of a student's educational program.

Coaching is a broad term constituting an ongoing process intended to improve performance. While models of coaching may differ slightly, common components making up a coaching "cycle" include didactic instruction on the identified practice, educator observation of the coach engaging in (i.e., modeling) the practice, coach observation of the educator engaging in the practice while simultaneously delivering constructive and positive feedback, an opportunity for the coach and educator to jointly reflect on the use of the practice (e.g., how the student responded to the practice, the educator's perception of implementation), and an opportunity for the coach and educator to plan next steps (Jewett & MacPhee, 2012; Rush & Shelden, 2011; Snyder et al., 2015). Coaching may be delivered by professionals with relevant expertise in the identified practice. BCBAs have knowledge of behavioral and effective teaching strategies and are thus good candidates for coaching related to behavior intervention and skill-based instructional strategies. General educators have expertise in academic content such as mathematics, literacy, and science, while special educators have knowledge regarding curriculum modifications and adaptations. Coaching in schools depends upon the needs of the educators and students within the school.

Behavioral skills training (BST; Kirkpatrick et al., 2019) is one of the most commonly cited and practiced models for coaching in applied behavior analysis. It is important for BCBAs working in schools to remember that BST is one type of coaching and training and that other efficacious coaching models exist and are used in school settings, such as instructional coaching, practice-based coaching, and peer coaching (Desimone & Pak, 2017; Scheeler et al., 2010; Snyder et al., 2015). BCBAs in schools should avoid becoming stuck on the coaching model or terminology used but rather should emphasize the importance of coaching across disciplines to ensure accurate and effective implementation of evidence-based instructional practice.

6.1.4.7 Technical and Social Support for Families

The IEP team must ensure that caregivers, and, to the extent possible, students, are active members and decision-makers throughout the IEP planning and implementation processes. IEP team members are required to gain consent and input from caregivers in order to proceed with the IEP assessment process; but the quality of the process and product of the IEP can be improved when families feel like authentic partners in the process (Drasgow et al., 2001; Kurth et al., 2019). Further, the IEP team should consider caregivers as equal partners, rather than as passive participants. IEP meetings often contain large amounts of technical jargon and leave caregivers outnumbered as team members. Helping parents access information about educational terms, processes, and interventions is one type of technical support that schools can provide for families (Schwartz et al., 2017). For parents of culturally and linguistically diverse learners, ensuring that materials are translated, interpreters are present at meetings, and programs use "cultural brokers" (Conners & Capell, 2020, p. 209) such as advocates, religious leaders, or others with relevant cultural experiences to help to share important information with families can improve the parent experience and the overall program for the student. In addition to this technical support for caregivers in IEP meetings, support groups or parenting classes should also be provided (Schwartz & Davis, 2014). Caregivers of students with developmental disabilities are at increased risk of experiencing stress, particularly when a student engages in challenging behaviors (Woodman et al., 2015), and caregivers of students with ASD may experience higher levels of stress than those with other developmental disabilities (Estes et al., 2009). Accordingly, meaningful participation in the IEP process includes finding support and managing stress.

6.1.5 Context of Schools

Professionals who spend time in schools know the breadth of both the official and hidden curricula (Myles & Simpson, 2001; Sulaimani & Gut, 2019) that students experience across the school day. Schools play a vital role in students' development and present many opportunities that students do not have elsewhere, including opportunities for social interaction, independent management of materials, and community building throughout childhood and adolescence. Schools are also the setting in which the majority of students with ASD and related disabilities receive specially designed instruction and therapeutic services to which they are entitled under IDEA. The school setting provides unique opportunities and challenges. One of the primary benefits of the school setting for students with ASD is that schools provide the greatest opportunity for inclusion within a student's community of peers—school is where most children and adolescents are during the day! Providing support and interventions within the school setting brings opportunities for generalization and maintenance of skills, immediate access to peers to develop relationships, and opportunities to access a wide range of services and supports in one setting. Much of the intervention provided in schools is embedded into valued routines and rituals across the school day (Staub et al., 1994), providing multiple opportunities to learn in the natural environment and optimizing the generalization of newly acquired skills and behaviors. When compared with other intervention settings for individuals with ASD, public schools also contain unique features that impact teaching and learning, including interdisciplinary teams working together within the same setting, a diverse and inclusive environment, and access to the general education curriculum.

6.1.5.1 Collaboration and Interdisciplinary Support

Providing comprehensive and effective services to students with ASD requires a team effort. All students, including students with ASD, are heterogeneous in behavior, strengths, interests, and support needs (Dunlap and Fox 2007) and may benefit from provider support across disciplines. For instance, one student with ASD may require individualized instruction from a special educator and speech therapy from an SLP. Another student with ASD may benefit from services that support their identity as a dual-language learner in addition to gifted education strategies. Schools provide a unique opportunity for collaboration across a diverse, interdisciplinary team of educators, professionals, and community members to meet the various needs of students. All members of a school community can play an important role in supporting students with ASD, including educators, related service providers, office staff, paraprofessionals, school nurses, classmates, transportation team members, custodial staff, and the larger school community of families and students.

6.1.5.2 Diverse and Inclusive

Schools are a great equalizer; all students have the right to attend. Public school settings provide opportunities for students with ASD to establish diverse and meaningful relationships with members of their community. IDEA mandates that every student have access to the LRE to the maximum extent possible throughout their school day (IDEA, 2004). This means that every effort should be made to deliver individualized supports alongside typically developing peers in the general education setting. At the same time, simply being present alongside typically developing peers is not enough and is not inclusion. Inclusion is not a place or an instructional strategy, but a cultural shift that promotes all community members' active participation in and sense of belonging to that community (Sandall et al., 2019). Classrooms that use high-leverage inclusionary practices create diverse community spaces that allow for meaningful social connections in addition to emotional and academic learning (Agran et al., 2020; National Council on Disability, 2018).

Unfortunately, school and program placement decisions (i.e., locations within which a student will receive their education, such as general or special education classrooms) have often been based on perceptions of student competence and resulting placement policies, economic and demographic stratification, biases, teacher preparation and experience, and school resources and capacity. None of these factors relate to student learning needs (Agran et al., 2020). The opportunity to participate in a classroom alongside peers without disabilities should not be based on a student's zip code, race, or diagnostic label. Rather, placement decisions should be based on meeting the student's individual needs for optimal growth, as federal law defines it. Though many ASD-specific and special education classrooms exist, they are not necessarily the best fit for every student with ASD.

6.1.5.3 Access to the General Education Curriculum

In order to provide students with appropriately ambitious IEPs, educational teams must draw from the general education curriculum. The goal of special education is to support students to be successful in the general education curriculum. That means that every student, regardless of ability, should have academic goals and receive instruction in core requirements such as literacy and math (e.g., Agran et al., 2020). Although some students, often including students with ASD, will need instruction in additional curriculum areas such as ADL, organizational skills, and social skills, these should supplement, not supplant, access to the general education curriculum.

In addition to meeting academic goals, IDEA requires consideration of and planning for everyday functioning beyond the classroom setting. For this reason, the IEPs are required to include transition planning information for students by their 16th birthday so that students are prepared for life after school (IDEA, 2004). Planning and programming in an IEP should reflect this and incorporate students' dreams, strengths, and priorities into the transition plan. Further, the educational team should consider that quality of life will look different for every student and family. This highlights the importance of considering caregivers as equal members of an IEP team, rather than as passive participants. Family and student voices need to be heard, especially in transition planning. They are the experts on what their student needs to live a happy adult life beyond the classroom. Culture, language, values, and preferences should all be recognized in the implementation and planning of an IEP. A family-centered approach should be used to teach the individual the skills they will need to live a high quality of life on their own terms.

6.2 Conclusion

Access to a FAPE is the right of every student with a disability in the United States. Part of a FAPE is having access to high-quality instruction (i.e., EBP) in the least restrictive environment. In order to ensure that students with ASD achieve meaningful educational outcomes, they also need to have access to appropriately ambitious education plans, high-quality instruction, ongoing performance monitoring, and data-based decision-making.

Students with ASD are students first, and so it follows that in public schools students with ASD are general education students first. Therefore, the default placement for students with ASD and other disabilities should be the general education environment. For students with disabilities, additional services and supports are layered on top of the foundation of general education or Tier 1 supports (i.e., in the terms used by multi-tiered systems of supports) to ensure success in the general education curriculum and learning environment. If and only if the educational team can demonstrate that they cannot provide a student access to high-quality instruction in the general education setting can a more restrictive setting (e.g., a segregated classroom) be considered. It is important to remember that if a student receives a diagnosis of ASD, this is simply a description—*not* a prescription—for specific supports and services. There is not a specific learning program that will fit all students with ASD; rather, individualized programming is needed to meet student needs. It is a good reminder for behavioral analysts and all members of the educational team that *student failure is instructional failure*. If a student is not making meaningful progress toward important educational outcomes, it is on the shoulders of the educational team, not the student. The instruction must be changed to support the student and her success.

The IEP planning and implementation processes require interdisciplinary teaming and appropriately ambitious goals while recognizing and accommodating the multiple identities, strengths, and areas of need that students bring with them to school. Educating students with ASD is a team sport—no professional can implement a high-quality IEP alone. Interdisciplinary teaming includes promoting caregivers as active members of the team by incorporating caregiver input and providing for caregiver support. Caregiver knowledge of and long-term goals for their child contribute to the development of appropriately ambitious goals, and the team as a whole is responsible for providing the specific support and services needed to meet those goals. Working toward and achieving meaningful educational outcomes require acknowledging the individuality of students. The "I" in IEP stands for individualized; this cannot be overstated. Acknowledging and incorporating the breadth of a student's identity is imperative for a truly individualized and meaningful IEP.

Finally, we acknowledge the importance of EBP while simultaneously highlighting that EBP is simply the starting place for selecting appropriate and effective practices. Implementation of EBPs requires data-based decision-making to demonstrate meaningful student progress. Only the data can tell whether an EBP is truly effective for an individual student with ASD, and the data must be analyzed and the analysis must be applied to make the power of EBP a reality in the lives of students with ASD and related disabilities.

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7 Factors Influencing to Implement or Not to Implement Evidence-Based Procedures

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The percentage of children diagnosed with developmental disabilities continues to increase, with current estimates suggesting nearly 18% of children in the United States aged 3–17 are diagnosed with a developmental disability (Zablotsky et al., 2019). As of 2016, the Centers for Disease Control and Prevention estimated 1 in 64 4-year-old children (Maenner et al., 2020) and 1 in 54 8-year-old children (Shaw et al., 2020) in the United States are diagnosed with autism spectrum disorder (ASD). ASD is characterized by impairments in social communication as well as by presentation of repetitive and restricted behavior, with severity levels ranging from 1 to 3 according to the least to most support required for daily functioning (American Psychiatric Association, 2013). While the diagnostic criteria reflect the homogeneity of ASD symptoms, there is great heterogeneity in their manifestation within and across individuals on the spectrum (Lombardo et al., 2019).

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Despite the heterogeneity of ASD symptom manifestation, interventions based upon applied behavior analysis (ABA) have proven effective at building behavioral repertoires that improve the quality of life for individuals diagnosed with ASD; this claim is supported by experimental evidence demonstrating the effectiveness of ABA-based interventions with children diagnosed with ASD (Leaf et al., 2020a; Reichow et al., 2012), endorsement by the US Surgeon General (United States Public Health Service, 1999), and mandated insurance coverage of ABA in most states (National Conference of State Legislatures, 2018). Adding to the evidence accumulated to date, Makrygianni et al. (2018) recently published a meta-analysis examining the effectiveness of ABA for children diagnosed with ASD. Their search of the literature revealed 29 studies meeting their extensive inclusion and exclusion criteria. The results of their analyses of the included studies indicated that ABA intervention is highly effective at improving intellectual functioning, moderately to highly effective at improving communication (specifically, highly effective at improving expressive language and moderately effective at improving receptive language), and less effective at improving daily living skills (perhaps due to the young age of participants or the increased focus of intervention in other domains). The results of this recent meta-analysis largely mirror findings reported in reviews of single-case research designs (e.g., Odom & Strain, 2002).

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Most individuals diagnosed with autism experience challenges across several domains, including difficulties with communicating effectively, developing relationships and socializing, playing and engaging in recreational activities, participating in daily living activities, and acquiring academic skills, among others (American Psychiatric Association, 2013). Given the extent of the domains impacted by autism, it is not surprising that approaches to autism intervention are prevalent among various scientific disciplines in addition to ABA including speech language pathology, occupational therapy, physical therapy, and psychology.

7.1 Evidence-Based Practice

Although most fields acknowledge the importance of incorporating research into practice, a research-to-practice gap is often cited (e.g., mental health, Kazdin, 2000; education, LeRoy, 2017; human resources, Rynes et al., 2002; behavior analysis, Slocum et al., 2014). The research-to-practice gap is a concern in that the quality-of-service provision may suffer due to practitioners implementing outdated or irrelevant procedures (Valentino & Juanico, 2020). Given the gap between research and practice, many fields began to develop and encourage evidence-based practice to improve and enhance decision-making by practitioners (Dunkel-Jackson et al., 2012; Slocum et al., 2014). In fact, many fields have created task forces to formally define, identify, and disseminate their field's evidence-based practices (Chambless & Ollendick, 2001). Several organizations promote and disseminate evidence-based practices. For example, the American Academy of Pediatrics (2020) is dedicated to encouraging basic and applied research within all facets of healthcare. To meet this goal, they publish a manual of evidence-based practices to help guide medical professionals in current best practices (American Academy of Pediatrics, 2020). Similarly, the Association for Science in Autism Treatment's (n.d.) mission is to promote and disseminate empirically based treatments for individuals with ASD while also educating on treatments that are not based on science as often fad treatments are embraced within the treatment of ASD.

7.1.1 Definitions of Evidence-Based Practice

There are several definitions of evidence-based practice (EBP). In general, EBP refers to integrating empirically based practices with clinical expertise while considering the context and the individual being served (e.g., American Psychological Association, 2006; Gast & Ledford, 2018; Institute of Medicine, 2001; Ioannidis, 2016). Practices include curricula, interventions, treatments, and system-level interventions aimed to change behavior (Horner et al., 2005). Typically, evidence-based practices require measurement of treatment effectiveness and maintenance, include fidelity and reliability measures (Dunkel-Jackson et al., 2012), and demonstrate replications of positive treatment outcomes across multiple iterations (Cook & Cook, 2013; LeRoy, 2017).

Horner et al. (2005) proposed five guidelines for assessing evidence-based practices in special education using single-subject designs. The guidelines included (a) an operational definition of the practice, (b) a description of the context, (c) measures of treatment fidelity, (d) demonstration of a functional relationship between the dependent and independent variables, and (e) replication of outcomes across multiple studies, researchers, and participants. Additional standards have been established by the What Works Clearinghouse (2020) to guide reviewers when evaluating educational practices using single-case research. To evaluate a single-case research study, a reviewer would evaluate the study to determine the (a) availability of data in graphical or tabular format for visual analysis, (b) extent to which systematic manipulation of the independent variable occurred, (c) confidence in measures of reliability (i.e., at least 20% of data points within each condition have a second, independent observer collect data, and reliability measures are at least 80%), (d) presence or absence of residual treatment effects (e.g., carry-over effects) and confounding factors (e.g., changes in therapists across conditions), and (e) extent to which treatment effects were replicated across time and phases based on specific criteria related to the type of design and number of data points.

Additional tools for assessing evidence-based practices (e.g., The Single Case Analysis and Review Framework; Ledford et al., 2020; The Risk of Bias in N-of-1 Trials [RoBiNT] Scale; Tate et al., 2013) and standards for evidence-based practice using single-subject research designs have been developed by researchers (Chambless et al., 1996) and organizations (e.g., National Clearinghouse on Autism Evidence and Practice; Steinbrenner et al., 2020). Similarly, many professional organizations have recommendations for evaluating evidence-based practices. Although there are similarities across tools, standards, and organizations, there are some differences that further lead to confusion about what constitutes an evidence-based practice (Ledford et al., 2018; Odom et al., 2010). For example, Zane and Hanson (2008) systematically reviewed the diversity of criteria different organizations used to define "minimal standards" for quality evidence. The authors selected several sources that published criteria for what constituted evidence (e.g., American Psychological Association, Presidential Task Force on Evidence-Based Practice, US Department of Health, US Education Department, What Works Clearinghouse). They then identified the separate criterion each organization included as part of the overall criteria for labeling an approach or strategy as either meeting the standards for quality evidence. A total of 19 separate criteria were noted, including reasonable effect size, use of experimental-control group, use of single-case designs, statistical significance, randomized controlled trials (RCT), use of treatment manuals, replications, and scientific results. The results showed a wide range across the sources incorporating these various criteria. For example, the criterion of replication was incorporated into nine of the different sources, the single-most agreed-upon criterion. Other than that, most source documents agreed upon only up to three of the criteria. Zane and Hanson concluded that although many different organizations support the concept and importance of evidence-based practice, there is little agreement as to what actually constitutes the criteria for determining whether a practice actually should be labeled as evidence-based. Regardless of differences between the standards developed, the use of these tools and reports generated by the standards allows practitioners to select appropriate evidence-based practices (LeRoy, 2017), thus enhancing their clinical practice and outcomes for the individuals they serve.

In the field of ABA, Slocum et al. (2014) proposed a definition of evidence-based practice for evaluating practices. In developing the definition, they considered how the definition aligned with behaviorism's philosophical tenets while also ensuring the definition would support the use of the most effective practices within the field, encourage advancements of behavior-analytic practices, and facilitate understanding and support for individuals outside of behavior analysis. Thus, they defined evidence-based practice within the field of ABA as "… a decision-making process that integrates (a) the best available evidence with (b) clinical expertise and (c) client values and context" (Slocum et al., 2014, p. 44). This definition suggests that a practitioner should primarily use the best available evidence; however, it takes into consideration the complexity of behavioral programming by providing other variables that should be considered such as the context and client preferences. The inclusion of best available evidence rather than empirically based practice acknowledges that there are some clinical problems that have not been extensively researched, allowing practitioners greater flexibility in their practice when research evidence is limited. When faced with a limited evidence base, practitioners should evaluate the evidence that is available for that problem (or similar problems) and evaluate and weigh the relevancy (i.e., formal and functional similarity of evidence with client characteristics, target behaviors, and other contextual variables) and certainty (i.e., methodological rigor, internal validity, quantity of replications) of the evidence when programming.

For example, in using Slocum and colleagues' (2014) definition as a guide to programming for reductions in self-injurious behavior, a practitioner would first review the research literature to identify interventions that have been used previously to reduce these behaviors. In their review, the authors identified weighted vests and functional communication training. The evidence supporting weighted vests should result in the practitioner being wary of this intervention (e.g., Carter, 2005; Quigley et al., 2011; Stephenson & Carter, 2009); however, the extensive literature supporting functional communication training should result in the practitioner coming to the conclusion that functional communication training is effective in reducing self-injurious behavior across a variety of individuals, functions of behavior, and settings (e.g., Durand & Carr, 1991; Hagopian et al., 1998; Rooker et al., 2013). Thus, the definition of evidence-based practice in ABA should guide a practitioner in making the best programming decisions for the individuals with whom they work.

There are many reasons why practitioners should adopt evidence-based practices (Foxx & Mulick, 2016). In addition to government legislation (e.g., Individuals with Disabilities Education Improvement Act, 2005; No Child Left Behind, 2002) that mandates their use, professional and certifying entities often include evidence-based practice in their standards (Gast & Ledford, 2018). For example, in the Professional and Ethical Compliance Code for Behavior Analysts (Behavior Analyst Certification Board, 2014), behavior analysts are held to relying on scientific knowledge in clinical practice, and clients have a right to practices that are validated and based on empirical evidence (e.g., Van Houten et al., 1988). Thus, there are several advantages to the use of evidence-based practices. First, they allow for accountability of practitioners (Gast & Ledford, 2018). That is, rather than solely relying on clinical practice or previous experiences in which decisions may be made quickly (McKibbon, 1998), practitioners are expected to implement empirically supported interventions, thus enhancing the decision-making processes of practitioners and the efficacy of treatment for an individual (Slocum et al., 2014). Second, the use of evidence-based practices decreases the likelihood of wasted resources (e.g., time, money; Zane et al., 2008) on practices that are ineffective or countertherapeutic (e.g., Beutler, 1998; Nelson et al., 1999). Fad treatments are common, particularly when working with individuals with ASD and other intellectual and developmental disabilities (Vyse, 2016). Therefore, the dissemination of evidence-based practices may help caregivers identify empirically supported interventions quicker, thereby decreasing money and time spent on ineffective interventions. Third, use of evidence-based practices may promote quality services and reduce the variability in treatment and programming errors (Carnett, 1999; Handley et al., 1994). This, in turn, would increase programming effectiveness of practitioners and outcomes for an individual. Fourth, funders are more likely to cover the costs of empirically supported interventions (Rogers & Vismara, 2008), decreasing the cost of and increasing access to effective services for more individuals.

Despite the unprecedented advantages of EBP, the field of autism treatment is continually being flooded with alternative or non-evidence-based practices (NEBPs; Weiss et al., 2008) that (a) lack empirical support, (b) are pseudoscientific in nature, and (c) are ineffective (Schreck & Miller, 2010; Simpson, 2005; Vyse, 2016). Fad treatments are best characterized as those whose popularity rapidly increases despite little to no scientific evidence, gains wide recognition or use, and then fades away as a result of disproving research or, more often than not, the emergence of a new fad (Vyse, 2016). For example, Ayres' (1972) created the theory of sensory integration, in which behavior (all types, including learning, social skills, etc.) is directly related to an individual's ability to process sensory input from the environment (Lang et al., 2012; Roley et al., 2007; Smith et al., 2016). Thus, sensory integration therapy (SIT) seeks to enhance an individual's ability to process input from the environment by restoring neurological functioning (i.e., nervous system; Roley et al., 2007; Smith et al., 2016). This improved functioning of the nervous system (e.g., vestibular, tactile, and proprioceptive systems) is believed to promote ideal responding (Lang et al., 2012). However, there is a substantial lack of scientific evidence supporting the philosophical underpinning of SIT (Lang et al., 2012; Smith et al., 2016). Moreover, Devlin et al. (2010) conducted a comparative analysis of a behavioral intervention and SIT in the treatment of challenging behavior. Results indicated that the behavioral intervention was superior in reducing challenging behavior for all four participants (Devlin et al., 2010). Furthermore, there was little to no change in the frequency of challenging behavior during the SIT condition, suggesting its ineffectiveness.

Many consider the "ultimate fad treatment" to be facilitated communication (FC). FC is a teaching strategy created in the late 1980s that utilizes augmentative and alternative communication (AAC) methods to assist individuals with intellectual and developmental disabilities (Hudson, 1995; Jacobson et al., 2016). A fundamental belief of FC is that individuals with disabilities possess linguistic competence, that of which is unknown to the outside world, but becomes apparent with the assistance of a facilitator (Jacobson et al., 2016). More specifically, FC requires the physical support of a facilitator to help an individual communicate via pointing to or pressing letters, pictures, or objects on an augmentative device (Hemsley et al., 2018). The end result, being a well-written document, or sophisticated poem, was believed to be the direct expressions/thoughts of the person being assisted. However, research over the past couple of decades has repeatedly demonstrated that FC (a) lacks replicability across well-designed studies (Eberlin et al., 1993; Jacobson et al., 2016), (b) relies on facilitator control instead of communication instead of client producing the responding (Hemsley et al., 2018; Jacobson et al., 2016), and (3) has negative behavioral and social effects (Boynton, 2012; Jacobson et al., 2016).

As autism prevalence increases, the need for evidence-based practice becomes imperative. Consequently, those in need of behavioral services have sought guidance from a wide variety of professionals including behavior analysts, teachers, occupational therapists, and physicians (Schreck & Mazur, 2008). Due to the differing theoretical beliefs of these professionals, a proliferation of treatment options emerged, creating an almost buffet-like approach to autism treatment, including scientifically supported and unsupported treatments (Schreck & Mazur, 2008). An unfortunate result is the continual implementation and promotion of NEBP treatments (Schreck & Mazur, 2008; Vyse, 2016).

7.1.2 Use of Evidence-Based Treatments by Service Providers

In an effort to identify the procedures used by Board Certified Behavior Analysts (BCBAs) and Board Certified Assistant Behavior Analysts (BCaBAs), Schreck and Mazur (2008) surveyed 469 professionals nationwide. The online questionnaire addressed various issues including (a) treatments currently being used for individuals with ASD, (b) treatments known to have been used by other professionals, (c) beliefs regarding the principles underlying various treatments, and (d) professionals' views on treatment effectiveness, ease of implementation, cost-effectiveness, and empirical support. Results indicated that both BCBAs and BCaBAs have or are currently implementing all treatments, scientifically validated and unvalidated, included with the questionnaire. While it may seem encouraging that ABA and discrete trial instruction (DTI) are included within the top five treatments used (98.7% and 91%, respectively), the continual use of NEBP treatments cannot go without notice. Examples of NEBPs included floor time (14.9%), sensory integration (16.4%), auditory integration training (1.1%), gentle teaching (2.6%), and facilitated communication (6.4%). Schreck and Mazur further noted an interesting correlation between treatment selection and ease of implementation. That is, "BCBAs decisions to use [NEBP] treatments seemed to be dependent upon the ease of implementation and cost effectiveness" (Schreck & Mazur, 2008, p. 210). Schreck et al. (2016) conducted a 5-year follow-up to assess current treatment selections. This time, participants included BCaBAs (*n* = 66), BCBAs (*n* = 848), and Board Certified Behavior Analyst-Doctorals (*n* = 136). Data again supported that notion that certified behavior analysts continue to use an assortment of fad treatments, all of which lack empirical support, have been deemed ineffective, and have the potential to cause harm to those receiving the interventions (Schreck et al., 2016).

Unfortunately, comparable results were obtained following an analysis of instructional practices utilized within the education system (Burns & Ysseldyke, 2009; Hess et al., 2007). Hess et al. (2007) administered surveys to 185 teachers across the state of Georgia to identify which treatments they were using with students with ASD. Results suggested that fewer than 10% of the interventions used by respondents were EBPs. The top five strategies used by this population included (1) gentle teaching, (2) sensory integration, (3) cognitive behavioral modification, (4) auditory integration training, and (5) social stories (Hess et al., 2007). Burns and Ysseldke (2009) noted similar results after surveying several members of the National Association of School Psychologists (i.e., 500 special education teachers and 1000 school psychologists). More specifically, ABA was ranked the fifth most-employed treatment for both professions, proceeding less-preferred strategies including modality instructions, social skills training, and formative assessment (Burns & Ysseldke, 2009). Overall, the results suggested a lack of commitment to EBP. Instead, the public education system seemed to rely on a variety of strategies, scientifically supported and unsupported.

7.1.3 Use of Evidence-Based Procedures by Parents of Children with Autism

Parents are at the forefront of autism treatment; whether or not they are asked to implement a procedure in coordination with behavioral services already being administered or attempting to provide services independently, parents are often left with the daunting task of treatment implementation (Miller et al., 2012). Green et al. (2006) surveyed 552 parents nationwide to identify current and previous treatments used with their child(ren) with ASD. Speech therapy was identified as the most commonly used intervention (70%), followed by visual aids/schedules (43.2%), sensory integration therapy (38.2%), and ABA (36.4%), respectively. Interestingly, researchers noted a differentiation in the percentage of parents who implemented ABA based on the severity of the autism diagnosis. That is, 24% of respondents implemented ABA with children diagnosed with Asperger's, while 80.5% implemented the same procedures with children who have been diagnosed with severe autism (Green et al., 2006). Data also showed that parents were implementing an average of seven different interventions at any given time, with 47 being the highest number of treatments currently implemented (Green et al., 2006). These results were also supported by Goin-Kochel et al. (2007) who noted that parents were, at the time of investigation, implementing an average of four to six interventions simultaneously. Results obtained by Goin-Kochel and colleagues also indicated a preference for alternative treatments such as sensory integration (46.9%) over behavior-analytic services (40.2%). Moreover, data showed a decrease in the percentage of parents who currently used ABA. That is, data specify that while 55.2% of parents have tried ABA, only 40.2% currently utilize ABA interventions.

7.2 Why Do Parents Continue to Explore Non-evidence-Based Practices?

It is clear that parents and service providers continue to use and recommend procedures that are not supported to be effective through quality research. To reach the goal of a wider use of evidence-based procedures, it may be important to try to identify the conditions under which people continue to select and implement fad treatments. Choosing to use a procedure, whether it be considered evidence-based or not, is influenced by antecedent and consequent variables, some of which will be explored next.

7.2.1 Antecedent Variables that Influence The Use of Fad Treatments

7.2.1.1 Media

The influence of popular media could be one of the possible explanations for why parents and others continue to select NEBPs. ABA is rarely referred to in commonly accessible literature or in non-behavior-analytic professional literature (Maurice et al., 2001). While a Google search for "autism treatment" will yield promising results with pro-ABA sources (e.g., CDC, Autism Speaks, the Mayo Clinic, the Autism Science Foundation), it will not take long to contact information about NEBPs. Following credible sources listed in a Google search, websites advertising fad treatments emerge. Another problem that arises in analyzing commonly consumed media is that if ABA is listed as an effective treatment, then it may be alongside other non-evidence-based procedures. For example, in an "autism treatment guide" published by Healthline (2018), ABA is listed as the first treatment option; however, it is then followed by NEBPs such as sensory integration therapy. Similarly, WebMD (2019) promoted ABA in their "6 Therapies that Can Help Treat Autism" article; however, also included in the list was therapeutic horseback riding, an NEBP. This can make selecting an evidence-based procedure more difficult for parents when the information is presented in a contiguous manner.

The media undoubtedly plays a role in influencing society's beliefs about autism treatments. Positive comments for NEBPs consisted of statements such as "cure/heal," "powerful tool," "hold hope," and "near miraculous" (Schreck & Ramirez, 2016). In contrast, less powerful descriptors were for EBPs including "getting better," "scientifically proven," and "made progress" (Schreck & Ramirez, 2016). These different connotations may make parents lean more toward using an NEBP, in part because the language paired with NEBPs is associated with *cure*, *fast results*, and *effectiveness*, in contrast to the words paired with ABA interventions, such as *no cure*, *intensive*, and *40 hours*. In addition, parents have reported choosing treatment for ASD based on media portrayal of treatment in movies and television (Miller et al., 2012). In recent years, there has been an increase in characters diagnosed with autism in movies and television (e.g., Murray, 2016). Often, these characters are portrayed as loving, competent, intelligent, and able to have a social and emotional connection with their loved ones. These characteristics are positive and desired by parents of children with autism who may not present these ways. Thus, parents who are exposed to these movies and television may make a connection between the strengths of the individual and any method, strategy, or tactic noticed in the media. This influence on mainstream media can promise outcomes that are not always achievable for every individual with autism. In addition to fiction characters portrayed on television and movies, the news also reports autism treatments and spotlights "success stories." Schreck and Ramirez (2016) found that over a 12-year period, airtime related to autism treatment on two major news networks were devoted more to NEBP than to EBP. Not only is the flood of information on NEBPs a problem; the verbiage used to describe effective treatments and non-effective treatments is a cause for concern, which may promote selection and use of these procedures. In print media, newspapers and magazines have been found to recommend NEBPs more frequently and in a more positive light than EBPs. NEBPs received four positive comments (e.g., powerful healing, life altering) to every one negative comment (e.g., controversial, flawed, inconclusive; Schreck et al., 2013). These statements can have a powerful motivational influence with parents who are trying to select a treatment.

There are also public figures that use the media to push their own agenda of supposed "treatments" for autism. Jenny McCarthy, famous anti-vaxxer, claims that her son's autism was cured through a combination of diet modifications (i.e., gluten-free, casein-free), supplemental vitamins, a detox of metals, and the use of antifungal medication to treat overgrown yeast in his intestines. In her words, these treatments enabled him to learn skills that he was unable to do because he was "frozen in autism" (McCarthy & Carrey, 2008). None of these treatments that she cites as the reasons for her son's progress are considered evidence-based practices, but they do draw on families' hope that "recovery" from autism is possible and point parents to interventions with no evidence of effectiveness.

7.2.1.2 Lack of Knowledge About Etiology

Families may seek alternative and NEBPs because of a lack of information on why ASD occurs (e.g., Matson et al., 2013). To date, there is no known cause of autism (e.g., Hodges et al., 2020). There are certain risk factors that have been identified, but the relationship is mainly correlational, not causal (Newschaffer et al., 2007). Some risk factors include certain genetic or chromosomal conditions, having a sibling who has autism, and advanced maternal or paternal age at birth (Centers for Disease Control and Prevention, 2020). Additionally, autism has been demonstrated to affect all racial, ethnic, gender, and socioeconomic groups (Centers for Disease Control and Prevention, 2020). This lack of understanding of causality may create an avenue for families to seek as many treatment options as possible. Some parents may be quite upset if they believed that autism could be prevented. Other parents may, in some ways, find it easier to cope with the diagnosis of autism if they identify with a specific cause that could not be avoided or that can be treated. The lack of a known cause of autism may create the conditions for a family member to identify unproven causes for regression such as an external toxic exposure rather than concluding it is a symptom of autism (Levy & Hyman, 2005). EBPs are effective at treating the symptoms of autism; however, these treatments do not eradicate the cause of the autism diagnosis, which many NEBPs may claim to be successful at addressing (Levy & Hyman, 2005). This could make NEBPs more appealing to families if a "cure" is the family's goal, as opposed to acquiring adaptive skills or addressing the core diagnostic characteristics of ASD. Even if it is not a familial goal, it may be an underlying or unspoken wish; it is natural for families, especially in the early years after diagnosis, to hope that autism could be eradicated.

Dardennes et al. (2011) found that parental belief about what caused their child's autism diagnosis impacted the decision of treatment options. Parents who believed autism was caused by a traumatic childhood experience were less likely to implement behavioral-based interventions, while those who believed an illness during pregnancy was the issue were more likely to turn to prescription medication as a treatment option. Dardennes and colleagues also found that parents who believed their child's diagnosis was caused by an allergen or a chemical imbalance were more likely to use diet and vitamin therapies as a treatment. Surveys (e.g., Lay-Beliefs about Autism Questionnaire; Furnham & Buck, 2003; Revised Illness-Perception Questionnaire; Moss-Morris et al., 2002) have also found that parental decision-making may be influenced by the seriousness of the disorder. Parents of individuals who are more severely impacted by autism have been found to be more likely to use behavioral-based therapy, while those who believe their child suffers from cyclical behavior patterns are more likely to turn to medication (Al Anbar et al., 2010). Those who attribute autism to hereditary patterns were more likely to turn to vitamins and other metabolic treatments (Al Anbar et al., 2010).

7.2.1.3 Promises of Cure

One of the hallmark characteristics of antiscience is the promotion of quick, fast, and easy results (Green, 1996). Parents have reported seeking out complementary and alternative medicine due to the emotional comfort and support from these providers (Hemsley et al., 2018). Another hallmark of pseudoscientific and antiscience approaches is to provide extensive testimonials about success stories (Green, 1996). The diagnosis of ASD is undoubtedly a stressor for parents, and one way of coping may be to seek out providers who appear more in tune with parental feelings (Hanson et al., 2007). Finding others who feel the same way (stressed, anxious, etc.) may result in parents connecting with those who provide such testimonials, and this reliance that pull at heart strings can be seen across several examples of NEBPs. Son-Rise therapy's website (Autism Treatment Center of America, 2021) features four pages of testimonials from parents whose children have "recovered" from autism. The videos all tout "recovery" and talk about how the Son-Rise program saved their child's life and drastically reduced, if not eliminated, all signs of autism with their child. One video even acknowledges that prior to the use of Son-Rise, the parents had no emotional connection with their child. Son-Rise is an NEBP with no research evidence demonstrating its effectiveness. However, the creators of the program appeal to the emotional side of an autism diagnosis and offer hope and a cure.

7.2.1.4 Lack of Knowledge About Quality of Evidence

When researching treatments for autism, it can be difficult and overwhelming to identify what is and is not evidence-based, particularly when a treatment is recommended by another professional. There are numerous NEBPs that are recommended by other professionals, such as therapeutic touch (Rosa et al., 1998; Vyse, 2016), sensory integration therapy (e.g., Williams & Shellenberger, 1996), and facilitated communication (e.g., Cardinal et al., 1996).

Parents and service providers may hold onto the belief that anything is worth a try and even if benefits are unlikely, there is benefit in trying every available option to help their child (Levy & Hyman, 2005; Smith et al., 2016). This seems to be especially true of treatments such as sensory integration and sensory diets where the "treatment" itself is rather benign (Smith et al., 2016). For example, Levy and Hyman (2005) found the gluten-/casein-free diet to be a popular treatment option for the same reason. The treatment was viewed as a healthy approach to living that is not invasive for the individual and is seen as a quick fix. The problem with this "it can't hurt" mentality is young children with autism do not have time to waste on ineffective treatments. The reality is that there are data showing that NEBPs often result in wasted time, financial loss, and pain (e.g., Mitka, 2008; Zane et al., 2008). This time spent on NEBPs can delay access to services that are able to help (Zane et al., 2008). There is a plethora of data and research to support the use of early intensive behavioral intervention to achieve the best possible outcomes for children with autism (Zane et al., 2008). By pushing limited resources into ineffective interventions, parents can be doing more harm than good (Smith & Antolovich, 2000). Smith and Antolovich (2000) found that parents were more likely to indicate that any treatment is more beneficial than harmful, even when there has been little to no change in behavior. This could be due to a response bias, in which parents are not willing to say that they have wasted time, money, and resources, on ineffective treatment. Nonetheless, parents often continue these treatments, sometimes because they already have funding for alternate treatments and sometimes because they feel that any benefits derived from the treatment are worthwhile. This is a cause for concern given the delay that can be associated with using ineffective treatments (Smith, 2016).

7.2.1.5 Lack of Access to Services Based on Evidence

A reason why parents may use any treatment available may be difficulties related to accessing quality services. Maurice et al. (2001) documented three parents' perspectives on the inadequacies of ABA-based interventions. The most daunting task from these parental perspectives was the quest to find a qualified professional. A parent who is meeting with various professionals to hopefully build a team of providers must be able to sift through what is opinion and anecdote versus what is evidence-based (Maurice et al., 2001). This requires a parent to have knowledge of various levels of scientific evidence and the time and capability to comb through a myriad of information. In the opinion of some parents, placement and services are based on what is readily available to the school district, and often fails to meet the needs of the learner, but instead promises that the school professionals will attempt to fit the student into whatever services and programs currently exist at the school (Maurice et al., 2001). There is a documented disparity between what is an appropriate service and what is an optimal service (Dymond et al., 2007). Thus, having the right professional to mentor and guide the parent through the maze of services is of utmost importance. Without a professional whose thinking is based in science and the worldview of behaviorism, a parent may be less likely to select quality services based on empirical evidence. Through the qualitative and quantitative use of open-ended surveys, Dymond et al. (2007) found that parents have cited a need for an increase in the availability and accessibility of services.

A lack of accessible ABA-based services could be due to various factors including the increased population of individuals with ASD, the lack of qualified behavior analysts, and a lack of coordinated efforts in terms of service delivery (Dymond et al., 2007). These issues become more pronounced in rural areas where children are less likely to have access to pediatric and mental health services. Children in these areas are also less likely to receive an early or efficient diagnosis of ASD (Murphy & Ruble, 2012). A lack of an early diagnosis may lead to parents and service providers, who are unfamiliar with the availability of EBPs, to choose from among available services, even those with little to no empirical support of effectiveness.

Within the United States, there are huge disparities from state to state in the number of available certified behavior analysts. For example, in Idaho, there are 74 BCBAs; in Louisiana, there are 398; and in New Jersey, there are 2081 (Behavior Analyst Certification Board, 2020a). Historically, rural areas have difficulty recruiting mental health professionals. This could be due to several factors such as lower pay rates, higher caseloads, and potential for dual relationships inside a smaller community (Murphy & Ruble, 2012). Another factor that could account for a lack of professionals in each area is the proximity to a college and/or to a supervision site which is necessary to complete certification (Deochand & Fuqua, 2016). The lack of access to a qualified behavior analyst could lead to the use of alternative treatment options, including non-evidence-based or fad treatments.

7.2.2 Consequent Variables Influencing the Use of Fad Treatments

There are consequent variables that could definitely influence parents and other caregivers to use NEBP. One is response effort. Some therapies take more time and effort to implement than others. For example, if a parent believed in the effectiveness of aromatherapy (e.g., Solomons, 2005), they would purchase special oils and have their child smell them throughout the day. This approach is much less effortful than implementing, say, a 40-hour per week intensive discrete trial approach based on the principles of behavior analysis. Mackintosh et al. (2012) found that parents cited both time and effort as negative detriments to using EBPs, specifically ABA. One parent stated, “ABA seems to be the only viable option, but it is an extremely rigorous and demanding form of schooling... And the expense is, of course, astronomical” (Mackintosh et al., 2012, p. 57). While another was concerned about time and effort, “I wish the behavior system we used wasn’t so time intensive on my part” (Mackintosh et al., 2012, p. 57). These are noteworthy concerns raised by parents that should be taken into consideration by behavior analysts.

Another variable that could function as a positive consequence for implementing NEBP is the attention provided to the implementor of the NEBP. Parents could receive individualized attention and displays of sympathy for using NEBP. Furthermore, the promise of possibly connecting socially with the child with autism and promises of progress and hope offered by the proponents of NEBP all could reinforce the parent for selecting that particular NEBP.

7.3 Why Do Behavior Analysts Continue to Use Non-evidence-Based Practices?

The Professional and Ethical Compliance Code for Behavior Analysts clearly outlines that all BCBAs must use science when delivering services or engaging in other professional behavior (e.g., section 2.09, Behavior Analyst Certification Board, 2014). The code also states that behavior analysts do not implement non-behavior-analytic interventions (Behavior Analyst Certification Board, 2014). Even with a clear outline of expectations for responsible delivery of behavior analysis, behavior analysts have strayed from the compliance code resulting in ethical violations. In questionnaires completed by BCBAs, Schreck and colleagues (2008, 2016) found that BCBAs reported to use auditory integration training, facilitated communication training, gentle teaching, and music therapy. Although these fad treatments were not reported to be used as commonly as ABA-based interventions, the fact remains that this is concerning for the field.

7.3.1 Antecedent Variables that Influence The Use of Fad Treatments

7.3.1.1 Lack of Sufficient Education and Training in Behavior Analysis and Science

A lack of comprehensive education and training in behavior analysis could point to one possible reason why behavior analysts select and implement NEBPs. Although there is accreditation and verified course sequences through the Association for Behavior Analysis International, there is less structure around more concentrated aspects of graduate school courses (Pastrana et al., 2018). As an example, consider training in research methodology. Behavior analysis is based on science and the scientific approach toward the study of behavior. An important component of the coursework for becoming a behavior analyst is studying experimental design. This needs to be the basis for which every behavior analyst evaluates the degree of scientific integrity of research. Without competence is experimental design and all that entails (e.g., measurement reliability, internal and external validity, etc.), an individual may be more likely to interpret results of a study as causally related to the independent variables manipulated. In autism research, that suggests a possibility of a Type I error (Martella et al., 1999), meaning that treatments that appear to be working are in fact not. At minimum, quality research must include objective definitions of the dependent and independent variables, an experimental design that adequately controls for threats to both internal and external validity, the ability to replicate the study, and technological and conceptually systematic procedures (Zane et al., 2008). Behavior analysts need to have repertoires that permit appropriately interpreting what is quality research when reviewing literature to make treatment decisions. Kubina et al. (2017) reviewed 4313 line graphs from 11 different behavior-analytic journals to analyze the quality of the graphical representation of the data. The authors found that there was a high degree of variability in how the graphs were constructed and labeled. Differences in aspects of a line graph in particular the scale, the labels, and the axis can skew the visual interpretation of the graph. Behavior analysts should keep this in mind when critically reviewing research and analyzing the visual display of data. Visual interpretation of data has been recognized as a subjective behavior, and research has been conducted to develop more structured criteria for interpretation of data. Hagopian et al. (1997) used a panel of experts to create structured criteria for how to interpret functional analysis data. These criteria consist of how to place criterion lines, how to check for trends, and how to interpret data to ascertain function. Additionally, close consideration of appropriate use of experimental design is warranted. Group designs are not widely used in behavior analysis, in part due to lack of focus on individual change and a greater focus on change of the average. However, behavior analysts need to be able to analyze all types of experimental design in order to effectively determine if research is valid and appropriate (Smith, 2012).

Being able to critically analyze experimental design is one way to avoid believing that an NEBP is responsible for changes in behavior or learning.

In addition to coursework, behavior analysts must accrue supervision hours to qualify for certification (Behavior Analyst Certification Board, 2021). Within the supervision context, behavior analysts demonstrate competency in a number of areas important to clinical competence, such as case conceptualization, problem-solving, and decision-making repertoires. A major area of competence focuses on practicing as a scientist, determining what constitutes an EBP, and using and advocating for these types of treatments. Behavior analysts in a supervisory context have their skills shaped and acquired through quality supervision, which must include consistent feedback and development of skills to a mastery criterion (Brodhead et al., 2018). Some of the key components of quality supervision include focusing on collaboration and ethics, outlining performance expectations, evaluating performance consistently, and maintaining confidentiality. There is a general assumption that when supervisees acquire quality supervision, they will in turn become effective practitioners in the field of behavior analysis. Turner et al. (2016) also emphasized conducting baseline assessments of trainee's skills and through various teaching methods honing those skills. The intersection of NEBP and supervision is this – poor supervision may increase the chances of behavior analysts not being sufficiently trained in science and science-based practices, thus more potentially influenced by the flimflam of NEBP.

7.3.1.2 Practicing Outside Scope of Competence

Behavior analysts who practice outside of their scope of competence may also be at greater risk for implementing NEBPs. While the Behavior Analyst Certification Board (BACB) dictates in the Professional and Ethical Compliance Code for Behavior Analysts that all BCBAs must practice within their scope of competence (Behavior Analyst Certification Board, 2014), there are factors that could influence behavior analysts to begin practicing in ways that involve skills and competence currently not in their repertoire. With the increasing incidence of autism, there is a concomitant increase in the demand for services and treatment options. There is reliable documentation that parents and other consumers have strong opinions about the usefulness and preference for different therapeutic approaches (e.g., Green et al., 2006). A behavior analyst may consider offering treatment options (for which adequate training may not have been completed) outside of behavior analysis with the goal of providing more treatment for more individuals who otherwise might face very long delays before accessing treatment (Brodhead et al., 2018). For example, a behavior analyst, realizing there is a demand for solving sleep disorders, may attempt sleep interventions even though they had no specific study or training in this particular area. Another potential factor is the perception of the behavior analyst feeling more qualified than other professionals to deliver any service, due to having certification in behavior analysis (Brodhead et al., 2018).

7.3.1.3 Perceived Permission to Use NEBP

Another factor that could lead to the use of NEBPs is the allowance by the BACB for BCBAs to use a disclaimer when engaging in NEBPs. In the Professional and Ethical Compliance Code for Behavior Analysts, section 8.01 states:

> Behavior analysts do not implement non-behavior-analytic interventions. Non-behavior-analytic services may only be provided within the context of non-behavior-analytic education, formal training, and credentialing. Such services must be clearly distinguished from their behavior-analytic practices and BACB certification by using the following disclaimer: "These interventions are not behavior-analytic in nature and are not covered by my BACB credential." The disclaimer should be placed alongside the names and descriptions of all non-behavior-analytic interventions. (Behavior Analyst Certification Board, 2014)

Arguably, this disclaimer allows behavior analysts to engage in non-behavior-analytic treatments, including NEBPs if it is included in their service description and if they possess the appropriate training. This disclaimer is in conflict with section 6 of the Professional and Ethical Compliance Code for Behavior Analysts, which mandates that behavior analysts must put the field of applied behavior analysis above all other training (Behavior Analyst Certification Board, 2014). Allowing behavior analysts to add the disclaimer could create dual worldviews and treatment that is governed under non-scientific principles.

7.3.1.4 Consumer Preference

A final variable to discuss as an influence on behavior analysts using NEBP is consumer preference. Many behavior analysts offer themselves as consultants to families to assist in the education and development of their children. As noted above, parents often had specific notions as to what type of therapy they want. It is logical to assume that the more therapies and approaches one can offer to parents, the more marketable a behavior analyst is likely to be. To put it another way, the more therapies a behavior analyst can offer to a prospective client, the more likely it is that the client will hire that behavior analyst. Thus, behavior analysts can be influenced to offer more than just evidence-based practices.

7.3.2 Consequent Variables Influencing the Use of Fad Treatments

7.3.2.1 Response Effort

Allen and Warzak (2000) considered the reinforcing consequences of parents and service providers selecting treatments based on the effort involved in providing that treatment. For example, a parent of a child with autism is most likely managing a complex situation filled with multiple professionals, financially difficult decisions, different intervention recommendations, various medications, and an influx of concerns that arise on a frequent basis. Parents may seek solutions for their child's behavior that require less effort than other solutions. In fact, response effort has been found to be one of the most critical elements of parental adherence to a treatment plan (Allen & Warzak, 2000) and is partly explanatory when considering behavior analysts who admit using NEBP (Schreck et al., 2016). When looking at allocation of response effort across evidence-based treatment plans and non-evidence-based treatment plans, it is likely that there is a greater response effort in the implementation of ABA procedures. As such, if response effort is a critical variable, parents may select NEBPs over EBPs that may require more response effort for all parties involved.

7.3.2.2 Reinforcement for Using NEBP

Since parents and caregivers continue to use NEBP, there must be some payoff for doing so. That is, the users of NEBP must obtain some sort of reinforcement for trying and continuing such procedures. What might that be? One possible source of reinforcement would be perceived progress on the part of the individual receiving the NEBP. The emphasis here is on *perceived* progress. As noted in other sources (e.g., Smith, 2016), the quality of evidence varies a great deal. Often, if there are in fact positive changes in behavior once an NEBP has been implemented, it is not clear whether that procedure is solely responsible for the improvement or if there could be other potentially explanatory factors. In education and clinical work, often multiple treatments are used simultaneously, and the degree to which each resulted in individual progress remains to be determined. Thus, consumers of NEBP may not be able to discriminate as to where the improvement is coming from. Additionally, improvement noted by caregivers, teachers, or others may not be actual improvements. One part of scientific rigor is the careful measurement of behavior. Studies have shown that without careful operational definitions and well-planned measurement systems, the wrong impressions and results of the data could result (Freeman, 2016). Thus, implementors of NEBP may attribute real progress to NEBP when in fact such progress could be due to other variables, or implementors may not actually see progress, but believe it to be so erroneously.

Other potential sources of reinforcement for using NEBP could include the alleged savings of time and effort. For example, purchasing gluten-free foods could be considered simpler than many hours of ABA therapy each week. Parents and caregivers may also find using NEBP to be reinforced with supportive feedback and attention. For example, if a professional suggests using some type of intervention, and the parent in fact implement the said intervention, then the parent will likely be supported by that professional, and perhaps others will approve as well.

These perceived reinforcers for using NEBP often compete with incentives for using scientifically validated treatments. For example, ABA-based interventions and procedures used in effective treatment plans rarely produce immediate change in behavior and cannot often compete with other more immediate reinforcers for service providers and parents (Allen & Warzak, 2000). Undoubtedly, negative reinforcement plays a key role in adherence to ABA-based treatment plans, as in the moment it may seem more appealing to reinforce challenging behavior to escape the aversive consequences the behavior has on the parent.

Using NEBPs may also be reinforcing for behavior analysts for several reasons. Schreck et al. (2016) identified verbal praise, ease of use/cost-effectiveness, monetary gain, research results, and observed success to all be possible reinforcers that maintain the use of NEBPs by behavior analysts. In this study, behavior analysts indicated they primarily used unestablished treatments or ineffective or harmful treatments because of verbal praise from the client's family or school/teacher or because they witnessed success during the use of the said treatments.

7.4 What Parents and Providers Should Do When There Is a Lack of Access to EBPs?

Despite the growing body of EBPs available to autism service providers, most will experience conditions under which implementation of NEBPs may be inevitable (Shawler et al., 2018; Weiss et al., 2008). Of late, several scholars have offered guidance applicable to situations in which a behavioral practitioner is considering implementing an NEBP (Brodhead, 2015; Chadwell et al., 2019; DiGennaro Reed et al., 2017; Leko et al., 2019; McDonald & Reed, 2018; Walmsley & Baker, 2019). Brodhead (2015) proposed a model for making collaborative intervention decisions within interdisciplinary teams. Both DiGennaro Reed et al. (2017) and McDonald and Reed (2018) provided lists of questions practitioners can ask to help guide decision-making surrounding the implementation of interventions, including NEBPs. Questions addressed goodness of fit for the client, degree of evidence, resources available, and implementation-specific details, among others. Leko et al. (2019) proposed that similar factors be considered by special educators when selecting interventions. Walmsley and Baker (2019) suggested thoroughly evaluating the state of the evidence for non-behavioral interventions and advanced one formula for how to do so that involves "searching the literature," "recognizing and evaluating the common properties of fad treatments," "distinguishing quality of evidence," and "ascertaining behavioral mechanisms of action" (p. 680). Data reported by Chadwell et al. (2019) reminded practitioners to consider consumer preferences pertaining to the intervention process relative to treatment effectiveness. Assuming a practitioner is up to date on the literature regarding EBPs (Behavior Analyst Certification Board, 2014; Walmsley & Baker, 2019) and has a working understanding of what questions to ask to guide their clinical decision-making surrounding the use of NEBPs both within and outside of interdisciplinary teams (Brodhead, 2015; DiGennaro Reed et al., 2017; McDonald & Reed, 2018), what are some of the conditions under which they may consider implementing an NEBP?

Perhaps the most likely occasion for which practitioners may consider implementing NEBPs is when there are insufficient EBPs to inform treatment for a particular individual, but there is strong reason to believe practices deemed evidence-based with other populations will be effective. For example, when providing intervention to a child with Rett syndrome, a provider might draw from evidence-based practices for children diagnosed with ASD. Similarly, practitioners may consider implementing NEBP when all existing EBPs have been demonstrated to be ineffective for a specific behavior exhibited by a particular individual in a particular environment. For instance, if a service provider is targeting reduced vocal stereotypy that occurs at high rates at school and impedes client and peer learning, and all evidence-based interventions designed for a school environment produced insufficient decrease in the target behavior, they may consider implementing more restrictive procedures considered evidence-based within clinical settings. In this scenario, an interventionist would have conducted comprehensive assessments aimed at identifying function-based interventions as well as thorough reviews of the literature at each decision point during treatment planning and progress monitoring to ensure no evidence-based interventions were overlooked.

When consent for a particular EBP is not provided, but consent is provided for a treatment with emerging evidence (i.e., an NEBP), some practitioners may consider implementing the treatment with emerging evidence. Service provision for individuals diagnosed with autism typically involves coordinated care among service providers such as behavior analysts, teachers, speech and language pathologists, occupational therapists, physical therapists, and physicians, to name just a few, to promote skill generalization and improve outcomes. As discussed by Brodhead (2015), collaboration among ancillary service providers may result in the need to evaluate NEBPs (Behavior Analyst Certification Board, 2020a, b). In any of the above cases, it is assumed that practitioners have conducted assessments to guide their search for an appropriate intervention (Behavior Analyst Certification Board, 2020a, b; see PECC 3.01) and have thoroughly reviewed the evidence (or lack of evidence) in support of the NEBP they are considering implementing (and, thus, evaluating) prior to developing an implementation plan (Behavior Analyst Certification Board, 2014; see PECCs 1.03 and 2.09).

There are some additional steps that should also be taken to ethically evaluate an NEBP, as illustrated in the decision trees presented in Figs. 7.1, 7.2, and 7.3 and discussed below. It is important to note that steps presented in the decision trees represent but a particular configuration of presumedly many paths. Beginning with Step 1 of Fig. 7.1, prior to engaging in any practice of behavior analysis, service providers assess whether they are competent to do so (Behavior Analyst Certification Board, 2014; see PECCs 1.02 and 2.05). Assessing competence involves self-reflection and questioning to determine whether one has received sufficient education, training, mentoring, and/or supervised experience in a particular subject area, target behavior, population, or technique to intervene successfully (Alligood & Gravina, 2020; Brodhead et al., 2018). When an individual lacks competence, they should either obtain supervision by a competent mentor or develop competence through documented training prior to proceeding (Behavior Analyst Certification Board, 2014; see PECCs 1.02 and 1.03). If competence is not obtained through a supervising mentor or training, the practitioner is encouraged to either pursue other interventions for which they meet minimum competency requirements or ethically decline the case or that aspect of it, instead referring the client to a competent service provider (Behavior Analyst Certification Board, 2014; see PECCs 2.15 and 4.11).

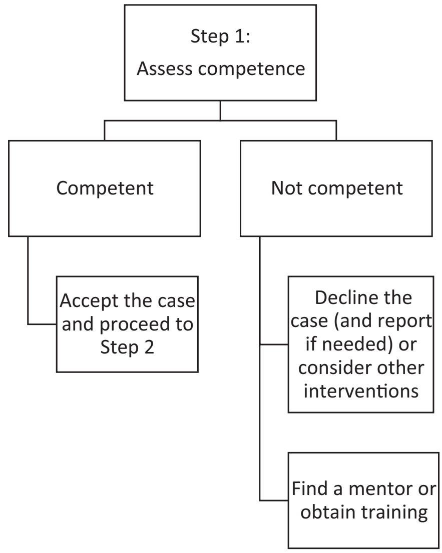
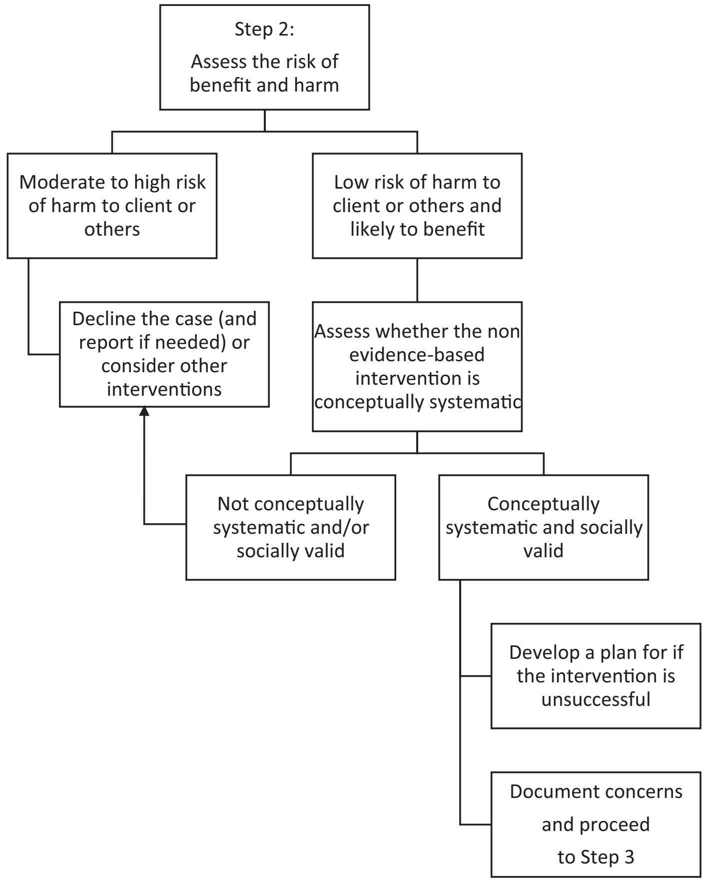


Fig. 7.1 Step 1 of the decision tree to guide ethical evaluation of non-evidence-based practices

Fig. 7.2 Step 2 of the decision tree to guide ethical evaluation of non-evidence-based practices



After the interventionist is deemed competent, a plausible next step is to assess the likelihood of benefit and risk of harm to the client and others in the environment, as depicted in Step 2 of Fig. 7.2 (Bailey & Burch, 2016). If the NEBP is only likely to produce modest benefit to the client, it may be best to focus resources elsewhere. When an NEBP poses a moderate to high risk of harm to the client or others, considering other interventions with lower risk of harm or ethically declining the case and referring to a qualified provider may be the responsible course of action. If it is probable a harmful intervention will be implemented or is already being implemented, the behavior analyst has an ethical obligation to report the case to the relevant authorities (Behavior Analyst Certification Board, 2014; see PECC 7.02b). When the likelihood of benefit is considered high and the risk of harm is considered low, the behavior analyst may proceed to assess the extent to which the NEBP is conceptually systematic with a behavioral worldview (Leaf et al., 2020b). Interventions that can be operationalized and described in terms of the underlying behavioral mechanisms may be considered conceptually systematic (Baer et al., 1968; Walmsley & Baker, 2019). Behavior analysts are obligated to provide conceptually systematic interventions, and practitioners of behavior analysis are strongly encouraged to do so; thus, when considering implementing NEBPs, service providers should either evaluate the effectiveness of NEBPs that are conceptually systematic for which they are minimally competent to implement or ethically decline the case, referring the client to a competent practitioner (Behavior Analyst Certification Board, 2014; see PECCs 2.15 and 4.11).

A crucial element of any effective behavior plan is having feasible alternative plans available

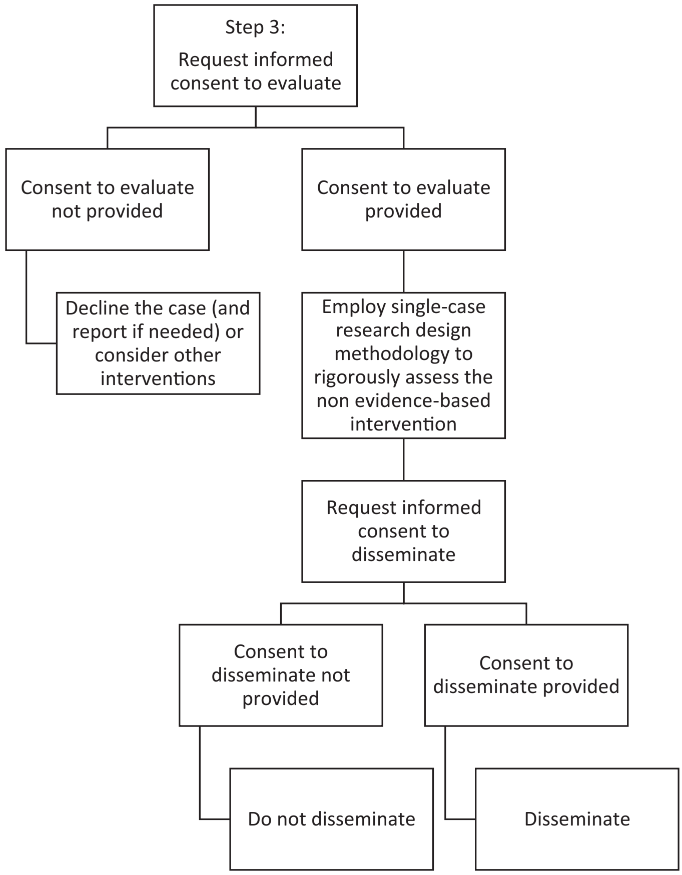


Fig. 7.3 Step 3 of the decision tree to guide ethical evaluation of non-evidence-based practices

if needed (Zimmerman, 2020). Such an approach is borrowed from the medical model, and although there is likely variability among behavior analysts in how treatment recommendations are provided to relevant stakeholders, one method involves discussing a few suggested treatment options, perceived goodness of fit, likelihood of success, possible negative effects, and implementation considerations specific to each and deciding together which to implement (Shepherd et al., 2011). When evaluating an NEBP, it is essential to have contingency plans in place to prevent interruption of services if the NEBP being evaluated is deemed ineffective (e.g., Cihon et al., 2020), particularly given the possibility that implementation of NEBPs may disrupt continued use of EBPs (Pellecchia et al., 2020). Contingency plans may not be constrained to alternative interventions, but may include, for example, further assessments that could be conducted or experts who could be consulted if needed.

Documenting concerns is the next critical step, even for conceptually systematic non-evidence-based interventions within a practitioner's area of competence. First, service providers should implement effective, evidence-based procedures and evaluate any variables that could affect intervention (Behavior Analyst Certification Board, 2014, PECCs 2.09a and 2.09d, respectively) as well as meticulously document their work (Behavior Analyst Certification Board, 2014, PECC 2.10). Second, service providers should obtain informed consent prior to assessing (Behavior Analyst Certification Board, 2014, PECC 3.03) and intervening (Behavior Analyst Certification Board, 2014, PECC 4.02). By documenting concerns regarding an NEBP, not only is the practitioner meeting ethical standards of best practice, but they may also be more likely to communicate all potential concerns to relevant stakeholders and obtain better informed consent.

As illustrated in Step 3 of Fig. 7.3, obtaining consent to evaluate an NEBP for research purposes is also required (Behavior Analyst Certification Board, 2014, PECC 9.03). Practitioners may want to obtain written consent not only for evaluating the NEBP but also for disseminating the results obtained; however, they may wait to request consent to disseminate after the evaluation of the NEBP has concluded. Once consent to evaluate an NEBP is obtained (Behavior Analyst Certification Board, 2014; see PECC 9.03), along with review board approval where necessary (Valentino & Juanico, 2020), the practitioner may proceed to evaluate the NEBP using a single-case research design (SCRD; Kazdin, 2011).

As it is beyond the scope of this chapter to discuss details pertaining to single-case research methodology, interested readers are encouraged to examine the abundance of resources on SCRD (e.g., Dallery & Raiff, 2014; Kazdin, 2011; Ledford et al., 2018; Perone & Hursh, 2013). Having said that, certain features of SCRD that are particularly well suited for initial investigations of the effects of NEBPs warrant mention. First, SCRDs can detect causal relations between variables within a single individual, making them ideal to assess the effectiveness of a particular NEBP for a specific consumer (Perone & Hursh, 2013). Second, SCRDs can be implemented relatively quickly with few to any additional resources beyond those already required for intervention implementation and can be monitored using visual analysis of data collected (Barton et al., 2018; Wolfe et al., 2019). Third, SCRDs can be flexibly combined and adapted as needed in real time in response to data collected (Ledford et al., 2020; Perone & Hursh, 2013). There are numerous exceptional examples of the use of SCRD to assess the effectiveness of NEBP, many of which are discussed above as well as in Foxx and Mulick (2016).

After the NEBP has been evaluated, the intervention may be continued if effective and must be discontinued if ineffective (Behavior Analyst Certification Board, 2014; see PECC 2.15, 4.11). Regardless of whether the NEBP was effective or ineffective, it is important to disseminate the results (with consent from the consumer) (Behavior Analyst Certification Board, 2014; see PECC 6.02). Publishing findings on the results of studies examining the effectiveness of NEBP, even those with questionable demonstration of experimental control (Tincani & Travers, 2018), will aid practitioners' efforts to implement EBPs while decreasing publication bias and its downstream effects within the service delivery sector (Tincani & Travers, 2019).

7.5 How to Further Promote Implementation of EBPs in Autism Treatment

Given the critical importance of using procedures and practices that are based on scientifically derived, evidence-based procedures in autism treatment, considerations must be given to ways to further spread the adoption of such strategies and approaches. The information presented above discussed factors influencing the selection of different treatment options, both evidence-based and non-evidence-based. There are several specific strategies that can be put into place that increase the selection of empirically derived practices.

7.5.1 Consensus on What Constitutes Quality Evidence

Currently, there are differing criteria various organizations set for what constitutes scientifically based evidence (see Ledford et al., 2018; Odom et al., 2010; Zane & Hanson, 2008). It would be helpful if these organizations could agree upon a specific set of criteria adopted universally by all. Professionals and scientists must agree to what constitutes rigorous and science-based standards for quality evidence, standards for research designs that control for internal and external validity, and procedures for measurement and data collection that promote accuracy in measurement. If such standards for quality evidence were adopted, then perhaps disciplines would be influenced by these common standards and thus promote a more widely adopted set of criteria, resulting in more common agreement as to procedures that are and are not evidence-based.

7.5.2 Broadly Disseminate Evidence-Based Information on Autism

The myths about why autism occurs and the solutions to this condition need to be effectively countered and neutralized through education based on science and current research. Professionals who give advice to parents of newly diagnosed children – such as pediatricians, social workers, psychologists, and educators – need to be given up-to-date information, based on science, about what is known concerning the etiology and prognosis. Most importantly, factual information regarding the importance of treatments based on objective data and quality evidence (hence, the importance of the criteria for evidence-based approaches) must be disseminated to these professional groups, because they are in the position to be providing advice and counsel to parents who will be making decisions on treatment for their children. Enhancing the quality (i.e., science-based) of information that goes to parents and service providers should increase the probability that treatment and program choices will be made toward evidence-based treatment and programs and less toward fad treatments and programs based upon misinformation and anti- or pseudoscience. Informing parents and service providers of the importance of science and quality evidence with regard to treatment decisions should further blunt the misinformation presented through the media about flimflam approaches and weak thinking by non-scientists and popular figures in the news.

Part of this information campaign should include detailed presentations about the potential dangers and disadvantages of using treatments not based on science and evidence. Much has been written about the emotional, financial, and time costs of ineffective treatments (e.g., Kay, 2016; Smith, 2016; Smith & Antolovich, 2000; Vyse, 2016; Zane et al., 2008). These variables need to be considered when choosing from numerous autism treatments. More awareness of these potential issues could decrease the selection of treatments that seem promising, helpful, and not harmful and sway parents and service providers toward evidence-based approaches.

7.5.3 Increase Availability of Services Based on Evidence

If there were more access to services based on science and evidence, parents and service providers would be more likely to select such services. The Behavior Analyst Certification Board (2020a, b) promotes the training and certification of professionals who can offer such quality services. Although the number of people certified continues to increase, clearly there is a need for more. In some geographical areas, such as rural communities, there remains a dearth of service providers. As the number of professionals trained in evidence-based approaches increases, perhaps this will alleviate this particular problem. However, due to the COVID-19 pandemic, there has been an explosion of telehealth services around the world, and this has included the delivery of ABA-based interventions (e.g., Baumes et al., 2020; Crockett et al., 2020; Frederick et al., 2020). Treatment providers should strive to become skilled at the delivery of clinical services (certainly, delivering only those clinical services that can be done competently through a telehealth delivery mode), and this would extend the availability and opportunity for all to obtain quality services based upon science.

7.6 Conclusion

The incidence of autism continues to increase. Unfortunately, although the concept of evidence-based treatment is widely adopted across disciplines, the reality is that much of autism treatment is not based on science and quality research findings. As described in this chapter, there are many reasons for the persistence of fad treatments; these treatments delay improvement of the individual with autism, provide parents and service providers with false hope of cures, and, in some cases, cost more financially and waste financial resources that could have been invested into approaches with a proven track record of effectiveness.

The scientific approach has been shown to be powerfully effective in learning about the world. In whatever discipline the scientific approach has been adopted, researchers begin yielding results and findings that are replicable and valid. This scientific approach has been applied to get effect in autism treatment. It is the major impetus for the importance of EBPs. Service providers have the responsibility of being informed about the criteria for quality evidence and applying that information to the vetting of their services and approaches toward supporting individuals with autism. The more a scientific attitude and approach is adopted by service providers, the more the goal of evidence-based approaches will be realized. This, in turn, will improve the quality of services, better educator parents and consumers, and – ultimately – benefit individuals with autism to live more independently, make more choices for themselves, and allow them to live the types of lives that they choose to live.

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8 Effective Collaboration: Maximizing Outcomes in Autism Intervention in an Interdisciplinary Model

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8.1 Effective Collaboration: Maximizing Outcomes in Autism Intervention in an Interdisciplinary Model

One goal of therapy informed by applied behavior analysis (ABA) is to make socially significant changes in the lives of individuals with autism spectrum disorder (ASD). The effectiveness of the use of ABA-based therapy with individuals with ASD was initially demonstrated by Lovaas in 1987. Lovaas (1987) showed that children with ASD could make significant gains in cognitive abilities and reductions in inappropriate behaviors, when exposed to intensive hours of therapy at early ages. This pivotal study increased the demand for ABA-based therapy for individuals with ASD.

One of the most significant challenges facing behavior analysts is the diversity of the needs of individuals with ASD. Each individual with ASD presents a different set of skills and challenges, which increases the complexity of the case for the behavior analyst. The Ethics Code for Behavior Analysts (Behavior Analyst Certification Board, 2020a) states that behavior analysts should only accept and work with clients that are within their boundary of competence and their available resources. When faced with a case that presents a challenge that is novel to the behavior analyst, the behavior analyst should seek advice, training, and recommendations from others who have expertise in the area. The Ethics Code for Behavior Analysts explicitly states the need for effective and respectful collaboration as a core principle for all behavior analysts, which includes collaborating within the field of behavior analysis and with professionals from other fields. The collaboration with other behavior analysts can assist in building the behavior analyst's skill set to better serve individuals with ASD and improve the outcomes of intervention.

Oftentimes, the case necessitates expertise not commonly possessed by behavior analysts and requires interdisciplinary collaboration. The Ethics Code for Behavior Analysts states that consultation across disciplines is to occur as necessary, given the specific skills and challenges of a client, and to promote the best interests of the client (Behavior Analyst Certification Board, 2020a). Individuals with ASD have highly complex needs, and every individual presents differently, further increasing the skill set needed to appropriately serve the client. For example, some individuals with ASD speak fluently, while others do not emit any vocal language. Also, some individuals engage in aggression or self-injurious behaviors, while others do not. To further add to the challenges of each individual case, the indi-

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viduals with ASD may also present with varied degrees of language and behavioral challenges that change based on situational contexts or over time.

An additional challenge results from comorbid diagnoses. Comorbid diagnoses occur when two or more diagnoses are made for the same individual. Individuals with ASD have been noted to have a high rate of comorbid diagnoses (Matson & Nebel-Schwalm, 2007). These comorbid diagnoses include psychological diagnoses, such as depression, anxiety, and attention deficit/hyperactivity disorder (Matson & Nebel-Schwalm, 2007). The comorbidity may also include medical diagnoses, such as gastrointestinal dysfunction (McElhanon et al., 2014), unhealthy weight (Ranjan & Nasser, 2015), and nutrient deficiencies (Ranjan & Nasser, 2015).

The complexity of individual profiles may lead to the need for collaboration with other professionals to ensure that all issues are comprehensively addressed and to ensure that best practice treatments are implemented for the client. Medical, psychological, psychiatric, allied health, and educational professionals are common partners in treatment that behavior analysts will ally with when treating an individual with ASD. Each professional plays a vital role in the treatment of the individual with ASD.

To best treat an individual with ASD, the behavior analyst is required to work with various disciplines collaboratively. Each professional brings different skills and knowledge to the case, and it is essential that a collaborative relationship is built among the professionals to ensure consistency and efficacy of treatment. All professionals of an interdisciplinary team bring the desire to best help the individual client that they share with other professionals. This shared desire to do what is best for the client needs to remain at the forefront of collaboration to ensure effective collaboration can occur and can lead to a mutual respect across professionals on the team.

Interdisciplinary collaboration can sometimes be difficult for various reasons, leading to reduced effective collaboration. Some of the barriers to effectiveness for behavior analysts specifically include the lack of direct training on collaboration, lack of training on empathy and relationship building, overreliance on behavioral jargon, reluctance to incorporate recommendations from other fields, and negative perceptions of behavior analysts. This chapter will further identify and describe the challenges of interdisciplinary collaboration, the variables directly affecting interdisciplinary collaboration, and the possible solutions to enhance collaboration for providers of services to individuals with ASD.

8.2 Definition and Concept of Collaboration in ASD Intervention

Professionals may agree with needing mutual respect of different professionals and the desire to do what is best for the client, but different disciplines do not always agree on what collaboration is and how it should occur. Within treatment for individuals with ASD, professionals from special education, education, behavior analysis, speech therapy, occupational and physical therapy, and medical disciplines work collaboratively but may all have different expectations of how to do so.

In special education, collaboration emphasizes interactions between the general education teacher and the special education teacher, while education emphasizes the interactions between the consultant and consultee, such as between the speech pathologist and the teacher (Kelly & Tincani, 2013). Behavioral consultation further defines collaboration as a process that involves identifying the problem, analyzing the problem, implementing treatment, and evaluating the treatment (Kelly & Tincani, 2013). In order for effective collaboration to occur, one must understand the model of collaboration in effect. There are several models that have been used in cross-disciplinary treatment of ASD (e.g., Gerenser & Koenig, 2019). Multidisciplinary treatment maintains more separateness of the individual disciplines, but members share assessment results and intervention outcomes with members of the other disciplines on the team. Interdisciplinary collaboration approaches aim to provide more integrated and less fragmented services and cooperate to identify goals and priorities. Transdisciplinary collaboration is a fully integrated model, in which members of different disciples often work alongside one another and engage in co-assessment and co-treatment. For the purposes of this chapter, we will be viewing the interdisciplinary model as ideal and will primarily reference the process with this term.

8.2.1 Why Collaboration Is Essential

When multiple interventions are recommended across disciplines, professionals need to collaborate to determine which aspects of the recommended treatments would most benefit the client and how it will be measured to ensure the desired behavior change is occurring. An important aspect of determining how these collaborations occur is also examining the behavior of the staff making the recommendations and what the function of their behavior and their recommendations may be (Frykman et al., 2014).

Many factors influence the interdisciplinary team's treatment recommendations, which increases the need for effective collaboration between all team members. A survey by Kelly and Tincani (2013) found that behavior analysts are less likely to make recommendations to a non-behavior analyst than to other behavior analysts and are more likely to accept recommendations from other behavior analysts than from non-behavior analysts. To further examine what is affecting treatment decisions of behavior analysts, a survey by Schreck et al. (2016) highlighted that the clients and parents of clients influence treatment decisions only 38% of the time when choosing to implement ABA-based therapy, but 69% of the time when choosing to implement the unestablished procedure of sensory integration and 63% of the time for the ineffective and potentially harmful treatment of facilitated communication. Furthermore, the influence of coworkers and supervisors had similar patterns for sensory integration and facilitated communication, but demonstrated an increased influence on the use of ABA-based therapy (Schreck et al., 2016). Across these studies, it seems clear that behavior analysts are often influenced by parents and professionals from other disciplines when incorporating non-evidence-based interventions. It may be that they lack the skills to nimbly navigate these discussions and to assist the team in selecting interventions that are evidence-based. This may indicate a need for more training in collaborative work and in conflict resolution.

8.3 Challenges with Collaboration in the Field of Behavior Analysis

8.3.1 Lack of Information About Other Disciplines

It is common for behavior analysts to lack a detailed understanding of the roles and contributions of other members of the team (LaFrance et al., 2019). Unfortunately, this is often not emphasized in graduate education or in supervision. While some models of training in interprofessional collaboration are emerging, this is a relatively new emphasis within behavior analysis (Boivin et al., 2021). Working to increase the understanding of the contributions of other team members can be achieved by transdisciplinary training, joint treatment experiences, and content knowledge regarding different fields (Koenig & Gerenser, 2019).

8.3.2 Fundamental Differences Across Disciplines

Disciplines approach intervention from unique vantage points that reflect the fundamental assumptions, historical progress, and foundational values of their fields of study. These differences have both advantages and disadvantages for interdisciplinary team processes. Differences can be difficult to navigate, especially if they involve foundational principles such as a worldview or definition of evidence-based practice.

Much has been written about the fundamental assumptions and practices associated with closely allied disciplines (e.g., Koenig & Gerenser, 2019; LaFrance et al., 2019; Ottenbacher et al., 2002; Schell & Gillen, 2019). The potential for collaboration is based on the ability to identify both the unique and intersecting skill sets of different disciplines (Frost & Bondy, 2019). Furthermore, developing skills in understanding how different disciplines approach elements of intervention can help bridge between recommendations. For example, it may help to understand how speech and language pathologists and behavior analysts each approach assessment, the use of antecedents and consequences in terms of building skills, and the development of goals (Gerenser & Cicero, 2019; Koenig & Murphy, 2019; Vail & Koenig, 2019). Understanding the manner in which intervention is conceptualized and enacted may help build an appreciation for the contributions of the other professional. Similarly, much can be gained from occupational therapy and ABA professionals learning from one another and working together to address issues in motor planning, the execution of daily living skills, and strength training (e.g., Case-Smith & Arbesman, 2008; Dorsey et al., 2019; Swinth, 2019).

Each discipline approaches their scope of practice from the lens of their own discipline. In that context, they view evidence-based practice, effective treatment, data collection, efficiency, and effectiveness differently, and these elements of intervention are distinct across disciplines. The worldview that is the foundation of the discipline is also unique and may differ from the worldviews of other disciplines.

In addition, each discipline approaches the assessment of outcomes with methods specific to their field of study. Data may be defined and collected in radically different manners, and one discipline's approach may be completely antithetical to another discipline's approach. This can make it difficult for the team to align on goals, on progress reports, and on overall evaluation of the impact of treatment.

8.3.3 Preferences for One's Own Discipline

People naturally have an affinity for their own discipline and prefer it to other professions. While this is natural and expected, it does lead to some unintended consequences that can pose difficulty within a team. At its worst, this preference for one's own discipline may come across as arrogant and as superior. Behavior analysts seem most vulnerable to this error, as their commitment to the science may be conveyed as an intolerance for any other perspective.

When behavior analysts raise concerns about the lack of evidence for a proposed intervention, they are doing so out of a commitment to evidence-based intervention and out of a core obligation to use empirically verified treatments. While they have often been exceptionally well trained in this commitment to science, they may not have been as well trained in the professionalism skills associated with delivering their messages of concern. The delivery of these messages requires compassion, respect, and the ability to resolve conflict. When such concerns are voiced in the absence of these characteristics, it may result in interpersonal injury to other members of the team.

8.3.4 Lack of Training in Collaboration

Collaboration comprises a very large percentage of professional time and is a defining feature of most behavior analytic jobs. Most professionals agree that working in an interdisciplinary team when treating individuals with ASD is beneficial and important, yet the same professionals identify collaboration as a challenge to their daily jobs (Frykman et al., 2014). Unfortunately, most behavior analysts are under-prepared for the collaboration challenges they will face as professionals. If most professionals are reporting that collaborative interactions occur frequently as a piece of their behavioral practice, and the majority (i.e., 78%) of professionals collaborated with behavior analysts on a regular basis, why is the importance of effective collaboration still not a focus in training for behavior analysts (Kelly & Tincani, 2013)?

While the importance of collaboration has been clearly articulated here and elsewhere (e.g., Brodhead, 2015; Kelly & Tincani, 2013), it is less clear that behavior analysts and behavior analysis training programs prioritize collaboration and collaborative skills. Conversely, there is evidence that collaboration may not be focused on the training of behavior analysts (Kelly & Tincani, 2013; LeBlanc, Taylor, & Marchese, 2020; Taylor et al., 2019). In a survey of 320 behavior analysts, Kelly and Tincani (2013) found that participants highly rated the importance of collaboration (i.e., 4 on a scale of 1 to 5) and most participants (i.e., 62%) indicated that they collaborated with other professionals daily. However, despite the perceived importance and regularity of collaboration in behavior analysts' job roles, 67% of participants had not taken any courses in their behavior analytic training with the word *collaboration* in either the title or description, and 45% reported that they had not attended any workshops or trainings with the word *collaboration* in either the title or description.

This deficiency of training in collaborative skills is concerning, particularly considering the collaborative nature of many behavior analysts' job roles. Many behavior analytic training programs are designed based on the BACB® task list (Behavior Analyst Certification Board, 2017) to ensure that skills that will be required on the job are adequately trained, shaped, and practiced. However, it appears that despite task items related to collaboration (e.g., H-9 Collaborate with others who support and/or provide services to clients), training programs may not be effectively addressing these important skills.

8.3.5 Lack of Training in Empathy and Relationship Building

In the past several decades, a number of articles have been written about teaching individuals with ASD to make empathic statements, express empathy, and engage in active listening and other prosocial behaviors (e.g., Baron-Cohen & Wheelwright, 2004; Harris et al., 1990; Reeve et al., 2007; Schrandt et al., 2009; Sigman et al., 1992; Yirmiya et al., 1992). However, while compassionate care was emphasized by early founders and leaders of the field (e.g., Baer et al., 1968; Foxx, 1996; Wolf, 1978), it was not discussed much in the literature again until recently (e.g., Taylor et al., 2019). In the last few years, several articles have identified deficits in the skill sets of current behavior analysts in the area of compassionate care, and a call to action has been issued.

Specifically, LeBlanc, Taylor, and colleagues (LeBlanc, Taylor, & Marchese, 2020) found that behavior analysts lacked training in compassion, empathy, and therapeutic relationships. Of the 225 survey participants, only 28% reported that they encountered lectures or assigned readings on these skills in their behavior analytic coursework, and only 50% reported that these skills were addressed in their supervision experience. While these skills do not encompass the full range of responses associated with collaboration and the focus of their study was on working with families, it can be argued that these skills are also important prerequisite skills to effective collaboration with colleagues. For example, Taylor et al. (2019) defined empathy as "involving both a cognitive component (identifying the emotion being displayed) and an affective component (appreciating and experiencing the person's emotional response)" (p. 655).

The skills noted above are nuanced and would likely not develop in the absence of targeted training. Unfortunately, most behavior analysts do not receive such training. LeBlanc, Taylor et al. (Taylor et al., 2019) surveyed Board Certified Behavior Analysts about the curriculum and training they received in the areas of soft skills. The results indicated that of the 221 respondents, 72% reported they received no in-class instruction in the area of soft skills, 78% reported no assigned readings in the area of soft skills, 82% reported no formal training or instruction during supervision in the area of soft skills, and 45% reported being exposed to some type of training in soft skills outside of their behavior analysis training. Furthermore, 59% of respondents reported pursuing professional development in soft skills on their own through practicum settings, trainings provided by employers, or contacting the literature or at professional development and conference opportunities.

Understandably, since they reported not encountering formal training, LeBlanc, Taylor et al. (LeBlanc, Taylor, & Marchese, 2020) found that 82% of the respondents reported to sometimes or often feel unprepared or not trained to deal with the emotional responses of the families with whom they work. LeBlanc, Taylor et al. also found that 92% of the respondents felt that their colleagues also often struggle with soft skills. Furthermore, 91% felt that soft skills are important, while 83% thought that master's programs that produce behavior analysts should have soft skills as a component of their teaching. The majority of respondents agreed that most training seems to be provided by supervisors in applied settings, but question the qualifications and experience of those responsible for providing such training, as they often are relatively new behavior analysts themselves. It is noteworthy that this is identified as a weakness by so many practitioners and that there is widespread recognition of the need for more expertise in this area within the field.

While empathy may not be directly related to collaborative problem-solving that furthers client outcomes, empathic behavior can be directly correlated with relationship building. In the introduction of a new relationship, the behavior analyst may be a neutral stimulus. Empathic responses that are reinforcing for colleagues can, through stimulus pairing, condition the behavior analyst as a reinforcing stimulus. On the other hand, responses perceived as unemotional are likely to be experienced as aversive, and any stimulus (i.e., the behavior analyst) consistently paired with an aversive stimulus will become a conditioned aversive stimulus. As Skinner (1953) importantly stated, "Any behavior which reduces this conditioned aversive stimulation will be reinforced" (p. 188). In other words, any behavior that results in avoiding or escaping the behavior analyst will be reinforced. Therefore, a lack of empathic responding may decrease the likelihood of collaborative opportunities. If the behavior analyst is not invited to the table to discuss the client, it will be impossible for the behavior analyst to make recommendations that best support client outcomes. As such, a lack of focus on empathy and other relationship building skills in graduate and undergraduate behavior analysis programs may contribute to the challenges that behavior analysts face in collaborating with non-behavioral colleagues.

8.3.6 Problems in Translating the Science into Everyday Language

Related to practitioner preparation for collaboration, another concern that has been raised about behavior analysis coursework is the strong focus on the precise use of technical terminology (Taylor et al., 2019). While the use of technical terminology can assist in more precise communication (Neuman, 2018; Schlinger et al., 1991), it can be detrimental to collaboration with non-behavioral colleagues (Neuman, 2018). Becirevic et al. (2016) suggested that "collaboration requires conversation, a core prerequisite of which would seem to be reliance on mutually acceptable and understandable terms" (p. 312). However, behavior analysts are taught to avoid non-technical language that is commonly used by non-behavioral colleagues because these terms often attribute behavior to inner causes or hypothetical constructs (Hineline, 1980). For example, an instructor may be teaching the child to request a snack and may describe the instructional context as "arranging motivating operations to develop a manding repertoire related to snack time." While this accurately represents the motivating operation in this situation, this may be perceived by non-behavioral colleagues as a strange way of speaking.

Many publications have described the detrimental effect of behavior analysis technical terminology on the marketing of behavior analysis and the ability for behavior analysts to effectively speak to and collaborate with those outside of the field (Bailey, 1991; Carr, 1996; Doughty et al., 2012; Friman, 2004; Lindsley, 1991; Morris, 2014). One of the concerns is that behavior analysts' focus on language that precisely describes the relationship between behavior and the environment stands in opposition with the more broadly held view of *free will*. People who believe that they control their own behavior and life may find behavior analytic terms, such as *control* and *contingent*, uncomfortable. In addition, this terminology can lead to beliefs that behavior analysts have different priorities and values than other professions and the general public (Carr, 1996). Mainstream goals often include independence and self-esteem, and while most behavior analysts would assert that they are working toward those same goals, the terms used to represent these aspirations may differ greatly between behavior analysts and their non-behavioral colleagues (Carr, 1996).

Initial empirical research has shown the cost of using behavior analytic technical terminology with non-behavior analysts. Rolider and colleagues (i.e., Rolider et al., 1998; Rolider & Axelrod, 2005) provided instructions using technical terminology, conversational language, and conversational language with a rationale and asked individuals from the general public (without training in behavior analysis) to rate the instructions. These individuals rated the conversational instructions with a rationale as most understandable and acceptable and the technical instructions as least understandable and acceptable. Becirevic et al. (2016) similarly found that in an online survey of individuals without behavior analytic training, non-technical terms for behavior analysis procedures were rated as significantly more acceptable than the technical terms for these same procedures. Decreased perceptions of the acceptability of behavior analytic procedures could significantly limit behavior analysts' ability to have the procedures and protocols they recommend implemented by non-behavioral colleagues.

In addition to the possible negative impact on adherence, technical terminology may have deleterious effects on the implementation of interventions (Banks et al., 2018; Jarmolowicz et al., 2008). Jarmolowicz et al. (2008) trained new therapists with limited experience with behavior analytic terminology using instructions with high and low amounts of jargon. The therapists with low jargon instructions were more successful in implementing the procedure and indicated greater approval of the procedure than those therapists who received high jargon instructions. Banks et al. (2018) found that technical instructions did not impact acceptability ratings or evaluation of the therapist presenting the instructions for parents of clinically referred children, but did decrease comprehension. The parents provided with technical instructions recalled fewer steps of the procedure than parents who contacted non-technical instructions. Reductions in procedural fidelity can be especially problematic when behavior analysts work on interdisciplinary teams, in which interventions are typically implemented by numerous team members (Neuman, 2018). Interventions are more effective when implemented with fidelity, and, as such, ensuring all team members have access to language that increases their likelihood of accurate implementation of procedures is imperative. This is particularly relevant for members of other professions, who, like parents, would be unfamiliar with the technical terms. Like parents in these studies, they may implement procedures shared by the behavior analyst with less precision.

Furthermore, it has been shown that behavior analytic technical terminology elicits negative emotional responses in non-behavior analysts (Critchfield, Becirevic, & Reed, 2017; Critchfield & Doepke, 2018; Critchfield, Doepke, et al., 2017). Using publicly available ratings of the emotional effect of terms, Critchfield and colleagues found that behavior analytic terms were rated as more unhappy than the majority of terms in English and five other languages and were rated as more unhappy than other technical science terms (Critchfield & Doepke, 2018; Critchfield, Doepke, et al., 2017). Even when looking at overall communication, rather than individual terms, the researchers found that a sample of behavior analytic writing was rated as more negative (i.e., more unhappy at a higher intensity of emotion) than a sample of writing from a non-behavioral psychologist (Critchfield, Becirevic, & Reed, 2017). Engagement in verbal behavior that evokes negative emotional responses will make it difficult for behavior analysts to have effective collaborative interactions with their non-behavioral colleagues.

8.3.7 Reluctance to Incorporate the Suggestions of Other Team Members

As discussed above, behavior analysts may become conditioned aversive stimuli as a result of uncompassionate behavior and the use of technical terminology. Similarly, a lack of responsiveness to and implementation of non-behavioral colleagues' recommendations may also be aversive. Behavior analysts have reported that they are more likely to provide recommendations than to implement recommendations provided by other professionals within an interdisciplinary team (Kelly & Tincani, 2013). If behavior analysts are not evaluating and implementing interventions recommended by non-behavior colleagues, they may miss out on the opportunity to conceptualize these recommendations through a behavior analytic lens and either benefit from their potential value or determine their unacceptableness. Without a consistent process for conceptualizing non-behavioral treatments presented by colleagues, it is possible that behavior analysts will not develop this skill set (Brodhead, 2015). This deficiency may lead to ineffective behavior under circumstances when evaluation of other treatments is required (Brodhead, 2015).

If effective collaboration occurred, behavior analysts would be able to effectively review treatments with those making the recommendation to better determine a successful and ethical treatment for their clients. Though the Ethics Code for Behavior Analysts (Behavior Analyst Certification Board, 2020a) states that behavior analysts are to engage in practices that are evidence-based and do no harm to clients, it also states that behavior analysts are to engage in professional behavior. When working with non-behavioral professionals that may make recommendations that are not evidence-based or may pose some harm to the client, the behavior analyst becomes faced with the ethical dilemma due to conflicting ethical standards.

Often, the skills involved in reviewing the non-behavioral recommended treatments are not specifically targeted in training novice behavior analysts (Brodhead, 2015). Yet, it is a complex process that requires careful evaluation. Research has suggested that some aspects of non-behavioral treatments that require further review include client safety, translation into behavioral principles, and if the treatment will interfere with the goals of the client or compromise the professional relationship (Brodhead, 2015). Other research also suggests the behavior analyst gather a better understanding of what led the other professional to make these recommendations by further examining their scope of practice and training and their definitions and philosophical underpinnings (LaFrance et al., 2019). As noted above, these are multilayered skills that may not have been addressed in coursework or supervision. Junior behavior analysts (e.g., those with less than 5 years of independent professional experience) may be overwhelmed by the suggestions and unsure of how to proceed when such interventions are suggested.

Behavior analysts that are ill-prepared to have these discussions may be at risk for simply agreeing in the absence of the skills required to negotiate with interdisciplinary team members. Indeed, behavior analysts have been reported to use interventions that are not conceptually systematic and may even be harmful to clients (Behavior Analyst Certification Board, 2018; Schreck & Mazur, 2008; Schreck et al., 2016). A highly endorsed rationale for continuing to use harmful treatments is persuasion by colleagues/coworkers and clients/parents (Schreck et al., 2016). Without strategies in collaborative practices, including ways to effectively disagree with collaborators, behavior analysts may continue to be persuaded by non-behavioral colleagues to implement ineffective and harmful treatments that both are damaging to clients and contribute to negative perceptions about the field of behavior analysis.

8.3.8 Perceptions of Behavior Analysts' Collaborative Skills

Most recently, Taylor et al. (2019) surveyed families of children with ASD who received behavior analytic services from behavior analysts and found that parents rated behavior analysts high in listening to their concerns in the first meeting and that behavior analysts were good at maintaining confidentiality. Families rated behavior analysts low in the areas of caring for the entire family and acknowledging mistakes or treatment failures. Parents reported that obstacles to partnering with behavior analysts include the use of jargon, being distracted during meetings, and having interfering opinions about other disciplines.

Fellow professionals from allied fields often rate behavior analysts as difficult to collaborate with, which may also impede the initiation and the success of collaborative efforts. For example, speech and language pathologists have described behavior analysts as arrogant and as reliant on jargon (McCulloch, 2016). Additionally, Koenig and Gerenser (2015, 2019) have noted the issues posed by perception of professional encroachment, which is a particular risk in the shared scope of practice of communication skill development. In occupational therapy, behavior analysts may be perceived as failing to use naturalistic interventions or as de-emphasizing generalization (Welch & Polatajko, 2016). These perceptions may limit the contexts and goals in which occupational therapists seek collaborative practice opportunities with behavior analysts. Similarly, behavior analysts may hold misperceptions of other professions. They may perceive occupational therapists as using non-evidence-based interventions or as primarily implementing sensory integration techniques (Welch & Polatajko, 2016). They may also underemphasize the precision and data collection utilized in speech interventions (Koenig & Gerenser, 2015, 2019). Such misperceptions intensify the gaps between professional fields and reduce the likelihood that practitioners will seek, engage in, and succeed in collaboration across disciplines.

8.4 Strategies to Increase Effective Collaboration

8.4.1 Looking to Other Fields' Models

Bosch and Mansell (2015) defined five essential elements of cross-discipline collaboration in medicine: role clarity, trust and confidence, the ability to overcome adversity, the ability to overcome personal differences, and collective leadership. In this model, the authors note the importance of keeping patient care the primary objective and the need to develop professionalism and teamwork skills. These seem like essential elements of a collaborative context when treatment goals and treatment responsibility are shared.

Gerenser and Koenig (2019) highlighted several similar elements of a successful collaborative model: create a strong team, establish trust, establish conflict resolution strategies, establish role clarity, establish effective leadership, focus on outcomes, and become an advocate. In this model, there is also an emphasis on the primacy of the client's needs, the establishment of a functional structure for team process, and the demonstration of competent and respectful interaction.

There is also a need to ensure that members of each profession understand the value and expertise of the other professions. In order to achieve an understanding of the frameworks that define each discipline, it is important to provide both a formal introduction to the disciplines (e.g., in coursework) and informal opportunities to share information with professionals from other disciplines (LaFrance et al., 2019). Koenig and Gerenser (2006, 2019) make several suggestions for increasing understanding between behavior analysts and speech and language pathologists, including sharing articles from their fields, demonstrating intervention techniques, and creating forums for the development of personal and professional connections between the disciplines. In addition, these authors have made suggestions for creating strong teams including establishing trust, using conflict resolution strategies, establishing role clarity, and focusing on outcomes (Gerenser & Koenig, 2019). In essence, these disciplines are the primary providers for individuals with ASD and share many values and goals for their shared clientele. Working together and in tandem improves outcomes, which is highly valued by both professions. Finding common ground and appreciating the contribution of each discipline allow for more comprehensive care, coordinated interventions, and maximal outcomes.

8.4.2 Increased Training and Education

The growing number of behavior analysts that participate in interdisciplinary teams necessitates a focus on training and educating behavior analysts to do so successfully. The majority of participants of a survey stated that no course or official training on collaboration was provided to them during their education (Kelly & Tincani, 2013). In the same survey, the majority of the same participants stated they collaborate daily with other disciplines but that the collaboration only resulted in minor changes for the client (Kelly & Tincani, 2013).

Staff training and education on collaboration can occur across stages in the behavior analysts' development. Behavior analysts receive training and education throughout their career. This begins with their coursework and fieldwork supervision and continues with workshops, continued education events, and onsite training. Increasing the focus of collaboration during coursework and fieldwork supervision provides the behavior analyst with a collaborative skill set prior to entering the field (Shook & Johnston, 2011). Upon starting their career, the behavior analyst would then be immediately able to participate in interdisciplinary collaboration. The behavior analyst could then also benefit from increased training onsite with their employer and from professionally offered workshops and continued education events.

Behavior analysts are required to engage in coursework and supervised fieldwork prior to certification (Behavior Analyst Certification Board, 2020b; Shook & Johnston, 2011). However, collaboration is often not included in this training, as evident by the majority of individuals stating they had not taken courses on collaboration (Kelly & Tincani, 2013). Furthermore, upon review of the Behavior Analyst Certification Board's requirements for certification of coursework content requirements, there is no training hour requirement on the topic of collaboration (Behavior Analyst Certification Board, 2020b). Though some colleges and universities may offer electives for individuals to learn collaboration skills, those courses are generally not mandatory for graduation or certification.

Offering courses with a focus on effective collaboration within behavior analysis and other professions would increase behavior analysts' understanding of other professions and their roles. Knowledge of the other professionals' disciplines assists in creating an effective collaborative partnership across disciplines (Cox, 2012; LaFrance et al., 2019; Welch & Polatajko, 2016). Information about the scope and practice and code of ethics for all involved disciplines may increase the behavior analyst's acceptance of other professions through acknowledgment of areas other disciplines would contribute to the course of treatment (Cox, 2012; LaFrance et al., 2019; LeBlanc, Sellers, & Ala'i, 2020). Integrating this information into coursework and supervision would further prepare the behavior analyst to be an effective member of an interdisciplinary team.

To further supplement coursework, students of behavior analysis should seek training on effective collaboration from their fieldwork supervisor. One of the first professional collaborative relationships that the student of behavior analysis is faced with is the collaborative relationship with their fieldwork supervisor (LeBlanc, Sellers, & Ala'i, 2020). Building this relationship between supervisor and supervisee as a collaborative relationship provides opportunities for the student to engage in activities that develop their effective communication, treatment planning collaboration, and professional relationship skills that may then generalize to collaborative relationships in their careers (LeBlanc, Sellers, & Ala'i, 2020).

Since many behavior analysts work in interdisciplinary teams, fieldwork supervisors from those sites can involve their students of behavior analysis during collaborative activities to enhance their supervision experience, which will also serve to increase understanding of other disciplines (LeBlanc, Sellers, & Ala'i, 2020). Some of these experiences could include observations of Individualized Education Plan (IEP) meetings, overlaps with allied health team members, participation in group consultation of other behavior analysts, and reviews of reports from other disciplines. Each of these activities increases the future behavior analyst's experiences and provides a model of how to successfully engage in these activities (LeBlanc, Sellers, & Ala'i, 2020).

Training professionals continues to be an area of growing research (Parsons et al., 2012). Didactic training procedures involve the use of lectures to convey the novel skills to those being trained. Research demonstrates this method may not be the most effective method to train staff skills that involve the application of the skill (Parsons et al., 2012; Williams et al., 2012). Active responding by those being trained has demonstrated an increase in performance of novel skills (Williams et al., 2012). Competency-based training further ensures active participation of all individuals being trained and is supported as an evidence-based training procedure (Parsons et al., 2012). It is important that the training programs used incorporate active engagement of the trainees and focus on competency-based assessment of the targeted outcomes.

Competency-based training involves active responding by the individuals being trained until performance reaches a mastery criterion. Behavior skills training (BST) involves providing written and verbal instructions, modeling the trained skill, having the individuals practice the skills, and providing feedback on performance (Parsons et al., 2012). This is then repeated until mastery is achieved. BST is an evidence-based procedure that has been used to teach not only children but also adults valuable skills, such as staff implementation of mand training (Nigro-Bruzzi & Sturmey, 2010), proficiency with teaching the Picture Exchange Communication System (PECS)® to students (Rosales et al., 2009), and compliance with dental care (Graudins et al., 2012), and to teach gun safety to small children (Himle et al., 2004). With the success of the evidence-based approach of BST, it is possible to add soft skills to the repertoires of pre-credentialed behavior analysts.

Another competency-based training method that has been shown to be effective is the teaching interaction procedure (TIP; Ferguson et al., 2021; Green et al., 2020; Leaf et al., 2015). The TIP includes identifying the skill to be taught, providing rationales as to why the skill needs to be taught, breaking down the skill into smaller steps that the individual is able to state, demonstrating the steps completed correctly and incorrectly while the individual being trained identifies which model was the accurate model, having the individual engage in role-play of the skill until all steps are accurate, and providing feedback throughout the process (Leaf et al., 2015).

Employers should also provide opportunities for training in this crucial area. This can take a variety of forms and might include messages about role definition, the value of collaborative work, and the model of interdisciplinary coordination used at that company. Competency-based training at the workplace can be enhanced with increased offerings of workshops for all employees. Collaboration within the company is essential at all levels, and the use of BST or the TIP can be implemented with multiple staff simultaneously within a pyramidal approach (Parsons et al., 2013). Specifically, training using competency-based methods to teach collaboration would include defining what collaboration is and what each individual's role is, providing a rationale as to why collaboration is important and can increase client gains, breaking down the steps of effective collaboration, modeling each step of the process, role-playing effective collaboration until mastery of each step is complete, and providing feedback throughout the training.

8.4.3 Soft Skills Development

Many human service professions, including the medical, psychological, and nursing professions, include a focus on collaboration by including the development of soft skills, including active listening, compassion, and empathy within their training. With the direct teaching of soft skills including active listening, making empathic statements, and asking clarifying questions, professionals develop the skills necessary to work collaboratively with patients, families, and professions from other disciplines.

Studies have shown that when physicians have contacted teaching of compassionate care through coursework, professional development, and reading assignments, patients report being heard and understood, feeling better about the treatment, and adhering to treatment recommendations (Bonvicini et al., 2009; Coulehan et al., 2001; Kelm et al., 2014; Strauss et al., 2016). Physicians who engage in compassionate care are reported as having lower burnout rates, higher rates of personal well-being, higher ratings of clinical competence, and much less medical-legal risk (Kelm et al., 2014).

Historically, nurses have had compassion emphasized as part of their training and professional development (e.g., Buckley et al., 2004; Moscato et al., 2007). In their code of ethics, the first of nine provisions states, "The nurse practices with compassion and respect for the inherent dignity, worth and unique attributes of every person" (American Nurses Association, 2015, p. V). This is similar to the value embraced in physician training and is explicitly taught as part of nurse education. By including soft skills into their training repertoire, nurses are prepared and equipped with the necessary tools to effectively collaborate with multiple physicians, hospital departments, support personnel, patients, and families.

This is also true in the psychology field where psychologists, social workers, and mental health workers are specifically trained in the area of compassion. Through reading, coursework, training, and supervision, these professionals are trained in the soft skills necessary for collaboration.

Educators are also trained in the area of compassion and collaboration. Through coursework, readings, supervision, and professional development, teachers have been required to develop these skills to better serve students and families. The First Principle in their ethics code, Commitment to Student, states that educators help students realize potential by emphasizing the development of knowledge, inquiry, and goal development (National Education Association, 1975). The need for soft skills can also be found under the heading of the six characteristics of ethical teaching which, along with compassion, includes appreciation for moral deliberation, empathy, knowledge, reasoning, courage, and interpersonal skills (Lynch & Forde, 2016).

In behavior analysis, evidence-based methods exist for training and can be applied to teaching soft skills to behavior analysts. BST has been shown to be effective for training a wide variety of skills (simple and complex) across a wide variety of populations (including children and adults with and without disabilities) (e.g., Parsons et al., 2012). Implementation of BST in coursework and fieldwork supervision for future behavior analysts may assist in the development of these skills.

8.4.4 Understanding Roles and Contributions

Overlapping scopes of practice and role delineation are commonly cited sources of conflict in interprofessional collaboration (Brown et al., 2011; Suter et al., 2009). Interdisciplinary approaches to treatment aim to provide more comprehensive services by capitalizing on the unique knowledge and skills of each individual discipline. However, these joint efforts may expose the intersecting competencies across professions, leaving the discipline-specific expertise seemingly less exclusive. Thus, the boundaries that traditionally separate the disciplines become less discernible resulting in "role blurring" (Suter et al., 2009, p. 44), professional "turf wars" (Chung et al., 2012, p. 37), and a resistance to work cooperatively (Hall, 2005; Suter et al., 2009). To preserve the harmony of interprofessional collaboration and promote effective practices, it is crucial that each team member understand not only their own role on the treatment team but the scope of practice, expertise, and contributions of their colleagues as well (Hall, 2005; LaFrance et al., 2019; Strunk et al., 2017).

LaFrance et al. (2019) summarized the roles and responsibilities of four key professionals who commonly provide services to individuals with ASD under a collaborative model: ABA, speech-language pathology, occupational therapy, and psychology. Specifically, LaFrance et al. examined professional documents from each field that outlined each discipline's scope of practice and training. Their purpose was to clarify roles and identify practice and/or training areas which overlap with applied behavior analysis and may, therefore, cause contention in collaborative relationships. The descriptions of training and practice from each field were analyzed and directly compared to the Behavior Analyst Certification Board's *Model Act for Licensing/Regulating Behavior Analysts* (BACB Model Act; Behavior Analyst Certification Board, 2012). Areas of overlap in practice and/or training were noted if the content or practice activities of the discipline included an analysis of functional relations as described by the BACB Model Act. While they initially identified a small number of overlapping areas in training and practice, a more detailed review of educational standards for each discipline revealed greater distinctions. Hence, they concluded more differentiation than overlap between ABA and other disciplines common to ASD treatment.

While these distinctions highlight the value and unique expertise of each discipline, the expansive application of ABA may indeed overlap with the practice areas of other professions. The BACB Model Act defines the practice of ABA as the application of scientifically supported interventions "to help people develop new behaviors, increase or decrease existing behaviors, and emit behaviors under specific environmental conditions" (Behavior Analyst Certification Board, 2012, p. 3). *Behavior* is recognized as "the movement of the organism…[or]…what the organism is doing" (Skinner, 1938, p. 6). This broad definition encompasses a range of responses and activities including both observable, external events and private, internal experiences (Skinner, 1945). As such, these definitions of behavior and our practice support the widespread application of our science and its technologies to a multitude of socially significant challenges. Consequently, the potential for interprofessional conflict persists as the scope of our discipline is likely to impinge the practice purviews of our non-behavioral colleagues. In turn, our colleagues may propose non-behavioral interventions to enact desired behavior changes and treat deficits that are also within the scope of ABA.

8.4.5 Navigating a Shared Scope of Practice

The core characteristics and comorbid conditions of ASD often serve as the junction where professionals from different disciplines intersect and their overlapping practice areas are manifested. For example, sleep disturbances of children with ASD are quite prevalent (Rana et al., 2021) and span the practice domains of ASD service providers including pediatric medicine (Malow et al., 2016), occupational therapy (Ho & Siu, 2018), and behavior analysis (Jin et al., 2013). Suppose a client receiving services from these professionals reports abnormalities in sleep behavior and requests treatment. Each member of this treatment team will likely recommend an intervention according to their discipline-specific clinical perspective, although each treatment may be intended to produce the same outcomes (e.g., increased duration of sleep, reduced latency). That is, each professional will draw on their discipline's distinct academic training, available scientific evidence, and underlying theoretical foundations, resulting in three separate interventions each designed to yield the desired behavior changes.

There are many disorders, in addition to sleep, that fall within the boundaries of competence and practice for both behavior analysts and other collaborating professionals. Additional examples include speech, language, social interactions, feeding, self-care, leisure activities, household tasks, motor coordination, academic skills, safety, maladaptive behaviors, and caregiver training, among others. Since deficits in these areas are often the focus of treatment for individuals with ASD, collaborating professionals will quite often be met with multiple, independent recommendations derived from a specific discipline base. Circumstances such as these potentially threaten the cooperative nature of interprofessional collaboration. When discussing the available treatment options to determine the best course of action, non-collaborative practices such as questioning the validity of the proposed treatments, responding with skepticism, or suggesting modifications or alternatives may lead to disagreements among team members (Brodhead, 2015). Such responses may be interpreted as professional impudence which fosters mistrust, discord, and eventual dissolution. Although it may avoid interprofessional conflict, simply permitting each professional to implement their own intervention in a parallel manner moves the team from a truly collaborative approach to a mere eclectic package with no scientific support (Dillenburger, 2011). Furthermore, these "intervention medleys" may be composed of contradictory treatments and procedures that impede progress or produce unwanted side effects (Cox, 2019). Behavior analysts in particular are ethically obligated to evaluate the effects of treatment procedures which may impact current objectives and behavior change programs and endorse only the most effective, scientifically supported interventions (Behavior Analyst Certification Board, 2020a). As such, it is critical that behavior analysts and all members of the interprofessional team learn to navigate challenges such as these to avoid unnecessary conflict and ensure their clients receive the most efficacious treatment (Brodhead, 2015).

Brodhead (2015) recognized the value of cooperative relationships in interprofessional collaboration and warned against the detrimental effects of non-collaborative practices. When behavior analysts demonstrate professionalism and establish a good rapport with their non-behavioral colleagues, it benefits both the client and the field of ABA. Clients are afforded more comprehensive services that may be able to address a wider array of needs with increased treatment integrity. Additionally, through the interprofessional relationships, behavior analysts have the opportunity to disseminate the science of ABA and demonstrate the cooperative efforts of the field (see Behavior Analyst Certification Board, 2020a). However, as Brodhead explained, our ethical obligation to disseminate the science does not imply that we should criticize non-behavioral treatment recommendations by questioning a colleague's proposal or offering alternative interventions that we believe to be superior. Such contentious actions incite conflict, eventually causing termination of the relationship and thereby excluding the behavior analyst from future collaborative care. Since interprofessional approaches offer many advantages to client care and the field of behavior analysis, and non-collaborative practices present such risks, Brodhead encourages careful assessment of non-behavioral treatments before addressing any concerns.

8.4.6 Decision-Making Models

8.4.6.1 Brodhead's Model

Brodhead (2015) developed a systematic means of appraising non-behavioral treatments which guides behavior analytic practitioners through a comprehensive analysis of the intervention while protecting the professional relationship from any unnecessary conflict (Behavior Analyst Certification Board, 2020a). His decision-making model begins with an assessment of client safety. The behavior analyst must evaluate any threat to safety posed by the non-behavioral treatment by considering both short-term and long-term physical and psychological harm. Threats to safety may also include interventions that will limit access to more effective, empirically supported treatments. Any safety risks require the behavior analyst to immediately address the proposed intervention with the non-behavioral colleague.

Once safety concerns are eliminated, the behavior analyst should gain a greater understanding of the specific procedures and evidence validating use of the recommended treatment. A variety of resources should be explored to gather information needed to assess the potential effects of the intervention. Examples include scientific literature outside of behavior analysis, consultations with other professionals from the colleague's discipline, and reviews provided by organizations that compile and summarize scientific evidence for ASD treatments. Details of the underlying mechanisms, procedures, empirical support, and philosophical assumptions can help the behavior analyst understand the recommendation from the non-behavioral colleague's perspective. With this information, the behavior analyst can translate the non-behavioral treatment into behavioral principles and terminology to further evaluate its potential effects. As Brodhead (2015) explained, a behavioral interpretation of the treatment removes any discipline-specific jargon, hypothetical constructs, or dualistic theories of causation that impede a behavior analytic perspective. The specific variables and methods are analyzed according to the principles and procedures of behavior analysis to identify conceptual consistencies that may explain its potential success (Behavior Analyst Certification Board, 2020a).

As an example, let us consider a fictitious case where Timmy, a 6-year-old child with ASD, is enrolled in an inclusive kindergarten program and is being treated by an interprofessional collaboration team consisting of a special education teacher, speech-language pathologist, occupational therapist, and behavior analyst. The special education teacher expresses concerns regarding Timmy's ability to remain seated during the morning circle time, stay within the circle, and attend to the various activities. The behavior analyst conducts a functional behavior assessment which indicates the elopement from circle time is primarily maintained by access to preferred toys located at the back of the classroom, specifically the mini trampoline, inflatable rocking horse, and foam pogo stick. The occupational therapist explains that Timmy is hyposensitive to environmental stimuli and his elopement from circle time is caused by a proprioceptive dysfunction. She recommends use of a small, child-size therapy ball with ring stabilizer to help him maintain a state of arousal (Bagatell et al., 2010). According to the occupational therapist, sitting on the therapy ball during circle time will provide additional proprioceptive input, promote balance and postural control, and increase Timmy's attention and engagement during the circle time activities.

A behavior analyst's initial reaction may be to refute this non-behavioral treatment on the grounds that it lacks empirical support and instead propose a behavioral intervention to decrease the elopement. However, by analyzing this non-behavioral treatment according to the model developed by Brodhead (2015), we can carefully and systematically evaluate the intervention before we contest it and risk compromising the relationship with our colleague. Beginning with an assessment of safety, we see no threats to the client's physical or psychological well-being. We consider that this intervention might prevent implementation of a more effective alternative, but for the sake of a thorough analysis, we proceed through the model. Next, we gather additional information on the use of therapy balls and proprioceptive input for decreasing elopement and increasing attention. We review publications from the field of occupational therapy, speak with an occupational therapist from a neighboring school, and visit organizations such as the Association for Science in Autism Treatment to read recommendations based on currently available research. As we suspected, there is little empirical support for sensory integration therapy (Zimmer & Desch, 2012). Yet, through this review, we have come to understand our colleague's clinical perspective, sensory integration theory, and the procedures involved in this non-behavioral intervention. With this information, we can translate the non-behavioral treatment into behavioral principles. The function of Timmy's behavior was access to tangible items that allowed movements such as jumping, bouncing, and rocking. Making the therapy ball freely available during circle time is an antecedent-based intervention which will provide reinforcement (bouncing movements) non-contingently.

Thus, the therapy ball may function as an abolishing operation which may decrease the value of the trampoline, rocking horse, and pogo stick and abate the elopement behaviors.

The behavioral translation identified components in the non-behavioral treatment that are conceptually consistent with behavior analytic principles and procedures, namely, non-contingent reinforcement, abolishing operations, and abative effects. While the occupational therapist referenced sensory processing dysfunction as a cause for the problem behaviors and attributed their expected decrease to the internal changes brought on by the therapy ball, the procedures actually translated into a potentially effective behavioral intervention.

According to Brodhead (2015), if the behavioral translation reveals conceptual similarities that can explain its potential success, then there is no need to address concerns with the non-behavioral colleague. The intervention may be accepted and monitored to measure its effects. In our above example, the translation demonstrated how an unsupported treatment recommendation, based on unproven theory, could be an effective practice. Thus, we were able to avoid unnecessary conflict and preserve our relationship with the occupational therapist and other team members. If, however, the success of a non-behavioral treatment cannot be achieved through a behavioral translation, then the behavior analyst must evaluate its compatibility with the current objectives of the treatment program and consider if the level of interference is significant such that it warrants the risk of conflict by addressing it with the non-behavioral colleague (Behavior Analyst Certification Board, 2020a; Brodhead, 2015).

8.4.6.2 Newhouse-Oisten's Model for Use with Prescribing Professionals

Issues of compatibility and scientific support are central to an additional decision-making model developed by Newhouse-Oisten et al. (2017). While their model is presented in the context of pharmacological interventions, we find that it aligns with the model described by Brodhead (2015) and is applicable to a variety of treatment considerations when collaborating with professionals from other disciplines. According to Newhouse-Oisten et al., to appraise the effects of a proposed treatment, the behavior analyst should first review the available scientific evidence using many of the same resources recommended by Brodhead. Next, the behavior analyst must assess compatibility with both the goals of the program and the existing treatment procedures. The goal of the proposed treatment is considered compatible if it is consistent with the current goals of the program and is intended to produce desirable outcomes. In the same way, the procedures are considered compatible if they can be implemented concomitantly and without impeding current methods. This analysis results in dichotomous distinctions of evidence-based/non-evidence-based interventions and compatible/incompatible interventions.

Under the Newhouse-Oisten et al. (2017) decision-making model, the classification of the proposed treatment across the dichotomous categories then dictates the behavior analyst's decision regarding acceptance of the treatment. Proposed interventions classified as both evidence-based and compatible with the current treatment program should be adopted. For example, suppose the special education teacher on an interprofessional team recommends computer-assisted instruction to teach literacy skills to a 9-year-old child with autism. The efficacy of this instructional method has been demonstrated and offers advantages over conventional approaches such as improved consistency and generalization (Root et al., 2017). Given the client's preference for computers and current reading objectives, the team classifies this intervention as evidence-based and compatible and opts to implement.

Interventions identified as evidence-based but incompatible should be further evaluated with consideration of stakeholder preferences and the advantages and disadvantages of both the new and existing treatments. As an example, a speech-language pathologist on an interprofessional team recommends the Lidcombe Program to treat speech disfluencies exhibited by a 5-year-old child with ASD. The current treatment program includes differential reinforcement and demand fading procedures to decrease escape-maintained tantrum behaviors primarily evoked by adult demands. The Lidcombe Program is an effective procedure for decreasing stuttering behaviors (Nye et al., 2013). However, components of this intervention include parental requests for self-evaluation of speech fluency and requests for correction of stuttered utterances (Onslow et al., 2020). These requests will interfere with the current demand fading procedures. Consequently, this approach is classified as evidence-based, but incompatible, and the interprofessional team will need to determine which of these interventions should be adopted.

Interventions deemed not evidence-based but compatible may either be rejected due to insufficient scientific support or (under some conditions) be considered for implementation if beneficial to the client with respect to their values and preferences (see also BACB, 2020a, section 2.0; Brodhead, 2015). Again, the behavior analyst and other team members should evaluate the benefits and disadvantages of accepting the intervention and weigh factors such as client safety, time commitments, cost, and ease of implementation. As an example, consider a case where a nutritionist recommends camel milk to treat the symptoms of autism based on reports of decreased oxidative stress and improved behaviors (AL-Ayadhi & Elamin, 2013). This treatment entails replacing the child's daily intake of two cups of reduced fat cow milk with pasteurized camel milk. While substituting the dairy source will not interfere with any aspects of the child's current treatment program, the evidence for camel milk as an effective autism treatment is lacking (Williamson et al., 2017). As such, this proposed treatment would be classified as not evidence-based, but compatible. The team may refute the requested changes based on the lack of evidence.

Finally, when an intervention is classified as not evidence-based and incompatible, it should be rejected, and the behavior analyst may consider proposing an alternative treatment. Suppose current interventions for a 6-year-old with ASD include manding with complete sentences using the Picture Exchange Communication System (PECS; Frost & Bondy, 2002). The special education teacher recommends the rapid prompting method to allow the child to demonstrate more advanced language and literacy skills through textual communication (Schlosser et al., 2019). The rapid prompting method lacks empirical evidence to support its use and is dangerously similar to the debunked and harmful method of facilitated communication. It would therefore be classified as not evidence-based and incompatible (American Speech-Language-Hearing Association, 2018; Schlosser et al., 2019). Hence, the interprofessional team should reject this intervention.

8.4.7 Consulting Resources

A fundamental aspect of the decision-making models developed by Brodhead (2015) and Newhouse-Oisten et al. (2017) is reviewing the available scientific evidence for a proposed treatment. Unfortunately, this crucial step is a daunting task for a practitioner. Empirical investigations must be assessed for both quality and quantity, that is, the methodological rigor, strength of experimental design, replication, and consistency of findings (DiGennaro Reed et al., 2018; National Autism Center, 2015; Reichow, 2011). According to the National Autism Center XE "National Autism Center" (2015), evidence is sufficient to establish an intervention as effective when at least 2 high-quality group designs or 4 high-quality single-subject designs are conducted with at least 12 participants consistently replicating the effects without conflict. Alternatively, Reichow (2011) graded interventions as established when 5 methodologically sound, single-subject designs with at least 15 participants, or 2 group designs, were conducted across different research groups and in different geographic locations. More replications are necessary to demonstrate sufficient evidence when experimental designs are weak, findings are inconsistent, or methodology is imprecise. In any case, it can be difficult for practitioners to keep up with the accrual of evidence, especially for interventions that come from many different fields.

Many reputable organizations have compiled and summarized the available research for autism treatments, which may offer practitioners a more efficient and reliable means of examining the science. Notably, the Association for Science in Autism Treatment, the National Autism Center at May Institute, and Autism New Jersey have categorized treatments as established, emerging, untested, and ineffective according to the strength and quantity of available evidence (Association for Science in Autism Treatment, n.d.; Autism New Jersey, n.d.; National Autism Center, 2015). Established interventions are those with substantial scientific support and may generally be accepted by practitioners pending an assessment of compatibility. Emerging interventions have some preliminary empirical evidence supporting their use, but need additional research. Untested treatments are also in need of empirical investigation as their effects are unknown. Interprofessional teams should further analyze proposed treatments classified as emerging and untested before implementing. Those interventions classified as ineffective or harmful should, of course, be addressed with the colleague who is recommending them, regardless of the risks for conflict, and an alternate intervention should be identified in these instances.

Another resource recommendation is the American Speech-Language-Hearing Association (ASHA). While this is the professional organization for speech-language pathologists and audiologists and is not exclusively focused on effective ASD treatments, their online evidence maps serve as a valuable tool for reviewing empirical research in ASD treatments, particularly as it relates to the scope of practice for speech-language pathology and audiology (American Speech-Language-Hearing Association, n.d.). Their website provides an evidence map specifically for ASD spectrum disorders that can be filtered to generate treatments from domains such as feeding and language or more specific approaches such as augmentative and alternative communication or joint attention interventions. Results of the search include systematic reviews, meta-analyses, and guidelines from publications within and beyond the fields of speech-language pathology and audiology as well as ASHA's position statements and policies on harmful, yet controversial, treatments such as facilitated communication and rapid prompting. Summaries and quality ratings are provided for many of the systematic reviews and meta-analyses, with conclusions regarding the efficacy of the intervention.

ASHA's position statements are particularly helpful and are focused on the extent to which procedures have been empirically verified to be effective and the extent to which they pose risk. ASHA has position statements on a number of commonly suggested interventions, including auditory integration training, oral motor exercises, facilitated communication, and rapid prompting method. In all of these statements, there are a summary of existing evidence, an outline of known ineffectiveness or documented harm, and guidelines for practitioners regarding the incorporation of the procedure. There is utility for the practitioner in these documents, as they are reminded of their obligations to use and recommend only empirically supported, evidence-based interventions. There is also utility for consumers, as they are helping to avoid interventions that do not have merit and are likely to be an unwise investment of time, resources, and hope.

Other professional guild organizations also have position statements that can be extremely useful in collaborative contexts. For example, the American Academy of Pediatrics has position statements on auditory integration, facilitated communication, and sensory integration therapy. In all of these cases, the statements recommend against the use of these procedures and indicate that there is a lack of evidence to support their use.

The value of position statements from other professions is great, as they provide external and independent advice on proposed paths of treatment. A behavior analyst may be viewed as biased for their own profession and for interventions that originated within behavior analysis. When sources outside of behavior analysis are cited, it becomes a broader dialogue, and the focus is on effective intervention, and not on field-specific assessments of individual interventions.

It is helpful for behavior analysts to have a broad understanding of the positions that allied fields have on commonly implemented interventions. Staying abreast of these positions by guild organizations can enlarge the list of resources one consults and shares with the interdisciplinary team. Diverse and user-friendly resources can aid consumers and professionals in understanding the current state-of-the-science when it comes to evidence for or against a particular intervention.

8.4.7.1 Treatment Classifications

Autism New Jersey has separated empirically supported interventions from those lacking sufficient evidence with a simple traffic light analogy (Autism New Jersey, n.d.). Green light treatments signal efficacy. Yellow light treatments are those that should be implemented with caution and need additional research regarding their potential impact. Red light treatments are those that have been proven to be ineffective and/or harmful and that should not be implemented.

To illustrate the use of these classification systems in the evaluation of treatments presented in collaborative contexts, consider a recommendation for music therapy. A review of the information presented by the organizations listed previously indicates this treatment is a yellow light procedure, an emerging intervention with preliminary evidence suggesting it may be effective for individuals with ASD (Association for Science in Autism Treatment, n.d.; Autism New Jersey, n.d.; National Autism Center, 2015). A behavioral translation and compatibility assessment should be conducted to further analyze the potential effects, but given this information, the practitioner may opt to avoid unnecessary conflict and agree to closely monitor the impact of this treatment.

Yellow light procedures are those that might be individually applied while impact is closely assessed. Certain conditions are important to put in place for these trial interventions. For example, it is important that attention be given to the target behaviors; in other words, the team should identify and systematically track the behavioral changes expected with the intervention. Similarly, the procedure should be specifically defined, and measures of procedural fidelity should be taken to ensure that it is implemented as planned. Interobserver agreement measures should also be obtained, so that an objective assessment of impact is assured. Additionally, when possible, applying the intervention in a single-case design format is ideal. In this way, there can be confidence that the procedure was implemented in a way that allows for assessment of functional control. For example, the use of an alternating treatments design may help to identify whether attention was improved on days in which a sensory diet was implemented or whether the performance on days in which the sensory diet was not utilized was equivalent or better. Finally, the team should agree to a data-based decision on continuance or discontinuance of the procedure. This should be discussed before the intervention is begun, and there should be an explicit commitment to “listen to the data” regarding the ultimate decision about the intervention’s inclusion in the individual’s treatment plan.

At times, a yellow light procedure’s assessment process might yield useful data to guide treatment. For example, a behavior analyst could be asked to participate in an assessment of the impact of brushing for an individual learner. An outside occupational therapist may recommend the use of a brushing protocol to reduce stereotypy and to increase attention and performance on programs. The behavior analyst would work with the occupational therapy and the team to design a comparison of the brushing interventions with two other conditions: free play and intensive social play. In all three conditions, the child can be removed from the classroom and be sent to the gym to engage in one of the three conditions (i.e., brushing, free play, intensive social play). Educational staff would not know which condition was experienced prior to instruction. Over the course of several weeks, multiple data points can be accrued for each condition, and the rates of stereotypy and indices of attention and mastery can be evaluated. Potentially, results could indicate that the brushing condition was associated with lower rates of stereotypy and higher attention and engagement than the free play (control) condition. However, the lowest levels of stereotypy and the highest levels of attention and instructional performance were seen in the intensive social play condition. The data could then be reviewed by the entire team, and all might agree that intensive social play was the most effective intervention to achieve these goals. Going forward, the team could precede instructional sessions with intensive social play. In this case and outcome, the team was able to "let the data speak." When it is possible and safe to do so, such comparative intervention trials can shed light on the potential utility of an intervention. As in the brushing example, it might even lead to the identification of an alternative intervention that might actually work better than the proposed yellow light procedure.

Some procedures are not safe or even potentially therapeutic, and every effort must be made to ensure that they are not implemented. Accordingly, red light procedures are harmful and should immediately be addressed with the prescribing colleague regardless of the risks of interpersonal conflict. For example, Autism New Jersey's treatment guidelines list a number of procedures as red lights, including facilitated communication, auditory integration training, and chelation. All red light procedures have been definitively documented to be either ineffective or harmful, or both. In all instances, these procedures have been vetted by science and found to be without benefit and to possibly introduce harm. These designations have been given because scientific evidence shows a lack of therapeutic impact, because there may be evidence of harm, because they may have an anti-science basis, and because they are likely to waste time, energy, resources, and hope.

Green light procedures are those whose effects have been well established through empirical investigation. These efficacious interventions may generally be implemented and are likely to provide benefit to the individual.

8.4.8 Summary and Future Directions

Autism is a complex disorder that presents in highly variable ways. For this reason, treatment requires the expertise of multiple disciplines, to ensure that assessment and treatment are comprehensive and individually tailored. Interdisciplinary models of treatment are well suited to the unique profiles and challenges associated with autism, and coordinated intervention across disciplines leads to better outcomes.

Challenges in the implementation and coordination of an interdisciplinary model are many and include differing definitions of evidence-based practice, discipline-specific worldviews and intervention approaches, lack of training in collaborative models of care and in soft skills that increase the success of collaboration, the use of jargon that impedes understanding across disciplines, the reluctance of behavior analysts to incorporate the suggestions of other team members, and the negative perception of behavior analyst hold by members of other professions.

A number of strategies can be used to bridge these divides and to equip practitioners with skills to be more effective in interdisciplinary contexts. Several professions have created models and resources that can assist in this process, most notably, nursing (e.g., Fewster-Thuente & Velsor-Friedrich, 2008), medicine (e.g., Gabrielová & Veleminsky, (Gabrielová & Veleminsky, 2014), speech and language pathology (e.g., Koenig & Gerenser, 2006), and occupational therapy (e.g., Scheibel & Watling, 2016). Certainly, achieving a workforce that is skilled in interprofessional collaboration will require an increased focus on teaching and training skills relevant to interdisciplinary collaboration, especially with regard to the development of soft skills.

It is important for behavior analysts to understand both the roles and contributions of every member of the interdisciplinary team. Professional training should incorporate more information about allied field's training and expertise and should focus on navigating shared scopes of practice. Specifically, skills in making clinical decisions about courses of treatment need to be a focus of training. Helping practitioners to understand processes to use in team decision-making is helpful. It is also extremely helpful for practitioners to be familiar with resources that can help individuals and teams to assess potential risks and benefits and to evaluate the existing evidence for a given procedure.

All decisions made must be in the context of evidence-based intervention, and behavior analysts are obligated to uphold a commitment to effective treatment. Hence, behavior analysts must be trained to navigate these circumstances with interpersonal finesse and with science-based facts. Familiarity with resources that rank treatments in terms of evidence and with the position statements issued by organizations regarding specific interventions can help behavior analysts to decide when and how to express strong opinions about potential harm or limited benefit.

The benefits of training behavior analysts more thoroughly and methodically in interdisciplinary collaboration extend beyond the benefits for individual clients. As behavior analysts collaborate with more success, the experiences of colleagues in other disciplines will also improve. This will likely increase outcomes on the level of the individual, at the level of the team, and for the profession as a whole.

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9 Be Humble, Learn, and Care: Culturally Responsive Evidence-Based Practice

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9.1 Be Humble, Learn, and Care: Culturally Responsive Evidence-Based Practice

In the midst of our culturally abundant and complicated world, our goal as interventionists is to contribute to the betterment of the lives of all the children and families we serve. As the world changes through migration and the lifting of oppressive structures, greater numbers of people who are different from one another will interact and negotiate the process of living together and supporting one another. Interventions to help people with autism are highly interactive acts that enter into some of the most central parts of living: communication, social interactions, and activity engagement. Furthermore, the process of behavior change involves tremendous collective effort over time in each of these areas of life. Everyone, including the child, should see value in the process and outcomes and, also, contribute to the efforts. Cultural differences oftentimes produce tensions, avoidance, or exclusion. These difficulties set the occasion for close examination of intervention practices and growth, as individual practitioners and as a field.

Culture is a way of describing the common learning histories, behavior patterns, and values that groups of people share; these are differentiated from groups who have other sets of histories, behavior patterns, and values (Sugai et al., 2012). For any given person, cultural identity is fluid and intersectional (Osborne, 2015). That is, each of us will identify with multiple cultural groups, and that identification is porous and dynamic. Furthermore, some cultural groups will experience more oppression, hardship, trauma, and greater disparities in access and distribution of resources than others. Conversely, some cultural groups will experience more privilege, greater access to resources, and affluence than others. Given these subcultures and intersectionalities, cultural groups overlap. It would not be uncommon or unheard of, depending on cultural groups in which one identifies, to experience both privilege and oppression. Cultural groups are delineated in many ways: by race, ethnicity, religion, economics, gender, neurology, physicality, ability, sexuality, and more. As the world shifts and the voices of people from different groups are able to participate in societal discourse, we find

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that we are interfacing in hard and evolutionary ways, including in our intervention programs. There are many, many cultures in the world. Each cultural context will bring a range of different responses in relation to research evidence and interventions, particularly given the overlapping metacontingencies which surround each culture.

The greater the differences between the cultures of the people involved – the interventionist, the child, the family, and the community – the greater the potential for misunderstandings, conflicts, and harm. At the same time, if we bring a posture of humility, learning, and care, there are also opportunities for deeply meaningful and progressive outcomes for everyone involved.

As professionals interact with ever-widening cultural groups, we strive to respond in ways that produce betterment for all. For years, many of the helping professions have struggled with how to learn to do this and how to talk about it in both research and practice (Miller et al., 2019). For the purpose of this chapter, we will rely on the broad term cultural responsiveness (Ladson-Billings, 1995; Miller et al., 2019; Wlodkowski & Ginsberg, 1995). The concept of cultural responsiveness involves an emphasis on transformation. That is, we expect to be changed and to change the structures of our practices and how we approach intervention and training so that our combined efforts produce greater progress, inclusion, equity, and social justice for all.

Responsiveness should be a foundational element of our assessments, our procedures, our measures, our training, and our interactions and the foundation for organizational structures that support and give access to those activities. Learning to provide interventions that respond to the unique preferences, needs, and values of an individual child and their families in their specific cultural context is the work of a lifetime. Guided by postures of humility and learning (Wright, 2019), it can also be a life-affirming process for children, families, therapists, and supervisors.

The purpose of this chapter is to explore ways in which behavior analysts can be culturally responsive and inclusive in clinical practice and research. As we feel the tremors of a world in turmoil, we also see the advent of new ways of addressing our human condition. A scientific approach to human behavior, the systematic study of interactions and patterns between our behavior and our physical and social environments, is an advancement in the evolution of our species (Skinner, 1953). There is no doubt that this science has led to a considerable amount of evidence that suggests ways to accelerate and decelerate behavior that improves the lives of children with autism (e.g., Leaf et al., 2022, this volume). The cultural tensions lie in the conditions under which we change behavior and what behaviors are changed and when; in other words, sought-after behavior change may or may not be a contextual (e.g., cultural) fit.

And, above all, there is tension around who is directing the changes and why and how they are making decisions. The difficulties we see in intervention and practice are part of the broader conflicts we see in the world all around us; cultural values about change are colliding in hard and evolutionary ways.

The challenge is to evolve effective, care-based interventions that foster wellbeing for all without excluding, hurting, alienating, or marginalizing. This will involve imagining and shaping a broader and encompassing set of values that contain an ethic of compassion for people from a variety of cultural contexts (Ala'i & Re Cruz, 2021; Pritchett et al., 2021). This includes, but is not limited to, the agreement that there is merit and wisdom in recognizing our growing interdependence as a species on a shared biosphere, that each child born into the world is a responsibility of the collective of humanity, that each child has the right to education and happiness, and that we are in the process of learning how to value and nurture one another in equitable and just ways (e.g., Karlberg & Farhoumand-Simms, 2006; Maparyan, 2012, b; McGoldrick & Hardy, 2019; UN General Assembly, 1948). These are the values that direct an examination of how we engage in evidence-based practice across cultural contexts.

For the interventionist, the task is to consider research evidence in the context of a specific child and their cultures. Generally, this involves careful consideration of the child's needs, strengths, and preferences, the family's preferences and valued outcomes, and, also, cultural risk and protective factors that are likely to affect that child's quality of life in their present conditions and across the lifespan. The growing and collective wisdom of the interventionist, family, and community can help shape a satisfying future in which the child has an increasingly better quality of life (Schwartz & Kelly, 2021). To this task, teams can bring an ever-evolving research and wisdom base in the design and implementation of interventions. Both the wisdom and evidence base are influenced by the interventionists', families', and societies' responses to culture.

Our hope is to share methods to integrate evidence and wisdom to inform culturally responsive practice. As we touch upon the labor in diverse areas of scholarship, we will consider central concepts as they relate to culture, such as evidence-based practice, responsivity, perspective, reflection, transformation, social justice, and equity. We would also like to make it clear that the research base that we rely on in applied behavior analysis is produced and regulated by one dominant culture. Our overall aim is to describe how an evidence-based practice approach can increase possibilities and opportunities for valued progress even in the midst of a research base developed primarily by one group of people.

We will do this by exploring the notion of evidence-based practice as it relates to culture and highlighting a few important emerging lessons for increasing culturally responsive interventions. This chapter may seem challenging. It will not be prescriptive, and it will focus on creating conditions that allow for increased clinical wisdom and cultural responsivity.

9.2 Evidence-Based Practice in the Context of Culture

There are many ways of describing evidence-based practice in applied behavior analysis, and all are an attempt to describe how we provide responsible and responsive care (e.g., Slocum et al., 2014; Smith, 2013). In the seminal paper on evidence-based practice, scholars from some of the most respected medical institutions in the western world wrote about the increasing tensions in the medical community regarding the role of evidence and the role of clinical expertise (Sackett et al., 1996). They emphasized the relationship and importance of both sources:

> Good doctors use both individual clinical expertise and the best available external evidence, and neither alone is enough. Without clinical expertise, practice risks becoming tyrannised by evidence, for even excellent external evidence may be inapplicable to or inappropriate for an individual patient. Without current best evidence, practice risks becoming rapidly out of date, to the detriment of patients. (Sackett et al., 1996, p 72)

They also discuss the interaction between the two:

> Evidence based medicine is not "cookbook" medicine. Because it requires a bottom up approach that integrates the best external evidence with individual clinical expertise and patients' choice, it cannot result in slavish, cookbook approaches to individual patient care. External clinical evidence can inform, but can never replace, individual clinical expertise, and it is this expertise that decides whether the external evidence applies to the individual patient at all and, if so, how it should be integrated into a clinical decision. Similarly, any external guideline must be integrated with individual clinical expertise in deciding whether and how it matches the patient's clinical state, predicament, and preferences, and thus whether it should be applied. Clinicians who fear top-down cookbooks will find the advocates of evidence based medicine joining them at the barricades. (Sackett et al., 1996, p 72)

Evidence-based practice is a balance and synthesis of research evidence *and* clinical expertise. Slocum et al. (2014) wrote about how this particular perspective on evidence-based practice applies to practice of behavior analysis. They also highlighted the importance of considering the client values and context:

> Evidence-based practice of applied behavior analysis is a decision-making process that integrates (a) the best available evidence with (b) clinical expertise and (c) client values and context. This

> definition positions EBP as a pervasive feature of all professional decision-making by a behavior analyst with respect to client services; it is not limited to a narrowly restricted set of situations or decisions. The definition asserts that the best available evidence should be a primary influence on all decision-making related to services for clients (e.g., intervention selection, progress monitoring, etc.). It also recognizes that evidence cannot be the sole basis for a decision; effective decision-making in a discipline as complex as ABA requires clinical expertise in identifying, defining, and analyzing problems, determining what evidence is relevant, and deciding how it should be applied. In the absence of this decision-making framework, practitioners of ABA would be conceptualized as behavioral technicians rather than analysts. Further, the definition of EBP of ABA includes client values and context. (Slocum et al., 2014, p. 44)

How do we develop clinical expertise that helps us be responsive to client needs, values, and context? How do we relate culture to research evidence? This is a question being asked in many areas of health care (e.g., DelVecchio Good & Hannah, 2015). This tension is perhaps most apparent at the intersections of behavioral interventions and culture. The answers to these questions are complicated. It will take more than making sure that stimuli include representative pictures, that specific holidays are respected and honored, that correct names are used, or that translators are available. It is each of those things and much more.

To begin the process of integrating client values, preferences, and contexts with evidence and clinical expertise, we offer a twofold examination. First, it is helpful to understand the research base and how it is developing, how the base is being established, who is involved in knowledge production, and how it is regulated. Second, it is important to examine the development of clinical wisdom in relation to culture. That is, what are the sources and types of clinical wisdom? What are the specific areas of tension and potential? How does one know if expertise is progressing? Finally, how do we increase the probability of continued growth and responsiveness?

9.2.1 The Research Evidence Base

Generally, research in autism is conducted in universities and research centers. Researchers engage in a lengthy process of identifying research questions, obtaining human rights approval for the research, obtaining participant consent, conducting the research, preparing a report of the research findings, and submitting the findings to scientific journals. If peers find the research meets current scientific standards and has merit to contribute to our understanding of intervention, it is published and becomes part of the research base. Journals, libraries, and institutions make this information available to the practicing interventionist in different ways (e.g., through subscriptions, courses, workshops). Within the last two decades, concerted efforts have increased to make the research evidence more accessible and to provide a context for synthesizing a great deal of information. For example, there are articles that prepare practitioners to locate and find relevant research (e.g., Carr & Briggs, 2010; Gillis & Carr, 2014), research clearinghouses (e.g., National Autism Center, 2015; National Professional Development Center, 2014), and textbooks and volumes that consolidate and summarize findings for both professionals and parents (e.g., Leaf et al., 2022, this volume).

Part of our ethical and professional responsibility is to demonstrate knowledge of the basic principles of behavior change and to keep abreast of research developments as they relate to our specific areas of practice. To ensure that there is a minimum level of competence, interventionists are required to have degrees, certifications, and, sometimes, licenses. All of this requires diligence and a tremendous effort on the part of the practitioner.

In relation to culturally responsive interventions, there are several issues to consider about this research base. First, it is only within the past few years that professional organizations have released data regarding professional membership demographics (Association for Behavior Analysis International, n.d.; Behavior Analysis Certification Board, n.d.). These data, limited in content, breadth, and duration, indicate that the leadership (i.e., researchers, editorial board reviewers, professors who teach courses, directors who oversee intervention programs, scholars who compile research reviews and write books) is primarily of the dominant culture, that is, western, white, Global North inhabitants. This representation is also seen in recent surveys of practitioners. In one of the more comprehensive and earliest surveys, the results indicated that a majority of practitioners are white females working with children with autism and have little or no training about culture and diversity (e.g., Beaulieu et al., 2019). The process of systematically including research participant demographics has only recently begun, and, even then, demographic data about researchers and participants appears to be largely absent (Pritchett et al., 2021). It should also be noted that most of the research publications are in English and are products of the Global North. All of this is to say that the research base has largely been developed and created by a homogenous cultural group. This is similar to other sciences and helping professions (e.g., Adams et al., 2015; Dirth & Adams, 2019; Henrich et al., 2010).

There are two important points here. First, the homogeneity of the research foundation does not negate the relevance or utility of the knowledge. On the one hand, we have made tremendous progress in understanding how to accelerate meaningful change; many children with autism have made measurable progress, and the outcomes have been valued (e.g., Leaf et al., 2022, this volume). On the other hand, emerging scholarship within and outside of the field tells us that there are important voices that have not been part of the process and that the cultural positionality, the identity, of the researcher will influence the research questions, participant inclusion, the experimental methods, the data interpretations, and the suggested applications of research in a myriad of ways (Ala'i & Re Cruz, 2021; England, 1994; Jacobson & Mustafa, 2019; Jafar, 2018; Pritchett et al., 2021). The second point is the degree to which the research base has been participatory is limited (Fawcett, 1991; Pritchett et al., 2021). That is, research participants are not collaborators in the process of setting and carrying out the research agendas. Furthermore, neither the Association for Behavior Analysis International nor the Behavior Analyst Certification Board set disciplinary pre- or post-educational requirements regarding cultural diversity and practice for professionals in behavior analysis in order to teach leaders, researchers, or practitioners how to interact with culture and context, a core feature of evidence-based practice in behavior analysis (Slocum et al., 2014). Finally, translational research is not always conducted before publication; in fact, it is often considered a separate research type. While this is understood from the perspective of researching scholars, one may argue that research conducted in laboratory settings, as brief designs, etc., lacks cultural contextual fit or at the least has not been assessed beyond these specific contexts. In other words, generalizability of such research is not truly present.

In summary, the research base is primarily created, produced, and implemented by a relatively homogeneous group, and there are no formal training requirements for behavior analysts regarding cultural values and context. From this, we can conclude that we are only seeing a portion of the questions, methods, opportunities, frameworks, and outcomes possible.

9.2.2 Developing a Cultural Wisdom Base

Fortunately, a practitioner with clinical expertise is in a unique and important position and can bring wisdom to the process of contextualizing the research base with a given child and their family's needs, priorities, goals, and values (Slocum et al., 2014; Leaf et al., 2016). To understand the expansiveness and implications of the practitioner's role in contributing to the progression of the evidence-based practice, we will share a description of a paradigm shift occurring within the technology industry and relate this to the case of intervention. Boland and Tenkasi (1995) described the phenomena of "knowledge-intensive firms" that exist to produce new understandings that, in turn, produce valued innovations. They give the example of cellular phone development that required 5 disciplines in the first development phase and at least 14 distinct disciplinary technologies in the later phases. In the tech industry, the cell phone is considered a "killer app," meaning that it made previous technologies irrelevant and archaic. Of course, previous technologies were essential for the foundations of the cell phone, but before today's current version, few could have imagined a device that intensively combined and synergized the knowledge of so many disciplines and technologies to create a new way of interacting with the world. In some ways, this is similar to what is required of the interventionist. There is an obligation to deeply understand the evidence base and to understand the processes involved in honorably serving children and families that had no voice in the development of that evidence base. This requires the interventionist to develop skills and knowledge that exist in other disciplines, to reflect deeply on their own positionality and biases, to work collaboratively with the child and family, and to generate a series of programs that create a new way for each child.

Boland and Tenkasi (1995) posited that an essential part of the successful development of advanced technologies is based on a process of the disciplines engaged in both perspective taking and making. This applies not only across disciplines but within disciplines. That is, each disciplinary branch learns to narrate, shape, and reflect upon their own perspectives and contributions and to listen, integrate, and reflect upon the contributions of the other disciplinary groups. In this process, both data and narrative share importance. Data allowed the participants to understand conditional truths under specific conditions, and narratives gave context and meaning to the data. When the groups worked together toward a common mission, they developed new perspectives and new bodies of knowledge. It is within this intensive knowledge sharing, production, and action for a common product or purpose that paradigmatic shifts occurred and innovations were able to surpass all previous technologies. Boland and Tensaki also described those knowledge groups that are unsuccessful; such teams are characterized by a lack of skills in self-reflection and narrative, difficulty reconciling one another's priorities and projections, frequent ignoring, discounting, and a lack of appreciation for the perspective of one another as well as certitude that everything is known and correct within their own particular frameworks. These barriers limit creative problem-solving and advancement.

At present, the desired outcomes are increased quality of life and enhanced wellbeing of the children and families we serve, now and across time. The perspective taking, sharing, and making should occur within our intervention teams of diverse people with different lived experiences and vantage points. Each interventionist comes with a particular set of learning histories and, hopefully, a deep knowledge of the evidence base and its contextual strengths and limitations. Each family and child come with a set of learning histories developed within their cultural communities. All cultures have developed funds of knowledge, values, and priorities and have had particular positions within the social structures of society (e.g., Moll et al., 1992). Each of the positions is the product of generations of societal structures and individual and group learning histories that place people of different cultural groups in relative advantage and disadvantage.

These conditions create a compelling need for increased cultural responsiveness and clinical wisdom in interventions, especially with cultures often at a disadvantage, that is, people that are not from white, affluent, Global North, Christian cultures. This point is amplified in social and academic discourse as well as systematic qualitative studies with people of other cultures.

Neither interventionists nor the families know the outcome of the intervention journey. Each is part of a dynamic system in which cultural boundaries and positions are always in motion (DelVecchio Good & Hannah, 2015). Each comes in with knowledge, values, priorities, and contingencies that are to be discovered, acted upon, and synergized in a context. The context is the child's quality of life (current and future) in their specific cultural context, the research base, and the team's willingness to learn and care (Schwartz & Kelly, 2021). The goal is for each member to learn about their own skills, knowledge, values, and contingencies and how they fit within the context of the child's life. Fortunately, there are scholars outside of the intervention context that are studying the ways culture interacts with societal structures and patterns of interactions (e.g., Annamma et al., 2016; Benjamin, 2019; Love, 2019; McGoldrick & Hardy, 2019; Project Implicit, n.d.). On the one hand, this is daunting because there are as many sources, if not more, than were related to something like cell phone development. On the other hand, our discipline is working fast and furiously to access, unpack, and apply much of the learning from outside the field. For example, Behavior Analysis and Practice published a special issue on Diversity and Equity (Zarcone et al., 2019), and another is in progress on Racism and Police Brutality (Gingles, 2021b).

Our labor in creating culturally responsive evidence-based practice then comes to create what Barrera and Kramer (2009) called a "third way," an outcome that is a process of taking seemingly divergent and sometimes contentious positions to create a new, provisional approach. That is, in the case of evidence-based practice and culture, it means crafting a new way that harmonizes the family cultural values and contingencies, the child's immediate and long-term growth and happiness, the research evidence, and the sources of knowledge from other areas, such as sociology, anthropology, public health, and education (Miller et al., 2019). We can do this, in part, by perspective taking and making, a set of skills that is intertwined with humility, ongoing learning, and care.

9.2.2.1 Humility

The concepts of cultural competence, responsiveness, and humility have relatively long histories in fields such as social work, education, psychology, and health care (see Tervalon & Murray-Garcia, 1998, and Foronda, 2020, for reviews of the history in the context of humility). The call for responsive care was introduced in behavior analysis (e.g., Fong & Tanaka, 2013; Iwamasa, 1997; Iwamasa & Smith, 1996) and has increased in number (e.g., Fong et al., 2017; Miller et al., 2019; Zarcone et al., 2019) and has become more specialized since the March 2020 uprisings (e.g., Ardila Sánchez et al., 2020; Esquierdo-Leal & Houmanfar, 2021; Gingles, 2021a; Sadavoy & Zube, 2021). Wright (2019) published the first work specifically addressing cultural humility in behavioral practice.

We start specifically with humility for several reasons. First, it is foundational in developing "third ways" in situations of uncertainty and tension. Second, it is a prime example of how non-western frameworks can expand our way of navigating our shared world. It is both a useful concept for this particular situation and a way to understand that concepts and practices can differ across cultures; it is a concept that both teaches and exemplifies how cultural responsiveness can improve our ability to act toward the common good.

Within a western context, the notions of humility are related to intellectual reasoning and decision-making and "… the correctness or wrongness of one's beliefs, truth seeking, acceptance of one's fallibilities as knower/believer, and the nature of open mindedness occupy the center stage of discussions about humility at present" (Li, 2016, p.150). Within health care, including behavior analysis, there are also the added dimensions of personal and institutional accountability for power imbalances and the need to address these imbalances and inequities through critical analysis as well as the central role of openness to cultural diversity and ongoing learning about how to improve practice (Wright, 2019).

In an exploration of the concept of humility, Li (2016) noted that the concept may run contrary to other western cultural values, creating an ambivalence related to and in contrast with values related to concepts such as assertiveness and self-confidence. Li contrasts this with eastern cultures influenced by Confucianism and highlights some of the possible cultural differences. She looked at this across several quantifiable and qualitative dimensions. For example, controlled word searches across the samples of western and Confucian-heritage cultures (CHC) indicate that the word "humility" appears in much higher usage in everyday frequency in CHCs; in contrast, the word "pride" is used at a much higher frequency in western cultures than in CHCs. The more a word appears, the more relevance it has to the culture, "it is likely that in a culture where humility is more commonly emphasized, people may be more apt to think, feel, behave and judge each other accordingly. Likewise, parents and teachers socialize their children to do the same" (Li, 2016, p. 151). Li went on to suggest that honoring ongoing self-cultivation and learning is emphasized throughout *all* CHC societal relationships and that there is an implicit duty to others in each of these relationships, a required reciprocity, to humbly continue learning for the good of the collective. She introduces the CHC concept of "liability of self-fullness," that every time one learns something it is wise to try and return to the stance of knowing it is not enough. The "liability of self-fullness" is an important part of practicing cultural humility. It encourages us to try and do our best with what we know and realize we do not know enough to serve the wellbeing of the collective and continue developing as human beings. In the present case, it requires holding the tension of a research base that has suggested that children can make genuine and valued progress and know that the research base is incomplete and that it is not enough. The research base has not accounted for or included the perspectives of many cultures and ways of being. Our training programs, research, and practice do not contain an explicit responsibility and method for humble learning in relationship to one another, to the families we serve, and to the collective wellbeing of people from many cultures.

Fortunately, some of the specific areas for increased learning are being explored within and outside of our field. Most of these topics are uncomfortable. The process of intervention will always be controversial; intervening means that there is an intentional and explicit series of actions to change or not change responses and environments for a person or group of people. Oftentimes, the people who are the receivers of interventions are vulnerable, and other people are making decisions about what should be changed and how. When people express objections to the status quo, there are discussions, tensions, divisions, and sometimes reconciliations. Some of the controversies that directly intersect with culture are discussed in the emerging literature. For example, discussions relate to the use of aversive control (Morris & Hollins, 2021; Sidman, 2001; Singer et al., 1999; Van Houten et al., 1988), gender (e.g., Donovan, 2021; LeBlanc et al., 2020; Leland et al., 2021; Nordyke et al., 1977), race (e.g., Gingles, 2021a; Gingles, 2021b; Li, 2021; Čolić et al., 2021; Pritchett et al., 2021), indigenous peoples (e.g., Busch & Levasseur, 2021), intersectionality (e.g., Cirincione-Ulezi, 2020), ethnicity (e.g., DuBay et al., 2018), religion (e.g., Aljohani, 2021), language (e.g., Baires et al., 2021), neurodiversity (e.g., Friedman, 2021; Iland, 2021: Kirkham, 2017), poverty (e.g., Uwayo et al., 2021), and commodification (e.g., Keenan et al., 2010). Sometimes the discussions are in other forms, such as podcasts. For example, Beautiful Humans (Gingles & Donovan, n.d.) and Shades of ABA (Bradley & Moore, n.d.) are two active venues that address specific challenges and biases in practice and research. Such venues have expansive representation and content that is not controlled by the dominant majority culture.

It is important to note that the degree of gatekeeping, scrutiny, and peer review varies considerably in this emerging discourse. That is both the beauty and the tension. Social media and non-refereed publications have welcomed voices that are barred or inadvertently excluded from the discourse. The intention of peer review is to increase confidence that scientific communication is credible and meets the standards of quality for discourse and experimentation in a given field (Kelly et al., 2014). It is difficult to have peer review in the area of cultural congruence of research practices because there are few "peers" in relation to cultural diversity. That is, the majority of the scientific "peers" are also cultural peers from the dominant majority. As a field, we have not systematically addressed methods to reduce cultural bias, expand diversity, increase transparency, and further collaborative research methods so that the voices of participants are consistently included (Pritchett et al., 2021). Although some advances have been made, refereed publications have struggled in expanding the base of diverse researchers and reviewers with knowledge and lived experiences that are divergent from the status quo or majority. Several people in leadership have begun to publish discussions of these tensions in an attempt to tact the problems and develop solutions (Leaf et al., 2021). While continued dialogue is welcomed by many leaders, "non-traditional" spaces (e.g., social media) often remain the sole avenue for some groups of people to be part of such conversations and to offer differing perspectives. Without understanding the larger context and broader discussions taking place, both peer-reviewed publications and social media venues can sometimes appear to be binary and one-sided conversations. This process of disruption, fissure, and tension is also characteristic of our times. Part of our humble responsibility is to navigate these terrains and develop productive methods and venues for dialogue, arbitration, and mediation so that we can nurture relationships and welcome diverse perspectives and knowledge while creating new paradigms (Maparyan, 2012).

The range of considerations and tensions is astonishing, and one could feel overwhelmed and paralyzed by many of the binary and seemingly opposing conditions. It is compounded by the lack of formal cultural training for interventionists in behavior analytic practice (Fong et al., 2017) and that many of the injustices, exclusions, and tensions are normalized to the degree that they are not acknowledged or recognized in the published research. The path forward involves learning with great humility, to engage in the "liability of self-fullness" with a sense of responsibility to the collective to do the best you can with great care.

9.2.2.2 Learning

Learning to be responsive to the unique needs of people requires comfort in provisional spaces and accessing bodies of knowledge production within and outside of the research evidence in intervention. This will require interacting with texts and articles on the topics from within the discipline (Ala'i & Re Cruz, 2021; Conners & Capell, 2021; Mathur & Rodriguez, 2021; Sadavoy & Zube, 2021) and outside of the discipline on topics such as critical race theory and disabilities (e.g., Annamma et al., 2016) and technology (e.g., Benjamin, 2013). It will also involve learning from other disciplines that have had a longer focus in this area (e.g., Lynch & Hanson, 2011; McGoldrick & Hardy, 2019).

The topics to study and learn about will be directed by understanding the community you serve. That is, who are the members of the community? Do all members of the community have a voice? Are there disparities or incongruencies reported in the literature about populations served in your communities? Are there groups barred from receiving services in your communities? Who receives services later? Do the demographics of your staff match the demographics of the populations served? What are the concerns and tensions being voiced by and on behalf of the people you serve? How do those concerns interact with the research base?

Ideally, such questions and learning should be part of our initial training (Mathur & Rodriguez, 2021; Najdowski et al., 2021) and part of ongoing practice. In the meantime, as a way of organizing, communities of practice can be formed to study and systematically understand the complex information on cultural responsiveness and to make transformative changes in the way we engage in evidence-based practice (Anderson-Carpenter et al., 2014; LeBlanc et al., 2020; Miller et al., 2019; Wenger, 2000). Specific strategies are being developed to address approaches to training and culture that are specific to behavior analytic interventions (Mathur & Rodriguez, 2021) and address the distinct feature of a community of practice committed to increasing cultural responsiveness (Miller et al., 2019).

Time and Resources Have to Be Allocated to Learn That means portions of agendas and work days should have designated time to improve responsiveness to culture: to review and reflect on practices; discuss new sources of information; map the needs, strengths, and shortcomings of the community; decide necessary actions; and reflect and evaluate those actions taken. It also means that resources should be allocated to meeting times, additional training, bringing in outside experts, and assessing the effects for both the people being served and not those not served in our communities. And it means that time has to be allocated to act. This involves time allocations for entering and nurturing genuine relationships with the people that are part of the interventions, to have extended conversations, and to learn who they are and what they value, both now and in the future. It also means spending time observing and considering desired and current ecologies, including shared goals and values, such that interventions begin to sustainably shape current climates toward these preferred environments (e.g., Bernal et al., 1995; Schwartz & Kelly, 2021). Finally, both time and resource allocation should be made for formal evaluations, to be discussed ahead.

Create Conditions for Progress This involves identifying and creating opportunities for learning. Some of the central areas of opportunity relate to self-reflection, communication, valued outcomes, and measures of progress. Cultural awareness and self-reflection are key components in any helping profession's approach to culture and interventions. This involves a process of understanding your own identity and positionality, that is, your cultural context and how it relates to the people around you in terms of experiences, privilege, access, and power. A community of practice is an ideal place to start this process. There are a variety of training opportunities and articles (many cited in the reference list of this chapter) that can serve as a basis for learning. Each of these can be part of a community of practice with group discussions that tie back to the populations you work and serve with and that can expand your understanding, learn the parameters of social importance, and help you learn ways to include and tailor research evidence to meet the needs of the people you serve.

Another area emphasized is the necessity of improving our interaction skills across cultures. How to communicate and have safe and progressive conversations with clients and peers of diverse backgrounds, values, and learning histories is a complex skill and not an easy one to develop (e.g., Baires et al., 2021; Barrera & Kramer, 2019). Because culture is ever evolving and the learning process is ongoing, it will be perpetually uncomfortable. Conditions have to be created to practice the components of effective intercultural communication, to receive feedback, and to improve. Essential to this process is understanding the power differentials that exist in the provider-receiver relationship and that these conditions require a humble posture and acknowledgement that the learning will be eternal (Baires et al., 2021; Wright, 2019). The community of practice is the group that can help create increased fluency and courage. Members can provide simulated practice and feedback of component skills, provide a forum for reflecting upon and generating ideas to improve actual interactions, explore discomforts with the process, and generally nurture these developing skills by acknowledging effort and progress. The community can also identify intervention points that require improved communication to increase responsiveness to context and values.

Conditions can also be created to better understand valued outcomes and how these relate to cultural context and the evidence base. We start with creating conditions for the people we serve to feel comfortable in the perspective sharing and making process. Among other things, it is important to remember that everyone is in the process of learning. Mistakes are part of the learning process. The hope is that mistakes are as benign as possible, do minimal harm, and are quickly repaired. Intentionality is necessary to learn in order to prevent similar mistakes from reoccurring moving forward. Each of us understanding and articulating our values and perspectives is a work in progress that is affected by our environments. The degree to which we feel safe doing that will depend on where we are in relation to privilege and oppression in our communities. In all cases, it is a matter of developing skills. When any person is learning how to exert agency, there is an increased responsibility to create conditions for choices and preferences to be expressed, in both research and practice (Morris et al., 2021). The centrality of choices and balancing responsibilities and liberties has been an ongoing dialogue in our field and is heightened during conditions of cultural differences (Bannerman et al., 1990).

The tension and learning lie in how to develop strong interventions around those preferences and responsibilities within cultural groups, across cultural groups, and in ways that will serve children with autism in the present cultural context and in a cultural context that will change over the lifetime. Ultimately, this means how we understand and work with individuals to increase quality of life, now and in the future. One of the main considerations is how our understanding of this interacts with an evidence base that is largely molecular in nature (Zarcone et al., 2019) and does not have often concentration on dependent measures related to quality of life across the lifespan within the context of behavior change interventions or research (Ala'i-Rosales et al., 2019; Fawcett, 1991; Pritchett et al., 2021; Schwartz & Kelly, 2021). Again, it does not mean to say valued improvement is not demonstrated in the research base; it means that this research base does not often include these issues, which increases the responsibility of the practitioner to consider procedures across ecologies and time (Lutzker & Campbell, 1994) and to create assessments of social importance and valued change (Ferguson et al., 2019). Social validity can cover a wide range of formats, from measures of affect to choices in free and restricted operant contexts to interviews. The important thing for all social validity is that the data collection methods are culturally informed and interpreted and not just arranged to make the programs look good or as an afterthought after failing to include the family and child throughout the entire process (Schwartz & Baer, 1991; Wolf, 1978).

Nurture Progress Here, the focus is on establishing and developing ongoing methods to support progress. The central considerations are clear and evolving goals, safe and progressive interactions, and multi-dimensional and multi-sourced measures of progress. One of the first steps is to create a format for program evaluation, a widely underutilized mechanism for assessing organizational health in relation to goals and societal context, that includes various people from varied cultures within that subset of society (Miller, 2017). The second step is to have ongoing discussions and planning around the goals of the community of practice. What are the values of your community? Do your program evaluations incorporate indicators of these values in action, in outcomes (Binder, 2016)? How are they changing over time? What are you learning? How does it relate to the research? And most importantly, are the children making better progress? Are the families more involved? How did they participate in the process? Is there more variation in the way programs are designed that reflects cultural values and happy progress? Do the people you work with feel that you care about their identities and values? Do they feel the outcomes reflect that care?

9.2.3 Expansive Care

> we are each other's harvest:
> we are each other's business:
> we are each other's magnitude and bond.
> (Brooks, 1970)

We offer a portion of Pulitzer Prize poet Gwendolyn Brooks' work as the introduction to care for several reasons. One of the ways to understand people is through talking to them, hearing their poetry and music, seeing their art, listening to their stories, understanding how they spend their days and prioritize their activities, finding out what values they hold dear and what teachings guide them and their perspectives on life and the afterlife, and asking what gives their lives meaning and substance. In fact, as authors, we share this is as part of our poetry, as part of what informs our perspectives. By virtue of our differing and uniquely combined positionalities (women, brown, black, raised in poverty, immigrant, and children of immigrants), many sources of wisdom, in addition to research evidence, inform our perspectives and direct the guiding principles and focus of this chapter (Jafar, 2018). For us, Brooks' poetry reflects some core values; we find meaning and hope in acknowledging and acting on humanity's essential unity and responsibility to one another. Brooks writes of humanity's maturity, born of generational suffering, that declares that we are all interconnected and will affect one another, that those effects will be in direct proportion to our efforts, and that we are bonded in our responsibility to one another. An ever-expanding number of voices across the world echo these sentiments in many different arenas, from global policies to scholarship in the humanities to the ethics of the helping professions (e.g., Birdsong, 2020; Karlberg, 2008; Maparyan, 2012; McGoldrick & Hardy, 2019; Pritchett et al., 2021; UN General Assembly, 1948).

Viewing our interdependency is the first part of genuine and mature care. If interdependency and equitable wellbeing is acknowledged as a core value, the next step is to examine how this value translates to different areas of practice. Caring and ways to show genuine care for all in applied behavior analysis were part of our genesis (Baer et al., 1968; Wolf, 1978). The discussions centered around care and culture have increased in the last few decades in at least a few specific areas related to practice: (1) relationship development and communication, (2) procedures and outcomes, and, perhaps the most difficult area, (3) structural oppression and biased delivery systems. We will briefly discuss some of the caring actions interventionists can take in each of these areas.

9.2.3.1 Attention to Relationship Development and Communication: Show You Care

There are an increasing number of scholars that direct our attention to the importance of the therapeutic relationship in behavior analytic treatment and the dimensions of how to improve those relationships (e.g., Baires et al., 2021; Barrera & Kramer, 2019; Blell et al., 2010; LeBlanc et al., 2020; LeBlanc et al., 2021; McLaughlin & Carr, 2005; Rohrer et al., 2021; Tarbox & Rodriguez, 2021; Taylor et al., 2019; Walser & O'Connell, 2021). For example, both Rohrer et al. (2021) and Taylor et al. (2019) discuss approaches that may be likely to establish and enhance therapeutic relationships, including improving these skills to understand the different ways of expressing care and understanding meaning across cultures (e.g., Hurn & Tomlin, 2013; Zoch et al., 2018) and learning to change behaviors to adapt, to "sway," in our interactions across cultures (Lynch & Hanson, 2011).

9.2.3.2 Procedures and Outcomes: Show You Care

Here, the emphasis is on developing methods to systematically include participants and cultural context (e.g., Fawcett, 1991; Fong et al., 2016; Fong et al., 2017; Fong & Tanaka, 2013; Morris & Hollins, 2021; Pritchett et al., 2021; Schwartz & Kelly, 2021). As practitioners, our role is to understand these dimensions and to facilitate the family's voice in the design of interventions. This involves sharing and creating perspective and to do so for people of different cultural groups in equitable ways. That is to say, we should carefully consider the evidence base and to what degree it shows evidence of increased quality of life and of including people of diverse cultures in the research. It also means learning about the family's life and values across many important dimensions in which we humans can vary (Lynch & Hanson, 2011). This includes, but is not limited to, the privileges and oppressions we experience; the degrees of affluence and poverty in our life circumstances; who we rely on, trust, and turn to for help and support; how, what, and when we communicate; how we interact and respond to time; how we respond to hierarchies of power; refugee and/or immigration conditions; family constellations; gender identification; languages spoken; religious and spiritual practices; and trauma related to cultural identity. Time should be dedicated and methods employed to understand the participants' cultural perspective and values along these dimensions and for the interventionist to consider how this contrasts with the research and one's own personal experiences. The family and the interventionist begin the process of perspective taking and making as they integrate the best available research for the child's wellbeing in the present and in the future. Of course, over time, the child becomes a more and more active participant in this process. Behavior analytic evidence-based practice includes the participant context and values, by welcoming and listening to the voices of the participants in selecting goals, determining dependent measures, and producing satisfaction with outcomes that address cultural and quality dimensions of importance (Schwartz & Baer, 1991; Slocum et al., 2014; Wolf, 1978).

9.2.3.3 Structural Oppression and Biased Delivery Systems: Show You Care

Oppressive and biased systems are perhaps the most difficult and overwhelming area to navigate (Broder-Fingert et al., 2020; Cihon & Mattaini, 2019; Levy et al., 2021; Mathur & Rodriguez, 2021). Our interventions require moving beyond molecular analysis and improvements (Ardila Sánchez et al., 2020; Cihon & Kazaoka, 2021; Zarcone et al., 2019). The pandemic and the resulting disruptions of all our societal structures are giving us a chance to hear the voices of many oppressed people (e.g., Hill, 2020; Roy, 2020). In our own field, the pandemic and uprisings highlighted injustice, made difficult discussions with unfamiliar words and concepts more "permissible," and laid the groundwork for a series of articles and social media forums that specifically address socio-political concerns. Vigorous and heated explorations about what we can learn and what we might do during these times have emerged. These dialogues have laid the groundwork for us to specifically address cultural responsiveness at a systemic level. As behavior analysts, we are exploring what we can learn and what we might do during these times. Several authors have suggested how individual behavior analysts and behavior analytic organizations can take action (e.g., Ardila Sánchez et al., 2020; Levy et al., 2021; Mathur & Rodriguez, 2021; Miller et al., 2019). They include learning about the injustices in our own communities; welcoming and creating spaces for diverse voices within our organizational structures; developing communities of practice and strategic organizational plans specifically addressing values, goals, and outcomes related to equity and justice; and encouraging solidarity, because of and in spite of our differences, for the wellbeing of all. The suggested efforts can be studied and considered as we act and learn as individuals, as a discipline, and as our world evolves.

9.3 Conclusion and Onward

As the world undergoes social transformation, we can better our interventions for all children with autism in the context of their cultures, we can create and nurture genuine and caring communities of practice, we can center voices and expressed dreams and life outcomes of the people we serve, and we can learn in those communities with humility. The children and families we serve depend on it. We are doing hard work; there is a large evidence base we should learn and many skills we should master. And still, it is not enough. We have to place what we are doing in the larger context of culture and the human condition. We recognize that, on the one hand, we now know more than ever and can facilitate powerful changes and, on the other hand, they are not always the right changes, nor are they always accessible. That is the liability of our self-fullness. It is also our way forward.

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Part II

Evidence-Based Practices in Autism Intervention

10 Discrete Trial Teaching: Toward a Progressive Model

Justin B. Leaf, Julia L. Ferguson, and Joseph H. Cihon

10.1 Discrete Trial Teaching: Toward a Progressive Model

Discrete trial teaching (DTT) is one of the most commonly implemented behavior analytic techniques for autistics/individuals diagnosed with autism spectrum disorder (ASD; e.g., Lovaas, 1981, 1987). Within DTT an interventionist breaks down complex sills into smaller components and teaches these components one at a time (e.g., Leaf & McEachin, 1999). Therefore, DTT commonly consists of a sequence of several discrete trials to teach new skills. There are three primary components to each discrete tria1: (a) the interventionist providing an instruction, (b) providing the learner an opportunity to respond to the instruction, and (c) the interventionist providing consequence (i.e., reinforcement or punishment) based upon the learners' response. There are additional steps commonly associated with DTT including arranging establishing operations (EO; Keller & Schoenfeld, 1950; Michael, 1988), providing and fading prompts, and manipulating the inter-trial interval.

DTT has been extensively researched and has been demonstrated to be effective for teaching autistics/individuals diagnosed with ASD a variety of skills including, but not limited to, play and social skills (e.g., Nuzzolo-Gomez et al., 2002; Shillingsburg et al., 2014), conversational skills (e.g., Ingvarsson & Hollobaugh, 2010), and question asking (e.g., Ingvarsson & Hollobaugh, 2010). In addition to this research, DTT has been described in numerous curriculum books (e.g., Leaf & McEachin, 1999), commentaries (e.g., Grow & LeBlanc, 2013), book chapters (e.g., Weiss et al., 2017), professional conferences, and webinars. Thus, it is safe to say that DTT is a widely researched, clinically implemented, and disseminated procedure.

Leaf et al. (2016) discussed two general approaches to the implementation of DTT. More specifically, Leaf et al. suggest that the implementation of DTT occurs on a continuum with a conventional approach on one end and a progressive approach on the other. The main difference between a conventional and a progressive approach to DTT is the main source of control for the interventionist's behavior. Within a more conventional approach to DTT, the main source of control for the interventionist's behavior is a protocol that informs the interventionist what to do and when to do it. This could be referred to as rigid adherence to a protocol and requires less, or no, in-the-moment analysis from the interventionist based on the learner's responding. A more progressive approach to DTT differs in that the main source of the interventionist's behavior is

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the learner's behavior and other environmental variables. This has been referred to as a structured, yet flexible, approach (Leaf, Leaf et al., 2016) that requires almost constant in-the-moment analysis from the interventionist. Researchers have demonstrated the effectiveness of both approaches for teaching autistics/individuals diagnosed with ASD a variety of skills. However, some comparative studies have demonstrated the benefits of a progressive approach to DTT such as efficiency, effectiveness, and flexibility (e.g., Garvey et al., 2021; Leaf, Cihon, Townley-Cochran et al., 2016; Wong et al., 2020).

The purpose of this chapter is to describe various components associated with DTT, provide a brief analysis of the research on DTT, provide an analysis of misconceptions often associated with DTT, discuss the evidence base supporting the claim that DTT is an evidence-based practice, and provide suggestions for future research and clinical practice.

10.2 Some Components of DTT

10.2.1 Pre-trial Arrangement

10.2.1.1 Environment

One of the first decisions an interventionist must make is about the environment in which they will implement DTT. This can be viewed as a continuum with a distraction-free environment on one end and a more naturalistic environment on the other. Several variables may contribute to the selection of the environmental arrangement. For instance, a distraction-free environment may be desired for learners without a well-developed attending repertoire. This may lead to better attending, create opportunities to target attending within the DTT format, and result in quicker skill acquisition. Typically, when starting with a distraction-free environment, the interventionist should gradually fade in distractions until the environment resembles the naturalistic/terminal environment (e.g., school classroom). On the other end of the continuum is the more naturalistic environment. Similar to the selection of a distraction-free environment, there are several variables that may contribute to the selection of a more naturalistic environment (i.e., one that more closely resembles the terminal/desired environment). For instance, this environment may be desired for learners for whom attending with distractions is the terminal goal or for learners who have a history of skill acquisition within a more naturalistic environment. Approaching intervention with this environment in mind may help learners learn with distractions in place and resembles how they would learn in school or work settings. This may result in better generalization and maintenance of the targeted skills for the learner. Ultimately, the environmental arrangement selection should not be made a priori *but* should instead be based on the specific needs of each learner (i.e., individualized) and should be assessed frequently for possible changes and needed adaptations.

10.2.1.2 Target Selection

Prior to a block of teaching trials, an interventionist should consider what skills will be targeted within a block of trials as well as what specific skill will be targeted on each trial. Within a more conventional approach to DTT, the target for each trial across a trial block is commonly pre-planned. In other words, the target for each individual trial would be pre-determined and outlined on a protocol/data sheet for the interventionist. This contrasts with a more progressive approach in which the target on each specific trial within a teaching block is not pre-determined. Rather, the interventionist develops a plan for what will be targeted within a teaching block and assesses the learner's behavior within and across trials and adjusts the plan as needed. As a result, an interventionist can place focus on multiple targets within a teaching block or could conduct an entire teaching block dedicated to one target.

There has been limited research directly evaluating and comparing different methods to determine what to target on each trial across a trial block. In one of the few studies directly examining this, Wong et al. (2020) compared three different approaches (i.e., predetermined, constrained, and unconstrained) to the order and number of presentations of target stimuli during a receptive language task with three autistics/individuals diagnosed with ASD. The predetermined condition involved targeting each stimulus three times each across a trial block in a counterbalanced order (i.e., target and nontarget stimuli equally distributed between all positions across a trial block). The constrained condition involved targeting each stimulus a total of three times, but not in a predetermined or counterbalanced order. The unconstrained condition involved assessing participant behavior to determine the order and number of times each stimulus was targeted. Wong et al. found that the unconstrained condition required fewer sessions for the participants to reach the mastery criterion and minimal differences across the conditions with respect to participant responding during teaching and the assessment of maintenance.

Wong et al. (2020) also evaluated the interventionists' rationales within the unconstrained condition. This was done by having the interventionist select or note the reason(s) for the selection of the trial order of target stimuli as well as how many times each stimulus was targeted. Wong et al. found that the interventionists most frequently selected "child's attending behavior during teaching sessions," followed by "current responding during current teaching session/condition" and "correct responding to targets during probes" (p. 554). The results also indicated that the interventionists were likely to select more than one variable that contributed to their decision-making. While more research is needed in this area, it is clear that there are several variables that influence the interventionist's behavior within a progressive approach to DTT.

10.2.1.3 Target Location

Another decision that an interventionist must make prior to DTT is the placement of targets, especially in the case of teaching receptive targets (i.e., listener behavior). One method that has been developed to assist interventionists in addressing the placement of targets is counterbalancing. Counterbalancing ensures that each target and non-target stimulus appears in each position in an array (e.g., left, center, and right) an equal number of times across a trial block (Green 2001; Grow & LeBlanc, 2013). In an effort to ensure this occurs, data sheets are developed with arrays showing the interventionist where to place target and non-target stimuli on every trial within a trial block. Recommendations for counterbalancing can be found within the literature. For example, Grow and LeBlanc (2013) stated, "The instructor should rotate the auditory and/or visual stimuli across trials in a balanced manner" and "when presented horizontally, visual comparisons should be presented and targeted proportionally in the left, middle, and right positions" (p. 64). This greatly differs from selecting target and non-target stimulus location within a progressive approach to DTT in which the interventionist is not directed by a counterbalancing protocol or data sheet. Rather, the interventionist uses clinical judgement that includes assessing the learner's performance in the moment to determine the placement of target and non-target stimulus location. As a result, target and non-target stimuli might be placed equivalently across all locations or may appear in the same location across trials, depending on what is best for the learner on each trial.

While researchers have demonstrated the effectiveness of using counterbalancing (e.g., Grow et al., 2014) as well as in-the-moment assessment of stimulus placement (e.g., Leaf et al., 2018), it was not until recently that researchers began to compare the two approaches. Specifically, Leaf et al. (2018) compared three methods of stimulus rotation when teaching receptive labels with five individuals diagnosed with ASD. The three methods included counterbalancing (as outlined by Grow & LeBlanc, 2013), fixed (i.e., no rotation across trials), and in-the-moment assessment of stimulus placement within a DTT teaching context. The results were idiosyncratic across participants and, sometimes, within each participant. Two of the participants reached the mastery criterion with all three approaches, one participant reached the mastery criterion with the counterbalanced and in-the-moment assessment of stimulus placement approaches, one participant reached the mastery criterion only using a counterbalanced approach, and one participant reached mastery criterion only using an in-the-moment assessment of stimulus placement approach. Taken together, these results suggest interventionists should not default to the use of counterbalancing, or any approach, and should instead constantly assess and select the approach that will be best for each learner and context.

Like all clinical decisions related to DTT, the decision as to where to place target and non-target stimuli should be informed by the analysis of multiple variables. For instance, if a learner displays a pattern of responding indicating a possible *side bias* (e.g., selecting stimuli that appear in the same location across trials), counterbalancing might not be the best approach. If a side bias is occurring and the interventionist is using counterbalancing, the learner may still access reinforcement on a third of all trials for simply selecting any stimulus that appears in one location across all trials. In situations in which the learner has demonstrated learning with the stimuli changing locations on each trial, counterbalancing may be appropriate. This may be especially the case with newer staff as training on in-the-moment assessment of stimulus placement is likely to require more time and effort.

10.2.1.4 Field Size

Another decision that an interventionist must make prior to teaching receptive labels or matching is the size of the comparison array (e.g., 2, 3, 4, or 8 stimuli). Green (2001) suggested that "for most purposes, it is preferable to have at least three comparisons on every trial" (p. 76). However, it is likely that selecting the size of the comparison array should be based on a variety of variables and should not be determined a priori, which would more closely align with a progressive approach to DTT (i.e., learner responding being the main source of control for the interventionist's behavior). This also aligns with the research that has demonstrated the effectiveness of teaching receptive labels using a variety of comparison array sizes (e.g., Gutierrez et al., 2009). Some variables to consider when determining the size of the comparison array may include, but are not limited to, the learner's responses on previous trials, current and past attending, the type of array that may occur in a more naturalistic/the terminal environment (e.g., a larger array for selecting from a vending machine or a smaller array when selecting a writing utensil from a pencil box), and the terminal goals.

10.2.2 Instructions

Following all pre-trial considerations, the first component of DTT is the interventionist providing an instruction. There are two main variables that must be considered with respect to providing instructions: (a) the complexity of the instruction on each trial and (b) variations of instructions across trials.

10.2.2.1 Complexity of Instructions

When providing an instruction on each individual trial, the complexity of the instruction must be considered. For example, should a more complex/natural language instruction be used (e.g., "Where is the red ball?") or should a less complex instruction be used (e.g., "Ball"). Defaulting to a less complex instruction on each trial is common with more conventional approaches to DTT (Green, 2001; Grow & LeBlanc, 2013). For example, Green (2001) stated, "another desirable practice is to limit the auditory stimulus to start each trial to the word to which one of the comparison is to be matched (e.g., 'spoon,' 'fork,' or 'knife') rather than starting each trial with a nominal instruction like 'Touch ________' or 'Point to _______.')" (p. 77). Defaulting to the most complex/natural language instruction that can be used while still ensuring learning and striving toward more natural language instructions is common with more progressive approaches to DTT. As such, it may be the case that for some learners who are just beginning intervention, simple instructions are used initially with the goal to move to more complex/natural language instructions as quickly as possible. For example, Leaf and McEachin (1999) noted that "as the student progresses, instructions should become more complex, and may be more wordy" (p. 133). There are many benefits of moving to more complex/natural language instructions as soon as possible, with the possibility of preparing learners for a more natural learning environment (e.g., school) being the biggest benefit.

Ultimately, the complexity of instructions should be based on an analysis of the learner's responding and overall goals and should not be selected outside of this context (e.g., based on practice recommendations in isolation). For example, if a learner is acquiring targets slowly with the use of complex/natural language instructions, it may be fruitful to probe the use of less complex instructions. It may be the case that less relevant parts of the instruction are interfering with the learning process and less complex instructions could ameliorate that problem. It could also be the case that the learner does not have a well-developed attending repertoire and the length of a complex instruction prevents attending to the relevant parts of the instruction. Alternatively, for learners who have sophisticated verbal repertoires or if sustaining attention or generality is the main goal, then more complex/natural language instructions may be necessary and appropriate.

10.2.2.2 Variety of Instructions

Another consideration related to instructions is the variety of the topography of the instruction across trials. Some have advocated for keeping the topography of the instruction the same from trial to trial (e.g., saying "Touch the [target]" on each trial; Ghezzi, 2007), which is commonly associated with a more conventional approach to DTT. Others have advocated for the interventionist to have the flexibility to vary the instruction when necessary and appropriate (e.g., saying "Touch the [target]" on one trial and "Find the [target]" on another; Leaf & McEachin, 1999), which is commonly associated with a more progressive approach.

When and how to vary instructions requires the interventionist to analyze and respond to a variety of variables. For example, if a learner is responding correctly on several trials with the same instruction, the interventionist may probe a trial with a different instruction. If the learner responds correctly with the varied instruction, the learner may be ready for more varied instructions across trials. Conversely, if the interventionist probes a trial with a varied instruction and learner responding is negatively affected, the learner may not be ready for varied instructions. Varied instructions are also important to consider with respect to programming for generality (Stokes & Baer, 1977). That is, progressing to varied instructions as quickly as learner responding allows is likely to lead to generalized skills and better performance in the terminal environment. It may also be helpful for the interventionist to put themselves in the learner's shoes. Hearing the same instruction across many trials is likely to become monotonous and boring, which may lead to unwanted behavior (e.g., not attending to the instructional materials, property destruction). Varied instructions, on the other hand, may keep the learner more engaged and mitigate any unwanted behavior.

10.2.3 Prompting

Although not a compulsory step of DTT, prompting likely becomes one of the most important components of DTT for many interventionists. Prompting can be defined as any behavior that an interventionist engages in to increase the likelihood the learner will respond correctly (Green, 2001; Grow & LeBlanc, 2013; Krantz & McClannahan, 1998; MacDuff et al., 2001). For the purposes of this chapter, we will distinguish between *prompt types* and *prompt systems*. *Prompt types* refer to the specific prompt used on any discrete trial such as gestural, auditory, positional, partial physical, full physical, or reduction of the field (see MacDuff et al., 2001 for a review). *Prompting systems* refer to frameworks designed to help interventionists know when to provide a prompt, when to fade a prompt, and what prompt type to provide.

There are many prompting systems that have been researched and clinically implemented with autistics/individuals diagnosed with ASD, many of which more closely align with a conventional approach to DTT. Some of these prompting systems (e.g., least-to-most prompting, most-to-least prompting) are based upon providing and fading prompts along a hierarchy. In a *least-to-most prompting* system (e.g., Yanardag et al., 2011), the interventionist first provides an instruction alone without a prompt which gradually increases to more assistive prompt types until the learner engages in the correct response. Researchers have demonstrated that least-to-most prompting can be effective in teaching a variety of skills for autistics/individuals diagnosed with ASD. For example, Yanardag et al. (2011) evaluated the effects of least-to-most prompting in teaching four autistics/children diagnosed with ASD to play tennis. Specifically, Yanardag et al. taught the participants how to do a ball dribble, an air dribble, and a dribble the lines drill. The results demonstrated that least-to-most was effective for all four participants.

The inverse of least-to-most prompting is *most-to-least prompting* (e.g., Libby et al., 2008). Most-to-least prompting starts with the interventionist providing the most-assistive prompt type possible and systematically fading to less-assistive prompt types as the learner responds correctly. Researchers have also demonstrated that most-to-least prompting can be effective in teaching a variety of skills for autistics/individuals diagnosed with ASD. For example, Fentress and Lerman (2012) compared most-to-least prompting system to a no-no prompting to teach matching, receptive instructions, and imitation to four participants diagnosed with ASD. Fentress and Lerman demonstrated that both prompting systems were effective, no-no prompting was more efficient, and most-to-least prompting resulted in fewer errors.

There are three prompting systems based on the passage of time: constant time delay, progressive time delay, and simultaneous prompting. *Constant time delay* involves providing a prompt after two periods of time (e.g., Walker, 2008). Within this system an interventionist starts with providing a prompt with a 0 s delay which is increased to a fixed amount of time (e.g., 5 s) based on leaner responding. A *progressive time delay* involves providing a prompt on a progressive time scale (e.g., Walker, 2008). Like constant time delay, a progressive time delay starts with a 0 s delay which is progressively increased (e.g., 0 s, 1 s, 2 s, 5 s, 10 s) to a terminal duration (e.g., 10 s) based on learner responding. Both constant and progressive time delay systems have been demonstrated to be effective in teaching a wide variety of skills for autistics/individuals diagnosed with ASD. For example, Ault et al. (1988) compared progressive and constant time delay to teach community signs to three students with intellectual disability. The progressive time delay ranged from 1 to 8 s, while the constant time delay was 5 s. Ault et al. utilized a parallel treatment design and found both procedures to be effective.

The third time-based prompting system is *simultaneous prompting*, which involves providing a controlling prompt (i.e., a prompt that guarantees a correct response) with a 0 s delay on every teaching trial. Since all trials involve a controlling prompt, acquisition is assessed on probe trials without a prompt at the beginning of each session. Simultaneous prompting has been used to teach a wide variety of skills including handwashing (Parrott et al., 2000), expressive labeling (Akmanoglu-Uludag & Batu, 2005), leisure skills (Kurt & Tekin-Iftar, 2008), and dressing (Sewell et al., 1998). Akmanoglu-Uludag and Batu (2005), for example, evaluated the effectiveness of simultaneous prompting to teach receptive labeling for three individuals diagnosed with ASD. The controlling prompts were modeling and an auditory prompt. The results demonstrated that simultaneous prompting was effective for all three participants.

A final prompting system commonly associated with more conventional approaches is no-no prompt (sometimes referred to as wrong-wrong prompt; Leaf et al., 2010). No-no prompt involves initiating a trial without the use of a prompt. If the learner responds correctly, the interventionist provides the corresponding consequence (e.g., praise) and moves to the next trial. If the learner responds incorrectly, the interventionist responds with "no" and repeats the trial without the use of a prompt. If the learner responds incorrectly again, the interventionist responds with "no" and repeats the trial again but this time with the use of a prompt. No-no prompting was designed for use within a two-choice discrimination task to create learning opportunities deductive reasoning (e.g., if it [target 1] this then it must be [target 2]) but has been used outside of two-choice discrimination tasks. For example, Leaf et al. (2010) compared no-no prompt to simultaneous prompting to teach receptive labels to three individuals diagnosed with ASD. The results demonstrated that no-no prompt was more effective and efficient within the experimental context for all three learners.

Flexible prompt fading (Leaf, Cihon, Leaf et al., 2016; Leaf et al., 2014; Soluaga et al., 2008) is the prompting system that most closely aligns with a progressive approach to DTT. Flexible prompt fading requires the interventionist to assess the learner's behavior and the context on a moment-by-moment basis to determine if, when, and how to prompt. There are some general guidelines to flexible prompt fading, but it should be noted that these are guidelines, and not rules to be invariably followed. First, interventionists should attempt to keep the learner responding correctly (prompted or unprompted) on about 80% of all trials. Second, if the interventionist identifies conditions under which the learner is likely to respond correctly without a prompt, no prompt should be provided. Third, if the interventionist identifies potential conditions under which the learner is likely to respond incorrectly, a prompt should be provided. Third, the interventionist should strive to use the least-assistive, but still effective, prompt when possible and fade the use of prompts as quickly as possible. Fourth, if the learner is responding incorrectly with a less assistive prompt, a more assistive prompt should be provided. These guidelines can be used to develop tools to assist in the training of interventionists, an example of which can be seen in Fig. 10.1.

Flexible prompt fading has been implemented clinically for decades, dating back to the UCLA Young Autism Project (Leaf, Cihon, Leaf et al., 2016; Lovaas, 1987). Soluaga et al. (2008), however, were the first to specifically evaluate flexible prompt fading in an empirical study. In this study, Soluaga et al. compared flexible prompt fading to a time delay procedure to teach a variety of skills (e.g., sight words/letters, math facts, receptive labels) for five participants diagnosed with ASD. Soluaga et al. found that both prompting systems were effective, but flexible prompt fading resulted in fewer trials for the participants to reach the mastery criterion. Leaf et al. (2014) also evaluated the effectiveness of flexible prompt fading by comparing it to error correction to teach labels of cartoon characters for four participants diagnosed with ASD. Similar to Soluaga et al. (2008), Leaf et al. (2014) found that both systems were effective, but flexible prompt fading was more efficient. Most recently, Cihon et al. (2020) examined the relative effectiveness and efficiency of flexible prompt fading, constant time delay, and most-to-least prompting using a group design (i.e., a randomized clinical trial). A total of 27 participants were randomly assigned to one of three conditions, each correlated with a different prompting system. The results showed no significant differences during post probes across the three prompting systems. The number of sets the participants reached the mastery criterion was also similar across the three prompting systems. However, participants in the flexible prompt fading condition required fewer sessions to reach the mastery criterion, engaged in more independent correct responding, and less prompted incorrect responses.

10.2.4 The Consequence

The final component of DTT is an interventionist delivered consequence. This commonly means providing a reinforcing consequence following correct responses and some form of error correction following incorrect responses. This is consistent across more conventional and progressive approaches to DTT. However, consequences involving the use of edible items are more commonly associated with a conventional approach to DTT (Graff & Karsten, 2012; Kodak et al., 2012). This differs from a more progressive approach to DTT in which the goal is to condition and provide an array of putative reinforcers including tangibles, privileges, social interactions, and the occasional use of edible items (Leaf, Cihon, Leaf et al., 2016; Leaf, Leaf et al., 2016).

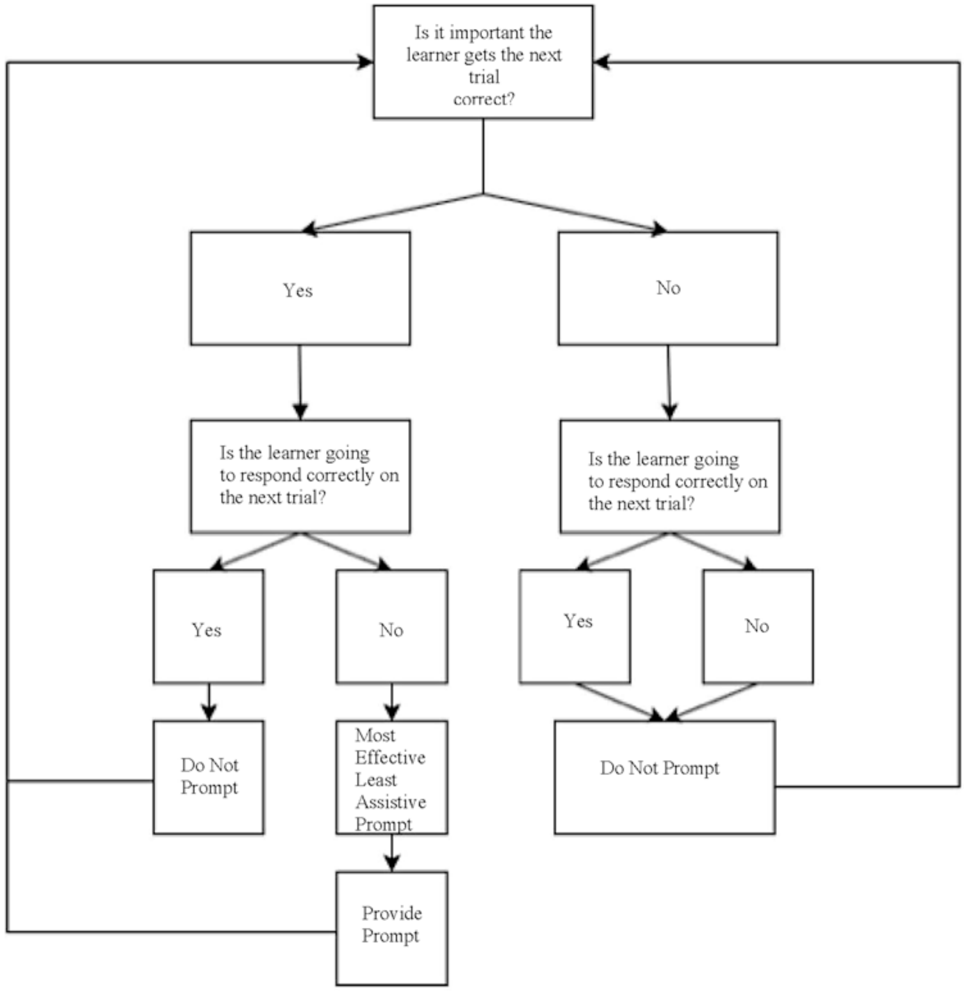

Fig. 10.1 Prompting decision-making tool

Within a more progressive approach to DTT, the interventionist provides reinforcing consequences for behaviors other than the acquisition target (e.g., receptive label, expressive label, matching). For example, reinforcing consequences may be provided for attending or refraining from interfering behavior (e.g., stereotypy). Thus, the amount, quality, and duration of reinforcement might differ from trial to trial. For example, if a learner is exhibiting more effort than on previous trials but is responding incorrectly, the interventionist may still provide a reinforcing consequence.

There are many ways in which error correction may be provided in more conventional and progressive approaches to DTT such as ignoring, providing corrective feedback (e.g., saying "No that is not it"), providing corrective and informative feedback (e.g., saying "No that is not it, it is a ball), and response repetition. Researchers have demonstrated that a variety of error correction procedures are effective for autistics/individuals diagnosed with ASD (Leaf et al., 2010; Leaf et al., 2014; Worsdell et al., 2005). For example, Smith et al. (2006) compared three types of error correction procedures (i.e., saying no to a participant after an incorrect response, modeling the correct response, and extinction) for six participants diagnosed with ASD. Results were idiosyncratic across the six participants, but showed that the error correction procedures were effective. Worsdell et al. (2005) conducted a series of evaluations of the effects of response repetition to teach 11 adults with developmental disabilities sight words. The results indicated that response repetition was effective. More recently, Leaf et al. (2020) compared error correction to errorless learning to teach tacting for 28 individuals diagnosed with ASD. The results demonstrated that both were effective; however, error correction was significantly more effective and resulted in low rates of aberrant behavior.

Although research and clinical practice have demonstrated that error correction is an effective strategy within a DTT context, some have argued against its use (e.g., Burk, 2008; Gast, 2011). Concerns about the use of error correction include error correction resulting in undesired behavior, more errors occurring, and making therapy aversive (Burk, 2008; Gast, 2011). Many of these concerns have limited to no evidence within the empirical literature. As such, interventionists should be cautious of blanket statements about avoiding the use of error correction procedures. Nonetheless, there are several variables that must be considered when using error correction procedures. First, corrective feedback should not be provided in a harsh or excessive tone. However, the corrective feedback must differ from the tone of the instruction and praise. Second, if the corrective feedback is ineffective (i.e., does not result in less incorrect responses and more correct responses), the interventionist should change their strategy. Third, if corrective feedback results in undesired behavior (e.g., emotional responding), then the interventionists should find a different strategy.

Finally, more progressive approaches to DTT commonly include the use of instructive feedback during reinforcing consequences and error correction. Instructive feedback has been defined as "consistently presenting extra, non-target stimuli during the consequent events of instructional trials" (Werts et al., 1995, p. 56). For example, if the targeted response was expressively labeling a picture of a ball, instructive feedback may be "Yes, it is a ball; you can bounce it" or "No, it is a ball; you can throw it." Researchers have shown that instructive feedback can be a useful tool as part of DTT.

For example, Delmolino et al. (2013) evaluated the effects of instructive feedback across two experiments. In the first experiment, instructive feedback was provided in a one-to-one instructional format for four individuals diagnosed with ASD, while the second experiment evaluated the effects of instructive feedback in a group instructional format. The results were mixed. In the first experiment, only one of the four participants acquired the instructive feedback targets, and both participants acquired the instructive targets in the second experiment. In another experiment, Leaf et al. (2017) evaluated the effects of instructive feedback within a group instructional format for nine individuals diagnosed with ASD. Specifically, Leaf and colleagues taught the participants to expressively label sports players or superheroes. As such, the instructive feedback was the team the sports players played for or the superheroes' powers. The results demonstrated that all participants learned the expressive label targets and the instructive feedback targets. Furthermore, the participants acquired the targets from the other participants through observation. More recently, Ferguson et al. (2020) evaluated the effects of instructive feedback using DTT within a dyad format delivered via telehealth for six children diagnosed with ASD. Similar to previous research, the participants learned the skills taught directly and through instructive feedback.

10.2.5 Data Collection

The final component of DTT is the interventionist taking objective data on the leaner's response and/or other pertinent behavior (e.g., attending, emotional responding). There are many types of data collection systems used within conventional and progressive approaches to DTT including trial-by-trial (e.g., Taubman et al., 2013), time sampling (e.g., Repp, Deitz et al., 1976), and probe data (e.g., Repp, Roberts, & Slack, 1976). A more progressive approach makes use of any of these data systems in addition to estimation data (Taubman et al., 2013). Within a more progressive approach to DTT, the interventionist uses whichever data system is necessary to collect data to inform decisions and not disrupt the learning process.

10.3 Misconceptions of DTT

Despite the plethora of evidence on the efficacy of DTT, there are several commonly noted misconceptions about DTT. First, DTT is sometimes considered to be a procedure that is only implemented in a one-to-one instructional format (Lerman et al., 2016). Although DTT is clearly effective in one-to-one instructional formats, research has found it to be effective in dyads (e.g., Ferguson et al., 2020), small groups (e.g., Leaf et al., 2017), and large groups (e.g., Taubman et al., 2001). Furthermore, the implementation of DTT in a group instructional format may offer several benefits such as observational learning, preparing learners for other environments (e.g., school), and assisting with generality.

A second misconception is that DTT and ABA-based intervention are synonymous. Dating back to the UCLA Young Autism Project, DTT has only been *one* teaching approach/procedure that is commonly used as a part of a comprehensive program. Other procedures within ABA-based interventions include, but are not limited to, shaping (e.g., Cihon, Ferguson, Leaf et al., 2019), token systems (e.g., Cihon, Ferguson, Milne et al., 2019), incidental teaching (e.g., McGee & Daly, 2007), the teaching interaction procedure (e.g., Green et al., 2020), and video modeling (e.g., Rudy et al., 2014). Simply put, DTT is not synonymous with ABA.

A third misconception is that DTT is a robotic procedure that only results in robotic-like responding in children (Tobenski Behavior Analysis Services, n.d.). While it is possible that DTT can result in robotic-like responding in children, the problem lies in the implementation of DTT as opposed to DTT itself. If DTT is delivered in a robotic-like fashion and robotic-like responding results in reinforcement, then robotic-like responding will be the result. However, if DTT is implemented in a flexible, naturalistic fashion and robotic-like responding does not result in reinforcement, then robotic-like responding will not be the result. A fourth, and related, misconception is that other procedures (e.g., incidental teaching or mand model) are more natural and effective than DTT (Chicago ABA Therapy, n.d.). While it is possible that DTT can be implemented in less naturalistic ways, not all DTT approaches do so. For instance, a progressive approach to DTT is likely to be viewed as more natural as a result of varied and natural language instructions.

A fifth misconception is that DTT is only useful for young children or for children who are new to intervention (Honsberger, n.d.). This misconception is not supported by the empirical literature that has shown DTT to be effective for a wide variety of learners. That is, research has documented the effectiveness of DTT for a variety of ages (e.g., Kurt 2011), children who are new to intervention (e.g., Lovaas, 1987), children who have had more experience with behavioral intervention (e.g., Ferguson et al., 2020), learners who display lower levels of language (Markham et al., 2020), learners who display higher levels of language (Leaf et al., 2010), learners who display lower levels of cognitive skills (e.g., Ferguson et al., 2020), learners who display higher levels of cognition (Leaf et al., 2013), learners who display lower levels of aberrant behavior (Leaf et al., 2013), and learners who display higher levels of aberrant behavior (Leaf et al., 2010). Essentially, research and clinical practice have clearly demonstrated that DTT is effective for individuals diagnosed with ASD across the spectrum.

10.4 Evidence-Based Practice

The literature base makes it undeniable that DTT is an evidence-based practice. This literature base is composed of studies that have clearly described the participants and independent and dependent measures. Furthermore, this literature based is composed of high-quality research designs with controls in place for threats to external and internal validity. Taken together, the literature base for DTT goes beyond the minimum standards that are commonly used to determine if an intervention should be considered an evidence-based practice (e.g., Hume et al., 2021). It is also worth noting that the components of DTT themselves are comprised of behavioral principles with a plethora of research documenting the conditions under which they result in behavior change. For example, DTT involves the use of reinforcement and punishment, both of which have been demonstrated as resulting in corresponding behavior change across a wide variety of contexts, organisms, and demographics. Research evaluating the effectiveness of DTT has also included evaluations of social validity, which have indicated that DTT is an acceptable approach and consumers have indicated that it results in favorable outcomes (e.g., Jennett et al., 2008).

10.5 Future Directions

Despite the documented effectiveness of and the size of the literature base for DTT, there are several fruitful areas for future work. DTT consists of several components (e.g., prompting systems, complexity of instruction, inter-trial interval), and there can be differences within and across these components within practice and research. Despite this, there has been limited research directly comparing differences within and across these components. While there have been some notable examples of this research (e.g., Aljohani et al., 2021; Garvey et al., 2021; Leaf et al., 2018; Leaf et al., 2020; Leaf, Cihon, Townley-Cochran et al., 2016; Leaf et al., 2014; Leaf et al., 2010; Wong et al., 2020), most of these comparisons have come from the same research group, and more research is needed. Future research should directly compare and manipulate these components of DTT to determine the conditions under which variations in these components are more or less effective. The results from these comparative studies will help practitioners to identify the conditions under which one approach may be more effective for the learners and contexts in which they provide behavioral interventions.

Another area for future research is continuing to compare the use of DTT to other approaches across a variety of skills and contexts (e.g., Jennett et al., 2008). These comparisons could be helpful in informing practitioners what approach may be best for specific goals, clients, and contexts. For instance, it may be possible that DTT is more preferred and effective for some skills in various contexts while other approaches may be more preferred and effective in other contexts. Relatedly, research should continue to evaluate methods to enhance the effectiveness and efficacy of DTT. This research could continue to evaluate the effectiveness of the use of instructive feedback (e.g., Ferguson et al., 2020) and implement DTT within a group setting (e.g., Taubman et al., 2001).

Perhaps the most fruitful and important area for future work is evaluating efficient and effective methods to train individuals to implement a progressive approach to DTT. There have been numerous studies developing and evaluating effective methods to train individuals to implement DTT (see Leaf et al., 2019, for a review); however there are no studies, to date, that have developed and evaluated methods to train individuals to implement a progressive approach to DTT. Given the emerging literature on the effectiveness of a progressive approach to DTT, effective methods to train others in this approach are required. This may be a daunting task for researchers as the progressive approach to DTT requires analysis of many variables, often in-the-moment, and changes in responding based on the outcome of that analysis. Identification of those variables and the effect on interventionists' behavior will be essential in this endeavor.

10.6 Conclusion

DTT has a long history within the field of ABA and autism intervention. Its evidence base is considerable, and its implementation is widespread. Its long history and common implementation have likely contributed to the development of protocols for the ease of implementation by practitioners with little to no training. This is a useful approach when attempting to meet the demand for more practitioners in a short amount of time.

Unfortunately, a potential side effect may be protocols becoming the main source of control for the interventionist's behavior as opposed to the learner's behavior and other relevant contextual variables. More training of interventionists in a progressive approach to DTT may help ameliorate this practice and lead to more interventionists providing meaningful, flexible, effective DTT that lead to meaningful improvements for autistics/individuals diagnosed with ASD.

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11 Incidental Teaching Research: Early Beginnings Through Recent Innovations

Gail G. McGee

11.1 Incidental Teaching Research: Early Beginnings Through Recent Innovations

Incidental teaching (IT) is a systematic protocol of instruction that is implemented in the natural environment where newly acquired skills are needed and helpful to the learner (McGee, 2005). By teaching new responses in the context of naturally occurring environmental stimuli, the probability of generalized and durable learning is enhanced.

What IT is not is random chatter from a friendly teacher. Given the definition of "incidental" in Merriam-Webster's (n.d.) dictionary … "occurring merely by chance or without intention or calculation" …, there is not much that is incidental about IT. Hart and Risley (1980), the original developers of IT, used the term "incidental" teaching to describe what were initially unanticipated side effects of the instructional procedures they were developing to improve children's use of language. Thus, early findings were that IT yielded flexible use of language beyond the confines of the stimulus conditions in which specific vocabulary words had been directly taught. They proposed that " … talking more involves talking in more varied and complex contexts, which inevitably produces the use of more elaborate language" (Hart & Risley, 1980, p. 407). In a nutshell, when teaching is provided in everyday situations, in which the naturally occurring cues are constantly changing, a learner benefits by using their new skills in ways that adapt to future circumstances.

IT procedures were not developed in isolation of other evidence on how children (and adults) learn. To the contrary, IT builds on the "shoulders of giants" in the experimental and applied analysis of behavior (e.g., Baer et al., 1968; Sidman, 1988; Skinner, 1948, 1957). IT is an operant conditioning procedure in which preferred teaching materials are both the discriminative stimuli for a learner's initiations that begin IT episodes and the consequent stimuli for responding to instruction (Ala'i-Rosales et al., 2017). When applied to the most challenging learning goals, such as speech shaping in nonverbal children with autism, IT also incorporates errorless learning procedures that gradually fade discriminative stimuli across temporal or physical dimensions (Halle et al., 1981; Touchette, 1968, 1971). In sum, IT procedures are firmly grounded upon past and accumulating empirical research in behavior analysis. When applied to young children, IT research is also informed by empirical findings from other fields (e.g., developmental psychology, social psychology, early childhood education).

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There are other wonderful "naturalistic" behavioral procedures that "go by several different names" (Schreibman et al., 2015, p. 2417) other than IT, but this chapter will focus on research that specifically uses the term and/or procedural components of IT. More than 50 years of systematic and carefully planned IT research have been conducted by a wide variety of independent investigators who have extended applied behavior analysis in interesting and creative ways. Recurring themes will be the importance of systematic environmental engineering to ensure reinforcer potency, provider preparation, and program replication.

11.2 Original Development of IT Procedures with Neurotypical Children

Betty Hart and Todd Risley initially developed IT as a method to narrow the "meaningful" differences in language development of children from economically disadvantaged versus professional families (Hart & Risley, 1995). Their first conceptualization of IT began by observing Montessori, Head Start, and university-based preschool teachers who had been recommended by parents and other teachers as the best teachers in their respective centers; those "naturally-born super teachers" were observed to discover commonalities in how they interacted with their young students (T. R. Risley, personal communication, November 17, 1988). Their goal was to identify the precise conditions under which children will best learn to use language. This early analysis of successful teaching exchanges led to conclusions that the key components of effective teaching interactions with young children include instruction in natural settings, child initiations, and response-produced reinforcement (Hart & Risley, 1982). These components continue to be considered the essential ingredients of IT, as illustrated in Table 11.1.

It is important to note that IT provides at least a two-step interaction between a child and their teacher (Hart & Rogers-Warren, 1978). In addition to accessing reinforcement for a correct response to the teacher's instruction, the child also accesses reinforcement for having successfully engaged in a social interaction with their teacher. It has been suggested that each IT episode should be brief, although a teacher may add up to two more quick prompts as needed to ensure the child's success (e.g., when a child does not answer the teacher's first prompt to expand their initiation, the teacher may provide an easier clue and then [if still needed] offer gentle physical guidance to "touch the block that you want"). IT episodes should also be interspersed with play to ensure that learning continues to be fun for the child.

Table 11.1 Components of classic IT episode

Setting	Child's verbal or gestural initiation and response	Teacher instruction
Natural environment is arranged to attract a child to desired materials and activities		
	Initiates to the teacher to request or discuss an item/topic of interest	
	Responds to the teacher's guidance by elaborating the original initiation	Assists child in elaborating an initiation by blending prompts for a skill the child needs to learn into the child's interests
		Praises and provides the child access to the desired play material, activity, or information

The first applications of IT were aimed at improving language use by preschoolers who attended Head Start and lived in economically disadvantaged neighborhoods (i.e., Hart & Risley, 1968; Reynolds & Risley, 1968). In a study of children's use of descriptive adjectives

(Hart & Risley, 1968), it was found that the children learned colors in a traditional circle time activity (e.g., the teacher displayed a blue toy car and prompted the children to say, "It's a blue car."); however, the children did not use the newly learned color adjectives during free play later in the day. Hence, limitations of the initial instructional procedures served as the impetus for developing a novel approach to enhance children's use of language. The IT format taught the children color adjectives during their play activities. For example, when a child pointed to a toy fire truck visible on a high shelf, the teacher would ask, "What color is the truck?" If the child responded, "I want the red truck," the teacher praised them and gave them access to the truck. When colors were taught using IT, the children immediately began to use color adjectives in their everyday vocabularies, and they continued to use them after teaching was completed. In the next two studies (i.e., Hart & Risley, 1974, 1975), more complex language was targeted in sequential phases (i.e., noun, then color adjective/noun, then color/noun/how the child planned to use the desired toy). The children in these studies learned the new language as teaching was introduced for each language target, and they generalized their use of compound sentences to use in unprompted situations with new teachers.

An extensive study next compared the language use of three groups of 4-year-old children across an entire school year (Hart & Risley, 1980). Specifically, data were collected on the total number of words per hour that participating children used during free play. Comparison groups included (a) children enrolled in a university-based IT preschool and whose parents were upper-middle-class professionals, (b) children enrolled in an IT Head Start classroom and whose parents were economically disadvantaged, and (c) children enrolled in a traditional (non-IT) Head Start classroom and whose parents were economically disadvantaged. Children in the university preschool had large spontaneous vocabularies at the first of the year, yet both groups of Head Start children rarely used language during free play. As the year progressed, the language levels of children in the IT Head Start class rapidly increased and eventually overlapped with those of children in the university preschool.

Throughout the course of the IT studies, recurring findings were as follows:

1. Toys must be chosen and displayed in ways that create opportunities for IT (Hart & Risley, 1978, 1980).
2. Children played more with toys that were only available through initiation and interactions with teachers, and they played less with toys that were freely available (Hart & Risley, 1974, 1980).
3. IT yielded not only unprompted use of skills that had been directly taught, but children enrolled in IT classrooms also showed impressive improvements in the "spontaneous" or flexible variety of how they used language (Risley, 1972; Hart & Risley, 1968, 1975, 1982).

Especially pertinent to future application of IT as an early autism intervention were childcare "models" developed by Risley and colleagues associated with the University of Kansas Living Environment Groups. Specifically, university-based childcare centers were developed for neurotypical infants (Herbert-Jackson et al., 1977), toddlers, (O'Brien et al., 1979), and preschoolers (Allen & Hart, 1984). Research was conducted to plan how to organize the staff in environments for dependent populations in ways that maximized opportunities for interaction and incidental teaching (Doke & Risley, 1972; Krantz & Risley, 1977; McClannahan & Risley, 1975; Twardosz et al., 1974). Also studied were appropriate nutrition for young children (Herbert-Jackson & Risley, 1977; Twardosz et al., 1975) and how to use differential attention to promote good behavior (Porterfield et al., 1976). A hallmark of the models was that multiple teaching zones were arranged in an overlapping activity schedule (LeLaurin & Risley, 1972). Multi-faceted formats were developed to ensure ongoing program quality (Risley & Favell, 1979), and program evaluation included a Planned Activity Check (PLA-Check) observational system that measured levels of engagement (Cataldo & Risley, 1974).

11.3 Applications of IT with Children with Autism

An interest in the application of IT to individuals with autism arose due to the long-recognized difficulty of establishing functional language in nonverbal children, along with frequently encountered problems that children with autism have in generalizing skills learned in traditional discrete-trial training (DTT) settings to use in everyday life (Lovaas et al., 1973; Stokes & Baer, 1977). In one of the first applications of IT with children with autism, sign word requests were taught to nonverbal children (Carr & Kologinsky, 1983). Results showed better acquisition of signs than had occurred during previous DTT, and there were collateral decreases in the occurrence of challenging behaviors during IT sessions. The students' new skills maintained after IT sessions ended, and the students generalized their use of signs acquired during IT to unprompted situations.

Receptive object labels were taught to three nonverbal children who had been raised in an institution but recently moved to a community-based group home (McGee et al., 1983). The children had been unresponsive to DTT aimed at teaching them the names of common household items (e.g., spoon, plate). However, IT seemed to pose a plausible alternative because the children did appear to be learning the names of items that interested them (e.g., "Please go get the brownies from the kitchen"). Brief interruption of a highly preferred daily routine (making school lunches) was a substitute for unprompted initiations to teachers. Acquisition of labels of lunch-making supplies occurred quickly across sets of items (e.g., relish, baggy, lettuce), and correct identification of the new item labels was generalized to a different activity conducted in the dining room.

There have been several controlled comparisons between IT and DTT procedures when applied to teaching specific skills to children with autism. Two such comparisons were conducted with school-aged children who attended the Princeton Child Development Institute (PCDI), a specialized school for children with autism (McGee et al., 1985, 1986). Prepositions were taught with IT during sessions in which reinforcers were arranged on a bookshelf in varying positions (e.g., on/under, inside/next to) in relation to plastic shoeboxes (McGee et al., 1985). Participants (who had been trained to wait for a teacher's prompt) had to be directly encouraged to "initiate" or say what they wanted. Traditional DTT occurred at a table, and teaching stimuli differed from reinforcers for correct responses. Highly preferred and systematically selected (cf. Shafer et al., 1984) candy and toy reinforcers were used in both conditions. Results showed similar rates of acquisition, but generalization of correct preposition use was far greater for prepositions that had been taught with IT (i.e., post-teaching transfer to a different classroom, with different teachers, under prompted and unprompted conditions, as well as for teaching stimuli arranged in same and novel positions than had been used during initial instruction).

A procedural comparison was also conducted in a study of sight word reading with school-aged children with autism who had been progressing slowly in the well-programmed Edmark Reading Program (McGee et al., 1986). IT was combined with stimulus fading procedures, which began with presentation of one sight word card on which the label of a preferred toy was printed; additional sight word cards were added (or removed) depending on a child's accuracy on the previous IT episode. Both participants showed faster acquisition and retention of sight words learned during IT than during concurrent instruction in DTT sessions, and only the sight words acquired during IT generalized across multiple dimensions (e.g., words printed in different type styles, differing print sizes, and oral reading of newly learned words in a book during both cued and unprompted conditions). These findings suggested IT may prevent over-selectivity, or attention to irrelevant stimulus features, which had been previously reported to interfere with learning by children with autism (Lovaas et al., 1971). Anecdotal observations also confirmed earlier reports that children seemed to enjoy incidental teaching (Hart & Risley, 1974, 1980); specifically, students often returned toys used as teaching and consequent stimuli before their play time ended and then immediately re-initiated for the same toy.

Linne and Melin (1992) compared IT and DTT as methods for teaching children with autism to use phrases containing descriptive adjectives to request preferred toys and foods. Initial instruction took place at school, and maintenance and generalization were later assessed in children's homes. Initial findings favored DTT in terms of efficiency. However, at follow-up, both procedures yielded retention, IT produced better generalization, and IT yielded equal or better use of unprompted language. Conclusions were that children who have formerly been taught with traditional DTT may have to "learn" how to learn from IT, but there may be benefits when they do so. In an examination of ten studies that offered controlled comparisons of DTT and IT (and other naturalistic teaching procedures), conclusions were that more naturalistic instruction was most effective (Delprato, 2001).

IT has also been successfully applied to promoting social skills in inclusive settings. Thus, preschoolers with autism and typical peers were taught how to interact with one another (Brown et al., 1991). In a study aimed at increasing the frequency with which a high-school student with autism (and another student with moderate developmental delays) received social bids, Haring and Breen (1992) established two small group social networks of high-school students without disabilities. The peer networks met weekly to discuss and schedule when (lunch and certain class transition times) and who would make social contacts with the students with disabilities. Results showed that inclusive reciprocal interactions developed among the students and friendship activities extended beyond planned activities at school and even to community outings.

More recently, IT research was conducted in a special education preschool in Istanbul, Turkey (Horasan & Birkan, 2015). Three boys with autism were taught to use verbal demands for help finding hidden objects that were usually present during art, academic, and leisure activities. All the children met initial acquisition criteria, but results varied across children during follow-up and generalization assessments (i.e., one child decreased his use of newly learned mands at follow-up, a second child retained skills at levels achieved during teaching but showed limited generalization, and the third child retained and generalized use of his new skills across materials, places, and people).

11.4 Extensions of IT to Various Target Responses and Populations

In a study of IT of sight word reading with students (who had not been diagnosed with autism), adolescents and young adults with moderate to severe mental retardation were taught to read words printed on tokens that had been earned during earlier DTT sessions (Fabry et al., 1984). The procedure was effective with five of the six participants; conclusions were that IT during periodic token exchange periods (which had previously not been used as instructional time) increased overall learning opportunities provided throughout the day.

One study used a group design to evaluate the use of IT to teach Spanish to eight neurotypical mono-lingual (English-speaking) preschoolers (Valdez-Menchaca & Whitehurst, 1989). The preschool environment was arranged to evoke children's initiations by displaying boxes labelled in Spanish words that matched the preferred toys inside each box. The toy boxes were visible but out of reach of the children, who were taught to request the toys in Spanish. Eight different children participated in a control condition, in which the children requested the out of reach toys in English and the teacher simply labeled the toys in Spanish as they provided them. IT procedures yielded more use of Spanish words both during and following instruction.

In a study of differences between IT and more highly structured programs that served 35 preschool-aged children (i.e., McWilliam et al., 1985), findings were that higher levels of child engagement occurred in the IT programs. Similarly, another study (i.e., Dunst et al., 1986) evaluated 20 preschool programs in Western North Carolina and found a significant positive correlation between the extent to which IT was used and children's levels of engagement with teachers. The quality of engagement displayed by individual preschool children with developmental delays was found to be best predicted by IT, developmental quotient, and levels of peer interactions. However, IT was the strongest predictor of time spent in sophisticated engagement (Casey et al., 2012).

IT procedures have also been extended to adults with disabilities. In an Indiana group home, peer tutors with developmental delays used incidental teaching to increase verbal requests from their peers (Farmer-Dougan, 1994). A package of instructions, prompts, and modelling was used to prepare peer tutors to (a) watch for initiations (reaches for desired items kept out of reach), (b) prompt requests from peer learners, and (c) provide the requested items. New requesting skills were generalized to interactions with other peers and group home staff in situations that varied from the teaching setting. Conclusions were that increased initiations were maintained due to naturally occurring reinforcement contingencies of fulfilled requests and social interactions with peers.

A unique application of incidental teaching was to teach verbal requests to an adult patient with a traumatic brain injury, who presented with severe challenges in generalization of language (Lennox & Brune, 1993). Evaluated in a multiple-baseline design across three settings/activities/locations, the patient quickly mastered verbal requesting skills learned via IT. Within a few sessions, they began to initiate with verbal requests rather than waiting for their requests to be cued.

11.5 Preparing Providers in How to Do IT

An early provider preparation study involved hands-on coaching of institutional staff to provide modified incidental teaching of sign language to four youths with autism and five youths with profound mental retardation; results showed that all participants increased their use of signs and continued to use them at follow-up conducted 5–17 weeks after teaching (Schepis et al., 1982). These lead investigators, highly experienced in personnel preparation research, published an additional IT study that prepared support staff for children with disabilities in inclusive preschools (Schepis et al., 2001).

When Head Start teachers of preschoolers with language delays participated in a large group workshop on IT (Mudd & Wolery, 1987), the teachers learned and later used some steps of IT; however, the workshop did not prepare teachers to use all the steps needed to implement IT effectively. In a second phase, the teachers were provided both verbal and written feedback on their use of IT in the classroom, and the frequency of their complete IT episodes increased markedly. Two IT preparation studies reported positive benefits of brief workshop training; interventionists were able to use IT with group home residents with autism (MacDuff et al., 1988), and teachers' use of some steps of IT led to increased student initiations to their teachers (Ryan et al., 2008). Casey and McWilliam (2008) prepared preschool teachers (i.e., 21 lead and assistant teachers from 10 schools) to use IT with children who had developmental delays. Specifically, provision of graphical feedback on the amount of IT that children received on the previous day was effective in increasing the teachers' use of IT.

The importance of preparing providers in how to arrange IT environments in ways that encourage initiations has also been explored in several studies. Haring et al. (1987) prepared teachers of older students with autism (and students with severe developmental delays) to use four different strategies to evoke the initiations needed to begin incidental teaching. The teachers learned to (a) provide students with opportunities to choose teaching materials, (b) block student access to desired materials and/or events, (c) place desired materials out of student reach, and (d) offer items out of context. Results showed that teachers increased the number of opportunities they provided for their students to use communication skills, although the teachers varied in terms of whether they pre-planned environmental arrangements as had been recommended. The students were interested in the objects and events used to structure IT episodes, and their responsiveness to teachers increased. Another study prepared nursery schoolteachers in Great Britain to use IT by emphasizing the importance of how classroom materials were arranged (Dolley & Whendell, 1987). In a later study, these same investigators (Dolley & Whendell, 1988) first prepared teachers of children from predominantly Punjabi-speaking families in the how-to steps of IT; results showed that children's initiations and the average number of words that children spoke to teachers increased as a function of the teachers' use of IT. In a second phase of this study (Dolley & Whendell, 1988), the teachers received additional preparation in how to arrange classroom environments to elicit children's requests for classroom materials; results showed even further increases in both the number of IT episodes provided and children's initiations to teachers.

Hsieh et al. (2011) prepared caregivers (including a group of home respite worker and two different parents of children with autism and severe developmental delays) in how to do IT during individualized sessions in their homes. All three caregivers were successful in increasing their resident's/children's use of mands; after their preparation was completed, the caregivers were also able to use IT to teach their children new skills. Rittenhouse-Cea and Cho (2018) reported similar results in a recent study in which four instructors were provided specific individualized performance feedback on their use of IT, and both the providers and the children with autism showed acquisition and generalization of targeted skills.

A series of especially timely studies have examined various forms of remote coaching of IT skills. For example, Rosenberg et al. (2020) used a "bug-in-ear" (BIE) device to coach four paraprofessionals (in an inclusive school system) to use IT to teach self-advocacy statements to four students with autism. The paraprofessionals increased the frequency and accuracy of their new IT skills, and all children participating learned to use their individualized self-advocacy statement(s). The paraprofessionals also maintained and generalized their IT skills to new situations, and their students continued to use their self-advocacy statements both when prompted and independently. The paraprofessionals gave positive feedback on a social validity survey (e.g., confidence in their increased abilities to use IT); one noted that the BIE device was initially distracting but said they became used to it over time. The researchers suggested the importance of relationship building prior to preparing classroom providers from a remote location, and they offered helpful tips and future research ideas regarding remote technology.

Neely et al. (2016) carefully evaluated another remote telepractice package designed to prepare various providers to do IT. The package consisted of (a) an online didactic module, (b) self-evaluations of videotaped teacher-child interactions, and (c) delayed feedback via videoconference during which the trainer and trainee discussed their independent videotaped reviews. Trainees were future behavior analysts (one with a B.A. and two undergraduate students who majored in Special Education, Psychology/Sociology, and Community Health, respectively); all were inexperienced in the use of IT procedures. Results showed that the future behavior analysts increased the number of communication opportunities that they provided to children with autism within the context of ongoing routines and activities. The children with autism also increased the frequency of using their new mands as a function of increased communication opportunities.

An extension of the previous methodology was used in a pyramidal approach to preparing interventionists to do incidental teaching (Neely et al., 2018). Two doctoral-level students in Educational Psychology were taught how to do IT, and they were then prepared to coach four additional master's-level or undergraduate students. Each of the six participants, all of whom were previously unfamiliar with IT, was paired with a child with autism who was receiving university-based clinic services to permit evaluation of their IT skills. Both coaches and interventionists acquired IT skills as a function of their provider preparation, and all six children increased their use of mands when their providers implemented IT. Another replication of this approach was accomplished by first preparing a bilingual coach in Japan, who then taught three interventionists how to use IT to effectively increase use of mands by three students with autism (Neely et al., 2020). Responses to a social validity survey were highly positive, despite some comments pertaining to the technology and the challenge of scheduling feedback sessions across widely different international time zones.

Comments on the IT literature reviewed above will be presented in Conclusions at the end of this chapter. The research presented next will describe the use of IT as a comprehensive approach to early autism intervention.

11.6 Comprehensive Application of IT: All Behavioral Intervention and Instruction Provided Exclusively in IT Formats

In 1985, Walden opened as a lab school at the University of Massachusetts-Amherst with the goal of advancing IT research in a manner that promotes broad positive change in children's developmental trajectories. It seemed like serendipitous timing to launch a research program that combined (a) the generalization benefits of IT, (b) the benefits of beginning intervention when children with autism were as young as possible (cf. Lovaas, 1987), and (c) the benefits of social learning opportunities afforded by inclusion of young children with autism among a majority of typically developing peers (cf. Odom et al., 1985).

Walden began and continues as a systematic replication of the previously described model programs created by Todd Risley (and the Living Environment Group at the University of Kansas). With inclusion, there comes an obligation to provide typical peers an enjoyable and enriched early childhood education, and the Kansas models offered considerable evidence that IT classrooms met that need (Doke & Risley, 1972; LeLaurin & Risley, 1972; Twardosz et al., 1974). Detailed manuals were available to describe how to arrange the furniture, toys, activities, and teachers so that IT can take place continually throughout the day, including during routine childcare activities (Allen & Hart, 1984; Herbert-Jackson et al., 1977; O'Brien et al., 1979).

11.6.1 Description of the Walden Classroom

To provide an abundance of teachable moments, traditional early childhood activities (e.g., free-play, snack, art, outdoor recess) are scheduled in multiple teaching *zones*. Teaching zones are defined by the activity and physical area of the classroom, which are opened in overlapping time sequences to provide children with a choice of three to four activities throughout most of the day. A schedule of overlapping zones minimizes the occurrence of inpatient behaviors that young children sometimes display during large group transitions. Thus, a child may join a small group tabletop game whenever space becomes available, and they may leave when they ask to go to a different activity. At Walden, no matter what time of day or where the child goes, there has been advanced planning to ensure the classroom environment provides opportunities for each child to learn what they need to know and a cheerful and energetic teacher is available to make learning easy and fun.

To make it possible for children to have a variety of activity choices, zone teachers must adhere strictly to detailed teaching routines. A classroom schedule (posted prominently on the wall) alerts teachers to which activity zone for which they are responsible, and every zone teacher is prepared to mastery on each zone routine to which they are assigned. Virtually all Walden staff preparation consists of hands-on coaching using zone checklists, which are task analyses of how a teacher needs to interface between a child and the zone environment in a manner that ensures child engagement and IT.

Space is arranged so that a lead teacher can constantly oversee the safety of every child, as well as provide ongoing assistance and feedback to teachers. The lead teacher also acts as the classroom conductor by facilitating children's transitions across zones (e.g., eliciting a verbal request from a child who wishes to move across zones or marketing an open activity zone to prevent overcrowding in other areas).

Walden has been visited by many behavioral colleagues, and (especially during the early years) our visitors were often shocked by the lack of pristine and distraction-free learning conditions that are standard in many behavioral programs for children with autism. Rather, on the surface, Walden appears to operate more like a three- or four-ring circus. All children move about as they please, amid the hustle and bustle of ever-changing distractions that are normally present in the real world. To paraphrase Alice in Wonderland, "Everything was not as it should be" … but we propose … "everything was as it could be."

11.6.2 Programmatic Adaptations of Kansas Models

Walden did, however, become more organized and systematically planned over the years as several adaptations in the Kansas models were made to better meet the needs of children with autism. Thus, several brief (i.e., 15 min), one-to-one (1:1) IT sessions were added to teach children with autism the language and social skills that are difficult to blend into everyday classroom activities (e.g., speech shaping, pronoun reversals). In addition, overall classroom goals and individualized objectives for children with autism are embedded into zones in which the environment best supports instruction of various skills. Cue cards are posted in zones to remind busy teachers of the content of both classwide goals and individualized objectives (see example in Table 11.2).

Table 11.2 Snack zone cue card posted on wall facing teacher

Snack goal: requests	Child
Contingent vocalizations	RS
1 – Word	BP JG
3 words	AK SI TD
Complete sentence w/ please	Everyone else

Research on Reinforcer Potency to Empower Learning Systematic assessment of reinforcer potency is essential when using IT with children with autism because (this bears repeating) a key procedural variable is that children's interests serve as the teaching materials as well as the reinforcers for correct responses to teaching prompts. One of the first studies conducted at Walden was conceptualized as a message piece, "reinforcement works" … [but] … "carefully selected reinforcement works best" (Mason et al., 1989, p. 179). Conditions were compared in which teachers of three children with autism selected the items to be used as reinforcers for correct responding during 1:1 sessions (Mason et al., 1989). Baseline consisted of a Teacher Selection condition, in which experienced teachers were asked to identify what toys a child liked the most. During a Child Selection condition, a package combined systematic assessment of the children's preferred sensory stimuli (adapted from Pace et al., 1985) with a "mini-assessment" conducted immediately prior to each teaching session; the child selected a desired toy from a basket of toys that featured their preferred sensory qualities (e.g., auditory, gustatory, olfactory, tactile, thermal, vestibular, and/or visual). Not only did the systematic assessment of toys used in the Child Selection condition increase correct responding, but the package also virtually eliminated off-task behavior and an array of maladaptive behaviors (e.g., eye-poking, waving arms in the air) during teaching sessions. The sensory preference assessment is now conducted monthly at Walden with every child with autism until they reach nearly normal levels of engagement and expressive verbal language and have neither behavioral nor learning difficulties. Information on children's sensory preferences, which change and usually expand across time in treatment, are then incorporated into classroom materials and used in 1:1 IT sessions.

Environmental Engineering of the Free-Play Area The most challenging zone to manage is free-play, where the teacher must continuously circulate among children with wide-ranging abilities and interests. Specifically, the free-play teacher preparation checklist requires at least 13 contacts with individual children within a 5 min period, during which the teacher (a) praises toy engagement, (b) comments about play activities, and (c) provides five IT opportunities (at least three of which secure successful responses). A set of practical procedures were developed to ensure that the classroom environment contains play materials that evoke children's interests, initiations, and interactions.

First, *hobby boxes* were created to make it easier to keep children with autism productively engaged with toys (McGee, Daly et al., 1991). Five toys are selected according to the Premack principle (i.e., toys that a child is observed to play with for relatively sustained amounts of time) and stored in small baskets on teacher-height shelves. Children can see, but not access, their individual hobby box until they gesture or verbally request it from a teacher. Neurotypical children eventually asked to have their own hobby boxes, and their requests were easily accommodated by a less systematic practice of holding a bi-weekly school store in which individual toys are picked from an array of choices (e.g., small boxes of crayons, party favors).

A *toy rotation* system was also developed to ensure the novelty of toys that are freely available on toy display shelves. Toy rotation sets of ten toys were put together in such a way that included "something for everyone." That is, toys that provide opportunities to teach vocabulary associated with weekly "themes of the week," toys that match the play skills of children at different developmental levels, toys that feature various preferred sensory stimuli, toys of an array of sizes, and a limited number of toys that are composed of many small pieces (i.e., to prevent teachers from having to constantly clean rather than teach). At any given time, two rotation sets of 10 manipulative toys (i.e., a total of 20 toys) are on display in the classroom (see Table 11.3 for an example).

Table 11.3 Toy rotations that support IT of animal or vehicle vocabulary

Toy rotation set 1	Toy rotation set 2
Farm play set w/ barn and tractor	Jungle animals train and tracks
Farm animals that make noises	Pop up pets
Farm animal puppets	Dress me teddy bear
Llama jack-in-the-box	Fire truck dressing frame
Rubber wagon	Pull cart w/ colorful alphabet blocks
Pound a ball car ramps	Vehicle puzzle
Numbers block train	Push/go cars
Smooth/sanded wood latches board	Bristle blocks
Kaleidoscope	Dimple sensory toy
Scented Coco doll	Xylophone
CAT Tough Truck (plastic)	Wooden Train Toy Set
FP Farm Set	Flashing Word Computer Toy

Fifteen children (i.e., eight neurotypical peers and seven children with autism) participated in a formal study evaluating environmental engineering in the free-play zone (i.e., McGee & Daly, 1999). Dependent variables were children's initiations to teachers and both positive peer interactions (e.g., sharing, cooperative play, interactive play) and negative peer-related behaviors (e.g., tattling, sharing disputes, sad/angry facial affect, and verbal or physical hostility). Certain play materials remained available in the free-play zone throughout all conditions (i.e., a cozy book area, housekeeping area, and large blocks). Three strategies for selecting free-play toys were compared using an ABCBC single-subject design. In Condition A (Systematic Toy Selection), hobby boxes were on teacher-height shelves, and two toy rotation sets were rotated weekly to provide 20 toys that were freely available on child-size shelves (e.g., toys from set 1 and set 2 were on display on toy shelves for a week, at which time the set 1 toys were returned into storage, set 2 toys remained in free-play, and set 3 toys were introduced to the classroom). Condition B (Enhanced Toy Selection) was identical to Condition A, except that toy rotations occurred twice weekly (i.e., Wednesday and Friday mornings). In Condition C (Conventional Toy Selection), toys were selected based on input from 20 experienced teachers who worked at accredited preschools in the community, and all hobby box toys were added to the child-size shelves in free-play. Children's initiations to teachers were high in both Systematic and Enhanced Toy Selection conditions compared to relatively low levels of child initiations during the Conventional Toy Selection conditions. Conversely, negative peer-related behaviors were substantially lower during Systematic and Enhanced Toy Selection conditions compared to Conventional conditions. Positive peer interactions were substantially higher during the biweekly Enhanced Toy Selection conditions than in either the Systematic or Conventional conditions. Identical results were found when a group design was used to compare the statistical significance of differences in the three conditions (Morrier et al., 2009).

The toy rotation system takes time to initially sort classroom toys into approximately 12 toy rotation sets, which are stored in plastic tubs. All toys, tubs, and hobby boxes are labeled w/ indelible ink to make it easy to maintain the system. Once established, teachers need not be specially prepared to arrange the environment in creative ways, and children are guaranteed a continual choice of toys that seem new and interesting. In short, the environmental arrangements in Walden's classrooms have been systematically planned to support teachers with ready opportunities to teach the skills that children need to learn (as described in Table 11.4).

Table 11.4 IT of farm animal labels in free-play

Materials: The classroom theme of the week is farm animals, and a cue card is posted in free-play to remind teachers that the week's objective for Dan is to learn easy animal labels (i.e., cow, chicken, and pig).	
Activity: Dan is playing with a toy barn with tractor and farmer. The teacher grabs a basket of noise-making farm animals from the toy display shelf; they approach Dan by bending down and lowering the basket so Dan can see the animals, and wait:	
IT:	
Dan points to the cow.	Teacher pulls a cow out of the basket and asks, "Which animal is this?"
Dan says, "Moo!"	Teacher says, "Cows say moo. Do you want a cow?"
Dan says, "Want cow."	Teacher cheers, "Terrific! Here's your cow!"
Teacher circulates among other children to briefly praise or comment on their play and then returns to Dan. Teacher stoops down to where Dan is playing, pulls out another cow, and waits for him to initiate:	

Preparing Parents of Children with Autism to Do IT Another adaptation was needed to address the needs of parents of children with autism. Although the exact format changed across the years, the most intensive preparation of parents of children with autism occurs weekly during the first year of a child's enrollment. Parents and other family members are provided with a wide range of options from which to choose. Specifically, they are introduced to a menu of 50 modules that address (a) language (e.g., during meals, bath time, outdoor play), (b) social skills (e.g., games with siblings, how to host a play date), (c) daily living skills, and (d) other family issues (e.g., grandparents, balancing personal versus parenting time, keeping a child with autism engaged while helping a sibling with homework). This array of options ensures that families are helped to address the issues that are individually valued and likely to make a difference in the context of their family's needs. Table 11.5 provides an example of how a parent may blend IT into one of their family's everyday home activities.

There is empirical support for ensuring that goals are individually selected by the family and that developmental progress occurs for the child in this format. Evaluation of an early version of the parent program (i.e., McGee, Jacobs et al., 1993) found that children progressed an average of 1.6 months on the Vineland for each of 9 months in which parents participated. Analyses of videotapes of the children during regular family activities revealed that children made the most progress in skills that their parents had selected to teach at home rather than in skills that parents did not choose.

Table 11.5 IT of action words while viewing home movie

Materials: Because Sue is fascinated by Star Wars movies on DVD, the remote control has become a powerful teaching tool.	
Activity: Dad decides in advance what action words he wants Sue to practice (ideally there will be multiple examples of the same action). Dad lets Sue watch and get interested in the movie, and he comments occasionally about what the characters are doing. When there is a clear-cut action, Dad uses the remote to pause the movie.	
IT:	
Sue says, "Turn on the movie."	Dad asks a question that requires an action word in the answer ("What is Luke Skywalker doing?").
Sue: "Luke is jumping."	Dad responds, "Correct! Let's see what happens after Luke jumps." He quickly resumes the movie.

IT of Conversational Language at Walden Expressive verbal speech shaping begins a month after entry to Walden by teaching a nonverbal child to use discrete sounds (to mean "I want anything"). The next targets are word approximations and discriminations among ten desired items (i.e., nouns beginning with different developmentally early consonants). Experience suggests that any child who learns at least ten discriminated words will continue to expand their language. A developmentally sensitive sequence of IT language objectives has been established to continue language elaborations by adding descriptors, action words, etc. until the child's vocabulary is diverse enough to directly target a variety of conversational skills.

Children with autism need social language to interact in age-appropriate ways with their neurotypical peers; however, teaching children with autism to use conversational language is far more complicated than teaching functional language. The first step is to identify colloquial phrases that are commonly used by neurotypical preschoolers. We ensured the external validity of target phrases by surveying the opinions of 15 teachers in other community preschools to determine what cute or funny phrases their children often said (McGee & Daly, 2007). The top two answers were "All right." and "You know what?" Teaching children with autism, who at the time had mild to moderate language delays, to comment was an anticipated challenge; teaching them to solicit social attention was an even bigger challenge. IT took place during a small group tabletop activity attended by typical peers (McGee & Daly, 2007). Systematic fading procedures were used to transfer stimulus control from use of the phrases as mands to use of the phrases as comments and queries in everyday social situations (i.e., most-to-least prompting was introduced across five phases). By the final phase, the teacher used no verbal prompts, and the children had access to their preferred toys. A multiple baseline across three children with autism showed that all children acquired appropriate use of the targeted social phrases during teaching sessions, and they maintained use of the phrases during unprompted conditions at the table and with the same teacher during free-play. Two of the three boys used the phrases with a free-play teacher who was uninformed about the study. Fidelity of procedural implementation was assessed throughout all conditions via verbatim transcription of videotaped sessions, and children's use of target phrases was removed from the data when few inadvertent prompting errors occurred (primarily when the uninformed teacher used a target phrase). The child with the mildest language delay showed the most flexible use of the target phrases ("All right everybody, it's time to go." or "Know what I have?"), but all three boys continued to use the phrases in varied situations (including at home for at least 6 months, according to parent report about two of the boys). Walden now targets one "child-culture" phrase or gesture per week during lunch, during which all children are encouraged to practice and laugh at one another while building behavioral momentum (e.g., "Why did the chicken cross the road?" All funny answers accepted).

From the outset, IT proved to be powerful in teaching children with autism to talk (McGee et al., 2001). At the time the first 34 children with autism entered Walden, 20 (59%) were completely nonverbal, 13 (38%) had random echolalia (1-word syllables that were usually spoken out of context), and one child used three functional words (they had participated in a pilot IT program). By the time these children graduated 18 months later, four (12%) remained nonverbal (although they had learned between one and three words or word approximations), 18 (41%) had functional verbal language (defined as more than 10 unprompted meaningful words, with a range of mild to moderate speech delays), and 12 (35%) were using functional verbal language throughout the preschool day within the ranges of the amount of time that their neurotypical peers spent talking.

Pack the Day with Social Intervention A descriptive study of how children with autism spent their time at Walden (i.e., McGee, Paradis et al., 1993) found significantly lower levels of "autistic behavior" (e.g., repetitive body movements or motions with objects that serve no apparent play function) when children with autism were within 3 ft. of a neurotypical child as compared to when they were alone or near other children with autism. These results were translated to everyday practice at Walden by routinely ensuring that a child with autism sits next to a neurotypical peer at tabletop activities such as snack or art. Popular toys (e.g., a marble maze toy that requires turn-taking) are also used to attract children with autism to play close to neurotypical peers.

Unfortunately, reduced self-stimulatory behavior was the only "free effect" of inclusion discovered at Walden. Rather, the potential benefits of inclusion with neurotypical peers required a great deal of carefully planned social intervention along with lots of practice. Although the children with autism had done well during peer interaction sessions during which they were directly prompted, we were disappointed in early results from our videotaped database that tracked children's social interactions throughout the day. When Walden relocated to Emory University in Atlanta in 1992, the social intervention curriculum was enriched by targeting peer-related social objectives during approximately half of the preschool day. We also changed the ratio of neurotypical peers to children with autism from a bare majority to two neurotypical peers for every child with autism. More neurotypical peers provide the children with autism with additional models of age-appropriate social behavior, ensure a larger pool of enthusiastic peer tutors, and preserve an "early childhood" atmosphere in the classroom (i.e., neurotypical peers are more likely to stay home when a grandparent visits or the family takes a long vacation, while parents of children with autism tend to be more diligent about their children's attendance in intervention). All children (with and without autism) attend large group social interaction games and peer imitation exercise sessions during a 15 min period of recess (Morrier & Ziegler, 2018), and each child with autism is invited to participate with two neurotypical peers in a 15 min dramatic play session (e.g., acting out a camping trip, flying in a space shuttle; modified from Odom & Strain, 1986). Two small group social sensory games are also offered every day (see Table 11.6 for an example).

By the age of three, each child with autism also attends at least one daily peer incidental session with a neurotypical peer. The peer tutor's adult coach provides the peer tutor with a basket of their buddy's toys and uses a simple checklist to teach steps of IT (i.e., hold up a toy and wait to see if your buddy wants it, ask "What do you want?", and give them the toy when they ask for it). Adult coaching and physical presence are withdrawn gradually. In a formal study of peer IT (McGee et al., 1992), a multiple baseline across three dyads of peer tutors and their buddies with autism showed quick increases in reciprocal interactions as a function of preparing the peer tutors. Peer interactions continued in the absence of direct coaching and transferred to lunch in a different part of the classroom. Also, neurotypical peers rated their buddies with autism as "more likeable" on a Likert-type rating scale.

Table 11.6 IT of peer proximity at social sensory games

Materials: Wooden rocking boat w/ space for 4 children to sit packed closely together. Boat is located near light switch on wall, and teacher has a cup of water.	
Activity: Teacher leads a dramatic pretend game about a boat in a storm, which provides sensory stimuli for children who like auditory, tactile, vestibular, and visual stimuli (and/or a fun game). Two children with autism are invited to ride in the "boat storm," along with the first two neurotypical peers to arrive.	
IT:	
	Teacher rocks boat vigorously while announcing a big storm is coming. Rain drops are sprinkled from the cup onto the boaters, lightning flashes as light switch is flipped, and teacher makes thunder noises.
All children laugh.	Teacher falls on floor, kicking feet, and roars like a pretend shark.
All children squeal.	Teacher asks children to take turns if new children have arrived or provides choice of rocking through another incoming storm.

Table 11.7 IT of handwriting in 1:1 session

Materials: Large Barbie house; small table nearby holds an easily grasped pencil and paper available for child to write the word wolf or pig. Handwriting task is kept as easy as possible by providing words to trace, or dot-to-dots of the words, and eventually a blank paper.	
Activity: Teacher pre-teaches child in steps of Three Little Pigs game. 1. Pig hides behind house. 2. Wolf knocks on door and says, "Little Pig, Little Pig, let me come in." 3. Pig says, "Not by the hair of my chinny chin, chin." 4. Wolf growls, "Then I'll huff, and I'll puff, and I'll blow your house down." Wolf then shakes the house. 5. Pig runs away squealing and laughing as Wolf chases him. After coaching the game, the teacher prepares to do IT of handwriting.	
IT:	
Child with autism asks to play the game.	Teacher asks, "Do you want to be a wolf or a pig?"; they show child where to write the word wolf or pig.
Child writes the word for the role they want to play (i.e., wolf or pig).	Teacher says, "Yay, you wrote wolf, so I'll be the pig." Game proceeds with lots of laughter.

A pre-kindergarten classroom was added a few years after the program moved to Atlanta, because children with and without autism need to learn the conventional classroom behaviors that ensure success in kindergarten. Across the last year at Walden, children are gradually taught to wait in a line to go to the playground, to raise hands before answering questions at story, and to cooperate during large group activities. Independent social interactions and academic readiness are also strongly emphasized in the pre-K (see Table 11.7 for an example of how IT may be used to teach kindergarten readiness skills).

Enrichment of the social intervention curriculum produced the desired social gains (i.e., increases in the amount of time that neurotypical peers gave unprompted social bids to the children with autism and vice versa) (McGee et al., 2001). Of the first 33 children with autism who graduated from Walden (one was lost to follow-up due to re-location), 26 (79%) were fully included in regular kindergarten classrooms (with varying levels of support, but most often with little or no support). By 2014, our program evaluation data recorded that 92% of Walden graduates with autism were successfully included in regular kindergartens (McGee et al., 2020).

Everything Works Better When You Begin IT with Toddlers In 1994, Walden opened the first inclusive toddler center in Atlanta. The initial goal for toddlers with autism is addressed during the first month of entry. Each child with autism is taught to orient toward (and not avoid) teachers by pairing teacher approach with quick delivery of a preferred and consumable piece of food or sensory stimulus (e.g., flickering light). When the child begins to look at a desired item in the teacher's hand, on successive approaches the teacher gradually raises the item toward their eyes. This procedure, which has been tested in pilot research and practice, almost always stabilizes engagement at higher levels than children presented with at entry, and some children develop eye contact with teachers. If a child's eye contact remains inconsistent after the orienting procedure, then another pilot-tested procedure blends IT with time delay in a 1:1 session (i.e., it is easier to precisely time prompt fading adjustments during 1:1 sessions than during group activities). When a child looks at and initiates for a desired toy, the teacher raises the toy to their eye level, and the child tracks the toy upward toward the teacher's eyes. On subsequent IT episodes, the amount of time between the child's initiation and the tracking prompt increases (in 1-sec increments) until the child eventually looks at the teacher when initiating for the toy (i.e., stimulus control of eye contact transfers from the toy to initiations to the teacher). An advantage of these approaches to establishing eye contact is that artificial prompts (i.e., "look at me" or manipulation of a child's chin) are unnecessary.

Daily living skills are taught at the same ages that neurotypical children usually learn them, and an abundant ABA literature supports this goal (e.g., toilet training procedures were modified slightly to remove overcorrection, so that bladder control conditioning usually takes approximately a week at Walden [Azrin, & Foxx, 1971; Azrin & Foxx, 1981]). Daily living skills such as handwashing are task analyzed and taught with backward chaining; the process is transformed into an IT format by teaching at times when children are eager to get to a highly desired activity (e.g., children must change from classroom slippers into shoes to go to the playground, and they get outside most quickly when they become independent). The Kansas Toddler Center provided an "Ask-Say-Do" faded guidance procedure to teach independence to neurotypical toddlers, and Walden modified the procedure to add an opportunity for independence and a gestural prompt (i.e., "Wait, Ask, Say, Show, Do" or WASSD).

The major adaptation of Walden Preschool for toddlers is in teaching peer-related social goals, because typical peers are not fully competent interaction partners until approximately 3 years of age. Our youngest children with autism are taught to tolerate proximity to peers, to play in the same or similar activity as peers, to watch other children, and to imitate the gestures of other children.

Progress of the first 28 children with autism who entered the first Toddler Model was evaluated through an analysis of Walden's videotaped database that randomly sampled time segments throughout the day (McGee et al.,1999). At entry, the amount of time that children with autism were talking was 35% of the day (including echolalia and perseverative speech). After 6–12 months in the toddler center, 82% of the children with autism were verbalizing meaningful words (functional expressive language). By the time of graduation to preschool, 96% of the children with autism spent their time in close physical proximity to typical peers. A decade later, improvements in the age at which autism can be diagnosed and greater space availability made it possible for Walden to open a new younger toddler classroom (and the first toddler program became the "Early Preschool").

11.6.3 Summary of Program Replications of Walden's IT Model

University-based lab schools are almost a thing of the past, but they offer certain advantages such as (a) capacity for conducting comprehensive intervention research, (b) opportunities for preparation of large numbers of young professionals, and (c) the potential to achieve widespread community impact via program replications (McGee et al., 2020). It was described above how internal Walden replications were used to develop a continuum of four IT classrooms, which have served 821 children (including 270 children with autism and 551 neurotypical peers). The hour intensity has varied across time, but 35 hours per week (plus daycare and home intervention) are now provided across 12 months per year, up to 4 years. The biggest change in outcomes for children with autism has been accomplished by lowering the age of entry into intervention (children with autism were an average of 44 months of age in the first preschool at UMass, they were an average of 29 months when the first toddler program opened at Emory, and the newest toddler program accepts children as young as 12 months (and walking). In sum, Walden provides a very hour-intensive IT intervention that emphasizes engagement in language and social interactions.

Replications of Walden's IT model have been established in external programs located in eight states across the USA, and week-long IT speech shaping (and provider preparation) clinics have served children from five continents. One of the first external replications of Walden's toddler model classroom was accomplished by researchers at Children's Hospital in San Diego, California, who wished to get their own "lab school" open quickly to accommodate their research programs. This program mixed IT with other naturalistic interventions and traditional behavioral interventions, and they reported similar outcomes to those of the children at Walden (Akshoomoff et al., 2010; Stahmer & Ingersoll, 2004). The longest continuously operating external replication (19 years) is a full Walden replication in North Dallas, Texas. Two years ago, this program added a classroom for infants at risk for autism and neurotypical peers.

11.7 Conclusions

A definite strength of the IT studies reviewed above is in the collective demonstration that IT yields positive benefits for many dependent populations, of wide-ranging ages, and when applied via diverse groups of providers. Thus, there are repeated findings that IT is effective in teaching a large variety of skills that maintain after instruction has ended, and most learners show generalization to use of new skills in situations (i.e., people and settings) that were not associated with initial IT. The literature reviewed also repeatedly reported beneficial side effects of IT that directly address learning challenges associated with autism (e.g., decreased behavioral difficulties, less social avoidance, reduced prompt dependency). Moreover, there were numerous observations that both children with autism and neurotypical children seemed to enjoy IT.

Especially heartening is the renewed focus on how to prepare personnel to do IT. We previously conducted a review of approximately 100 studies in which behavioral researchers prepared providers to either implement various ABA interventions or to simply do their jobs better (McGee & Morrier, 2005). Many were large-scale efforts aimed at improving the quality of life for beneficiaries of the providers, while others addressed motivational systems that improve and maintain provider performance (cf. Greene et al., 1978; Iwata et al., 1976). Most studies (including those reviewed earlier and those reported in this review) have found that some form of behavior-specific performance feedback system is essential to obtaining lasting positive change in provider behavior.

Many of these IT provider preparation studies were impressive in their attention to current essential features of ABA single-subject research methodology (e.g., specifying dependent variables for both providers and their beneficiaries, measuring fidelity of implementation and social validity). Various strategies for provider preparation yield repeated findings that providers increase their use of IT, and increased IT by providers yields concurrent increases in the frequency with which learners initiate and respond to their providers.

The remote telehealth technologies are not only timely during the age of learning to work from home, but these studies clearly offer the potential to prepare increased numbers of providers to serve children who live in geographic regions that do not have access to specialized autism interventions. It may be useful to know whether these technologies are best applied to certain skills, while other skills might be better prepared via hands-on coaching and/or a combination of remote and live performance feedback.

Based on my experience in training dozens of college students to do IT, I suggest that incidental teachers will do best if you first have a conversation with them about their big picture to determine how your preparation may be relevant to their interests. Whenever possible, assign them to a teaching routine that blends with their interests (e.g., a college student athlete may be most enthusiastic about designing fun outdoor running games, while an aspiring author of children's books might enjoy developing a checklist that prepares other teachers to be great story readers). When you are preparing an experienced behavior analyst who is accustomed to DTT, advise them to be patient because the timing of "waiting" for a learner's initiation may initially seem uncomfortable. Assure them that all their good ABA skills will kick back in and be useful once they have mastered a new prompting sequence.

11.7.1 Suggestions for Future Research in Early Autism Intervention

Having already suggested potential research directions in preparing IT providers, we turn now to suggestions for research that may advance early autism intervention. There are large literatures on developmental milestones for young neurotypical children and on the characteristic differences presented by young children with autism; however, the body of intervention research that addresses the social irregularities of the very youngest toddlers with autism is relatively sparce. It may also be useful to examine systematic ways in which to shape babbling into discrete sounds or to discover how to promote babbling in children who seldom vocalize.

By the age of preschool, we found that children with autism are delayed in their ability to understand even basic emotional expressions of others (Feldman et al., 1993). Although some clever preschool teachers address the issue of affective decoding, the few intervention studies in this area have been conducted with school-aged children. A descriptive analysis also found subtle differences in the emotional facial displays of children with autism and their neurotypical peers (McGee, Feldman et al., 1991). Early in treatment, when 3-year-old children with autism looked happy, they were usually playing alone, but when neurotypical peers looked happy, they were usually interacting with teachers or other children. We once had a Walden child with autism graduate to regular kindergarten, where they got into difficulty by following their neurotypical peers on one last slide before lining up to go inside (we secretly cheered); however, the principal was not amused when they entered the office for discipline with a broad grin on their face. In short, these and other population differences in social behavior might be usefully explored as progress indicators across time in early intervention (McGee et al., 1997).

There is also a need for more intervention research on the content of peer-related social communication in the highest-achieving 4- to 5-year-old children with autism, because they will likely receive little if any systematic social intervention after entering regular kindergartens (e.g., "I like to play with super-heroes. What are your favorite toys?"). One of the important social competencies taught at Walden is the same rule most of us use: "When in doubt in a social situation, do what everyone else is doing" (Okay, that wouldn't have helped our graduate on the playground, but it may have worked if we had taught them to look sheepish when appropriate to do so).

11.7.2 IT Is an Evidence-Based Practice

IT procedures have been primarily developed and evaluated using single-subject research designs. To use a current analogy during the days of a pandemic, there are some researchers who develop vaccines, others who compare vaccinations in randomized controlled trials, and still others who figure out how to distribute vaccines. ABA researchers are analogous to the intervention developers.

One set of standards (Horner et al., 2005) that may be used to qualify a body of ABA research as an evidence-based practice include the following:

1. A minimum of five single-subject studies that meet minimally acceptable methodological

criteria and document experimental control and have been published in peer-reviewed journals.
2. The research should have been conducted by at least three research groups who are in at least three different geographical locations.
3. The peer-reviewed studies should have had at least 20 participants. Cumulatively, the IT studies presented in this literature review far exceed these criteria.

IT procedures have been designated as an "established" and/or "evidence-based" practice by associations and research groups using objective criteria and known standards (cf. National Autism Center, 2015; Wong et al., 2015). IT procedures are also considered one of the empirically validated early autism interventions now known as Naturalistic Developmental Behavioral Interventions, which include approaches developed from the formerly very divergent conceptual frameworks of developmental psychology and behavior analysis (Schreibman et al., 2015). Finally, Walden was presented as one of ten evidence-based model programs for children with autism after review by an interdisciplinary team of experts (National Research Council, 2001). Certification that Walden provides "best practices" established for the education of all children is confirmed in repeated accreditation evaluations conducted by the National Association for Education of Young Children (NAEYC).

11.7.3 Enjoy Your Interesting IT Conversations

Spending most of my career at Walden has been a fascinating adventure, which was made more interesting by the generous time and advice provided by Todd Risley. Perhaps the most important aspect of "incidental," although not accidental, teaching is that the process is an interaction between two people that ends in an event desired by the learner and the teacher. Todd Risley loved to talk about the social dance between a child and their interaction partner. "IT is used to get elaborated language by waiting for another person to initiate conversation about a topic and then responding in ways that ask for more information from that person" (Hart & Risley, 1982, p.5). The goal of IT is to provide learners (whether they be children, parents, teachers, or persons with disabilities of any age) with interesting opportunities to learn needed skills.

Specific to early intervention for children with autism, key variables that contribute to successful outcomes are (a) the age at which intervention begins, (b) the content of social communication between a child and their caregivers, and (c) the amount of time a child spends engaged in language and social interactions within increasingly complex environmental contexts. IT procedures are highly compatible with efforts to influence each of these variables. A comprehensive IT approach addresses the rights of children with autism to receive early intervention that is sufficiently intensive to provide them with skills that will improve their future lives. At the same time, a comprehensive IT approach addresses the rights of children with autism to enjoy the only early childhood that they will ever have.

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12 Pivotal Response Treatment (PRT): Research Findings Over 30 Years

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12.1 Pivotal Response Treatment (PRT): Research Findings Over 30 Years

This chapter will discuss Pivotal Response Treatment (PRT), also called Pivotal Response Therapy. We will provide a background and description of early studies, discuss various pivotal areas, and describe the adaptation of PRT to different target behaviors and age groups. Included are several tables for reference. To start, the importance of evidence-based practice cannot be understated as many non-scientific interventions for autism spectrum disorder (ASD) are prevalent. Unscientific and untested interventions result in delays in evidence-based interventions. For children with ASD, time is of the essence, particularly in regard to verbal communication. The younger the child, the more likely they will learn verbal spoken communication (Koegel, 2000). Assuring the best possible outcomes necessitates implementing evidence-based practices.

PRT, an evolution of early applied behavior analysis (ABA) intervention, has a strong evidence base (Wong et al., 2015). In addition to the underlying ABA strategies of choosing meaningful target behaviors, carefully defining target behaviors, monitoring progress through systematic data collection, and coordinating across providers and settings, specific motivational components have been researched individually and as a package. The PRT package has been documented in both single-subject design studies and randomized clinical trials by the original researchers within the clinic where it was developed, as well as replicated by researchers in different research settings (Koegel & Openden, 2019; Mohammadzaheri et al., 2014; Verschuur et al., 2016; Wong et al., 2015). Again, providing evidence-based practices assures that individuals will receive effective interventions in a timely manner, thereby increasing the likelihood of more positive outcomes.

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12.2 Background and Early PRT Studies

Kanner's (1943) initial descriptions of 11 children, which he labeled as having *infantile autism*, included references to parents who were coldly intellectual and interpersonally distant. This work set the stage for psychoanalytic interventions focused on repairing the parent-child relationship, which often included a "parentectomy" wherein children were removed from their parents and placed in an environment where,

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theoretically, they would feel safe and protected in order to provide them with an opportunity to develop (Bettelheim, 1967; Roser, 1996). Although in later writings Kanner would go on to suggest a physiological cause, this initial work implying a parental etiology resulted in many years of ineffective intervention based on faulty theoretical constructs. Prior to the 1960s, before behavioral interventions emerged, the majority of children diagnosed with autism were institutionalized by adolescence or adulthood (Henninger & Taylor, 2013). Due to lack of effective interventions and prevailing parental causation sentiment, few remained at home.

Beginning in the 1960s, a positive change occurred with the shift from the parental causation theory to learning theory, which resulted in a transformation in the intervention for children with autism. That is, studies began to emerge showing that children with autism could indeed learn (Lovaas, 1966; Lovaas et al., 1965). The programs described in these early studies were largely based on direct intervention with the children focusing on teaching nonverbal imitation skills and then imitation of sounds, followed by the shaping of words from the imitated sounds (Lovaas, 1966; Lovaas et al., 1967). Behavior management and teaching trials were generally based on rewards for appropriate behavior and correct responding and punishers administered for inappropriate and incorrect responding (Lovaas et al., 1965; Risley, 1968). In regard to these behavioral interventions developed and implemented in the 1960s and 1970s, now frequently referred to as "traditional ABA," many now view the use of punishment as inhumane and unnecessary (Carr et al., 2002). However, nonaversive positive behavior support strategies to decrease interfering behaviors (including aggression and self-injury) were not yet developed and researched at that time (Horner et al., 1990). It should also be noted that while feedback and other consequences that decrease unwanted behaviors are important and a part of everyday life, positive consequences for desired behaviors have always been preferred, and punishment (sometimes severe punishment for dangerous behavior) is now infrequent. Importantly, research in the field of ABA has come to understand that many interfering behaviors are communicative. Understanding the functions and teaching replacement behaviors, rather than response consequences, results in more long-lasting changes. As well, creating inviting teaching environments using evidenced-based motivational procedures can be considered an antecedent intervention, thereby increasing responsiveness and engagement.

Further, starting in the 1970s, studies relating to parent personality profiles have continuously demonstrated that parents of children with autism are not aloof and exceedingly brilliant, nor are they "refrigerator parents" (Wolff & Morris, 1971). Over the years, accumulating studies have established that although specific areas of stress may be elevated in parents of children with autism (Moes et al., 1992), personality characteristics do not differ from parents of children not diagnosed with autism (Koegel et al., 1983). Additionally, in contrast to the psychodynamic interventions that separated the parent and child, research shows that parents are essential and necessary components of the habilitation process if generalization and maintenance are to be achieved (Lovaas et al., 1973).

Early ABA interventions used repeated drill exercises presented in a distraction-free environment (Pope, 1999). These carefully orchestrated Stimulus-Response-Consequence (SRC) trials, with repeated presentation until the child reached specific criterion, were very effective, especially considering many children at that time did not improve with the available psychodynamic interventions. It is important to consider the fact that autism was a low incidence disability, and this initial work was focused on demonstrating that with proper instruction children with autism could learn. However many children demonstrated interfering behaviors during intervention (Mohammadzaheri et al., 2015), appeared "unmotivated," and resisted coming to the sessions (Koegel, Koegel, & Surratt, 1992). In other words, many children did not appear enthusiastic about participating in the learning sessions and engaged in avoidance and escape motivated behaviors. Thus, while the interventions based on learning theory resulted in greatly improved progress relative to other interventions (Lovaas, 1966, 1981), researchers began a search for areas that could be incorporated into the trials that would lead to improved motivation that may result in faster treatment gains and greater generalization.

Initial studies, focusing on the construct of motivation, revealed that specific variables could be adjusted during the teaching sessions to improve responsiveness and decrease interfering behaviors. For example, child choice in regard to preferred activities, topics, and materials helped improve social engagement and decrease escape and avoidance behavior during intervention (Koegel, Koegel, Hurley, & Frea, 1992). Other studies showed that, rather than providing the commonly used social rewards paired with food treats, using direct and natural rewards improved learning (Koegel, O'Dell, et al., 1987; Mohammadzaheri et al., 2015). A simple example was teaching a child to open a container. Putting a snack inside the container was much more effective than providing the reinforcer extrinsically after the child opened the container. In short, arranging direct and functional response-reinforcer relationships created higher levels of responding (Koegel & Williams, 1980; Williams et al., 1981). Other studies addressed the drill type practice and showed that interspersing maintenance trials (targets that the individual has mastered) with acquisition (new target behaviors) resulted in more efficient learning and improved child affect (Dunlap, 1984). Similarly, repeatedly presenting the same task was compared to varying the task with different activities from the child's curriculum. This research showed that task variation resulted in improved responding with fewer interfering behaviors. As well, greater child interest, enthusiasm, and happiness (objectively rated on Likert scales) were observed during the sessions (Dunlap & Koegel, 1980). Finally, when targeting expressive verbal communication in nonverbal children diagnosed with ASD, reinforcing all communicative attempts, rather than using a strict shaping paradigm, was greatly more effective for teaching first words (Koegel et al., 1988).

During this time of exploration of motivational variables, our research found that combining the various individual components into a package appeared to be particularly effective. We first assessed whether the package of procedures would improve verbal communication in nonverbal children with ASD. Following the implementation of the package intervention, the participants improved their imitative and spontaneous verbal communication. Because these intervention sessions looked more like natural, play-based interactions than the traditional ABA sessions, the initial motivational package was described as "the Natural Language Paradigm" or "NLP" (Koegel, Dyer, et al., 1987). The package also led to lower levels of escape and avoidance motivated interfering behaviors (Koegel, Koegel, & Surratt, 1992). As time progressed, additional research showed that the package was also effective when targeting behaviors other than communication, and thus it was re-labeled "Pivotal Response Treatment" or "PRT." Our intention in using the word "pivotal" was that we were searching for core areas that, when targeted, would result in widespread positive changes in untreated behaviors. The idea was that behaviors could be learned more rapidly and efficiently if we targeted key core areas, such as motivation, instead of focusing on teaching individual behaviors that may be numerous for many diagnosed with ASD. In short, "pivotal" areas were targeted to speed up the learning process and result in positive improvements in untargeted areas.

Several points are important when considering the roots of PRT. First are the general principles of behavioral learning theory. That is, target behaviors must be clearly defined and measurable. Rewards are important and should be natural, whenever possible, as an integral part of the trial. In addition, positive affect on the part of the child and interventionist is essential. If children are motivated, their measured affect should be high, demonstrated by smiles, interest in the activity, and engagement. Teachers and interventionists should maintain a positive attitude, and when motivation is considered, the need for negative consequences is greatly diminished. Socially significant goals are developed using a "top-down" age-appropriate construct. For example, expressive verbal communication is targeted if a child's first words are delayed, regardless of whether the child is able to point to target items receptively or demonstrate other related skills. Next, data are collected regularly to inform intervention and track progress. Generalization and maintenance are essential and are systematically tracked. Thus, although PRT sessions sometimes resemble play, systematic trials are created using the antecedent-behavior-consequence (ABC) format (or SRC) so that clear learning trials can be evaluated. Finally, it is also helpful to understand that prior to the development of PRT that began in the 1970s, naturalistic strategies were not commonly used with this population (Pope, 1999). It should be also noted that this is not a dichotomous relationship. Some important behaviors that are difficult or nonpreferred may benefit from the addition of secondary rewards. This is similar to accepted practices of getting a good grade in a class or a paycheck. However, while the early ABA procedures resulted in improvements in responsiveness, more naturalistic strategies, such as PRT (previously called the "Natural Language Paradigm" or "NLP"; Dunlap & Koegel, 1980; Koegel, Dyer, et al., 1987; Koegel & Egel, 1979) and incidental teaching (McGee et al., 1983; McGee et al., 1985, 1986), incorporated into the intervention, particularly early on, led to a greater response-reinforcer relationship, improved child affect, and thus more rapid gains.

12.2.1 Learned Helplessness

Another important theoretical foundation of PRT is the concept that children with ASD are more capable than they appear, but may be affected by what has been described in the literature as "learned helplessness." That is, in order to understand motivation, it is helpful to understand the apparent lack of motivation in children with autism. For example, when children get their needs met without having to make communicative or behavioral efforts to accomplish the end goal, they may cease to engage in these important behaviors. In other words, under such conditions, children behave as if they are helpless, because they are unable to escape controlled events or negative situations, or they do not connect important behaviors with the outcome (Maier & Seligman, 1976). Thus, the concept of learned helplessness, as it applies to children with autism, was theorized. For example, well-meaning adults may dress a child who is taking too long to get ready. Similarly, a child may get needs met without having to verbally communicate. For example, a peer may intend to be helpful by opening a difficult container for the child at lunchtime without requiring the child to request "Help" or open it independently. In situations where children have no control, they may not attempt to respond, or they may engage in interfering behaviors, which appears as lack of motivation. However, this apparent lack of motivation may be "learned" because of environmental influences in teaching and other settings that created a situation where the child is emitting few responses with low effort. This theory highlights the importance of incorporating components that improve motivation into the intervention, which is a key component to PRT.

12.2.2 Pivotal Areas

As mentioned above, our goal in identifying "pivotal" areas has been to discover which key behaviors will result in collateral gains in untargeted areas of functioning and development (Koegel, Koegel, et al., 2010). To date, research has shown that several key areas appear to be especially helpful in the process of teaching and learning. Motivation is particularly important, as it is an essential underlying component of all PRT intervention. The motivational components can be implemented across the age span and with many different target behaviors. In addition to motivation, this chapter will discuss other pivotal areas, including initiations, self-management, and empathetic responses.

12.2.3 PRT Motivational Components

The five strategies that have been proven to increase motivation in children with autism include (1) providing choice and incorporating preferred interests; (2) interspersing maintenance tasks and acquisition tasks; (3) implementing task variation; (4) providing natural reinforcement; and (5) reinforcing all reasonable attempts.

12.2.3.1 Child Choice

Presenting the learner with a choice of instructional tasks improves engagement, responsiveness, and on-task behavior while also decreasing behaviors that interfere with learning (Dyer et al., 1990; Koegel, Dyer, et al., 1987; Ulke-Kurkcuoglu & Kircaali-Iftar, 2010). There are several ways to assess preference. The learner can be observed directly, and parents or caregivers can help identify various toys, games, books, foods, and activities that are highly preferred. Having a variety of options available is helpful as children's interests may change frequently, even within a single session. The influence of choice is quintessential, as the literature has shown that when intervention is conducted within a play context and choices are permitted, there are considerably fewer interfering behaviors, increased levels of appropriate social interaction, and improved pragmatic skills (Carter, 2001). The combination of reduced interfering behaviors and increased appropriate social interactions results in reduced interventionist redirection. Thus, the child has more opportunities to independently interact socially in the context of positive behavioral support.

Providing choice by following a child's lead also involves engaging the learner in preferred tasks and correctly identifying how to gain control of the reinforcing item or action. Lei et al. (2017) found that using choice may also help children with autism feel a sense of control, or predictability, over some uncertainty associated with the task at hand, since they are more familiar with the sequence of events during their preferred activity. Thus, strengthening the connection between the behavior emitted (such as requesting a highly desired item) and the positive outcome of that behavior (receiving the desired item) improves responsiveness and decreases learned helplessness.

12.2.3.2 Intersperse Maintenance Tasks

Completing the same task over and over quickly becomes monotonous for learners, particularly when targeting difficult tasks. Furthermore, repeatedly failing the same task each time may cause learners to lose interest and become frustrated, leading to a lack of motivation to continue. A more effective strategy involves teaching a student through a varied task condition, where the challenging target behavior is interspersed with a variety of relatively easy tasks that the child has already mastered. Research has shown that varied task conditions result in an increase in the number of correct responses, cause the student to show more interest, exhibit a happier demeanor, and display fewer interfering behaviors (Dunlap, 1984; Dunlap & Koegel, 1980).

12.2.3.3 Task Variation

Task variation involves revising the interaction such that a single task is not repeated until criterion is met. That is, rather than presenting repetitive opportunities in a drill-type manner, different targets and activities are incorporated into the intervention session. For example, instead of repeatedly prompting a child to label the colors of markers during an art activity, varied opportunities for different targets can be provided, such as choosing between different art materials, requesting help to open difficult to open containers, turn taking, identifying colors, and, when indicated, changing to a different activity. A literature review corroborated these findings that variation and stimulus novelty increase responsivity, which is exhibited by students' increased attempts to perform both target behaviors and other less preferred tasks (Clinton & Clees, 2015).

12.2.3.4 Natural Rewards

Another essential component of PRT intervention is the delivery of reinforcers that are directly related to the task at hand. In contrast, it was common practice in traditional ABA therapy to provide children with edibles, a more desired activity, or other reinforcers that were not directly related to the task following a correct response (Fisher et al., 2020; Shvarts et al., 2020). For example, a child may be given an M&M or a sticker for correctly labeling five pictures of common household items. While these types of external reinforcers can be effective, they do not provide learning opportunities with a connection between the response and the reward, and thus generalization may be moderated and acquisition slower (Koegel, O'Dell, & Koegel, 1987). While certainly tokens and edibles are useful and can improve behavior, using naturally rewarding contingencies such as directly enabling the child to gain access to a desired item or activity following a correct attempt or response appears to improve learning. For example, when targeting expressive verbal communication, if a child responds appropriately to a prompt for the word "ball," the child is immediately and naturally rewarded with access to the ball. This functional relationship between the child's response and the reinforcer results in more rapid acquisition of target behaviors (Williams et al., 1981). Natural rewards have been shown to have a broad impact in many areas, such as first words, language, self-help, and academics, and are increasingly being used in many intervention programs.

12.2.3.5 Reward Attempts

While every target goal has a specific criterion that must be met in order to be considered mastered, it is beneficial for the child to be positively reinforced for making an appropriate, earnest attempt to produce the target behavior. This way, the child is rewarded for their effort, therefore increasing motivation to continue responding to subsequent opportunities. Koegel et al. (1988) found that reinforcing attempts, rather than following a strict shaping paradigm, was more effective with respect to the children's interest, general behavior, and the targeted area of speech (word) production. Rewarding attempts may be analogous to behavioral momentum. When the child is rewarded for responses that are attempts at the target behavior, persistence follows. In contrast, a strict shaping paradigm may result in effort not being rewarded and in turn may extinguish the important behavior of trying. Rewarding attempts are particularly helpful for children with ASD who may experience more challenges with learning and may respond well to the higher frequency of rewards.

Table 12.1 shows the specific motivational procedures that were added to improve engagement and decrease interfering behavior (Koegel, Koegel, & Surratt, 1992; Koegel, Dyer, et al., 1987).

Table 12.1 PRT research has compared an adult-driven model with motivational components added, as shown

	Adult-driven	PRT motivational components
Stimulus items	Chosen by the adult or clinician Repeated until criterion is met	Chosen by the child Varied every few trials Age-appropriate items that can be found in the child's natural environment
Prompts	Manual or physical (e.g., touch tip of tongue or hold lips together), hand over hand	Clinician models the response, particularly when working on first words
Interaction	Clinician holds up stimulus item; stimulus item not functional within interaction	Clinician and child play with stimulus item that are functional within the interaction
Response	Only correct responses or successive approximations are reinforced	Looser shaping contingency so that attempts or "good tries" are reinforced
Consequence	Edible or token reinforcers paired with social reinforcers (e.g., "good job!")	Natural reinforcer (e.g., opportunity to engage with the item) is paired with social reinforcers

12.3 Adapting PRT for Different Age Groups and Target Behaviors

Most of the initial PRT research studies were implemented with preschool and elementary-aged children, but other research has shown that the motivational procedures can be adapted to wider age ranges and different target behaviors.

12.3.1 Adapting the PRT Motivational Components for Infants

The literature suggests that early identification of autism and early intervention are linked to more positive outcomes. While an increasing number of children are being diagnosed and receiving intervention in the preschool years, by that time the developmental gap has already begun to widen, in some cases, quite significantly. In recent years, research has focused on determining behavioral markers in infancy that later lead to a diagnosis of autism. With the development of early screening tools, such as the Autism Observation Scale for Infants (AOSI; Bryson et al., 2007), that assess prelinguistic behaviors such as social smiles, visual tracking, social interest, and eye contact, along with known risk factors (e.g., having an older sibling diagnosed with autism), there is a rising need for interventions that can be effectively implemented within the first year of life. Although the bulk of research showing the effectiveness of PRT has been focused on preschool-aged children and older, the core motivational components have also been adapted to target developmentally appropriate behaviors for infants as young as 6 months. Rather than having the focus of intervention be increasing functional verbal communication, as children are preverbal during the first year of life, PRT target goals are related to social engagement and include responsiveness, positive affect, and interest in parent-child social interactions.

Koegel, Singh, et al. (2013) described a modified PRT approach in which the traditional PRT motivational component "child choice" translates to engagement in infant-preferred activities. Task variation is incorporated, in that activities are changed approximately every 10 s before social breaks. Interspersal of maintenance and acquisition is implemented with the interspersal of preferred and neutral activities identified by observable signs of infant enjoyment during baseline. Finally, reinforcement is based on classical conditioning, rather than an operant conditioning paradigm. Table 12.2 outlines these modifications from the PRT motivational components used for infants compared with preschoolers and beyond when verbal communication is present or expected. Again, the parent involvement component of the PRT methodology is essential to this modified approach, as parents serve as the interventionists.

Specifically, the first step of this modified PRT approach involves categorizing activities as either "preferred" or "neutral" during play observations with the parent. "Preferred" activities are those that elicit positive reactions from the infant, such as smiles, laughing, or eye contact. Activities where the infant displays flat to low affect and avoids eye contact would be considered "neutral." During the initial phase, parents engage with the infant in a variety of preferred social interactions, such as peek-a-boo, tickles, and making silly faces, which are individualized based on the interest of the particular infant. These activities are incorporated into intervention sessions that consist of alternating short intervals of approximately 5–7 min when the parent engages in a variety of preferred activities. During the intervals of engagement, the parent implements task variation by switching the activity approximately every 10 s. By varying the task often and taking breaks in between short interaction intervals, both the parent and infant are more likely to maintain high levels of engagement. After the interactive intervals, a 5–10-min break is provided, during which time the parent and infant can take a walk or engage in another relaxing activity that does not involve providing an opportunity for the infant to engage in a non-social or restricted and repetitive behavior, such as staring at a ceiling fan. In regard to interspersing acquisition tasks, at the start of intervention,

Table 12.2 Motivational component adapted for pre-linguistic infants and preschoolers

PRT motivational component	Example for preschooler or older	Modified PRT motivational component	Example for pre-linguistic infant
Child choice	"Do you want to play train or bubbles?" or modeling the word "train"	Preferred activities	Engaging in preferred activity, such as peek-a-boo
Task variation	Varying opportunities for the child to request "cookie, please" with "open the box" (of cookies)	Task variation	Varying between different preferred activities, such as peek-a-boo, tickles, and making silly faces every 10 seconds
Interspersal of maintenance and acquisition	Providing three easy opportunities for one-word utterances (e.g., "blue," "block," "on"), followed by a more difficult opportunity for a two-word utterance (e.g., "red block")	Interspersal of preferred and neutral activities	Engaging in several preferred activities (e.g., peek-a-boo, tickles, making faces), followed by a neutral activity (e.g., singing, pull up to parent, air kisses)
Contingent natural reinforcement	Immediately providing the child access to a red block after the child makes a verbal request, "red block" (operant conditioning)	Reinforcement (classical conditioning)	Once affect is continuously high with preferred activities, neutral activities are paired with the preferred activities (classical conditioning)

the parent engages in only preferred activities. Once the infant is consistently displaying positive affect during the engagement intervals, neutral activities are gradually and systematically incorporated. Results of Koegel et al. (2013) indicated that this modified PRT approach led to decreased avoidance of eye contact and increased positive affect, as measured by Likert scales indicating levels of interest and happiness. As a collateral gain, the infants' responses to their name also increased, which occurs around 5 to 7 months in neurotypical infants.

While interventions for infants are in the early stages of development, pilot studies suggest optimism for the possibility of targeting pre-linguistic social areas (Bradshaw et al., 2015; Brian et al., 2015). While there are challenges in the area of intervention for infants, due to temperament differences across those who will not later receive a diagnosis of ASD, targeting parental concerns that are consistently shown on early development measures may provide parents with helpful tools and improve social engagement and responsiveness in the first year of life. These may include pre-linguistic activities, such as working with parents to attend to preferred activities to increase engagement, pairing activities and items with response to name so that infants do not extinguish, modeling word production, and encouraging high affect activities. Again, these programs are largely implemented through parent education and, in addition to showing promise, are highly cost-efficient (Table 12.2).

12.3.2 Adapting the PRT Motivational Components for Adults

The bulk of the intervention literature, as well as support services, focuses on preschool- and school-aged children with ASD (Levy & Perry, 2011). Thus, there is a need for effective interventions that support the different challenges that come with adolescence and adulthood. PRT strategies have been adapted to target areas that are meaningful to this population, such as social interaction, time management, and daily living skills. Traditional PRT motivational components, such as choice, task variation, interspersal of maintenance and acquisition, and contingent and natural reinforcement, are incorporated into the programs, but with modifications to be more appropriate and relevant to the age of the individual and the goal of intervention. For example, choice may be incorporated by having the individual choose what social club to attend or which day to go grocery shopping. For instance, choice was implemented in Ashbaugh et al. (2017) with college students diagnosed with ASD who engaged in few to no extracurricular social activities. During weekly intervention sessions, the participants were provided with a menu of social activities around their unique interests that existed in the community and on campus. These included campus clubs and classes, community activities, events in the dormitories, dining events, and study sessions with peers. Peer mentors were recruited to attend these clubs and activities each week and provide support, if desired (all participants requested peer mentors), such as introducing them to others, modeling, and helping them ask for phone numbers. Following intervention, all participants increased the number of social activities in which they participated each week and further maintained the social activities following the completion of the intervention. These types of structured social planning, which involve incorporating specific social activities into the person's weekly and monthly schedule with peer support, have been shown to improve overall reported satisfaction and quality of life for young adults on the autism spectrum (Koegel, Ashbaugh, et al., 2013). In addition, concomitant increases in untargeted areas, including improvements in unstructured social engagement, grade point average, and employment, have been observed (Koegel, Ashbaugh, et al., 2013). Other areas that are particularly relevant to adults are time management and daily living skills. Much like the structured social planning described above, these targets can be incorporated into daily, weekly, and monthly schedules and self-managed (Palmen et al., 2012). Table 12.3 shows examples of how the PRT motivational components can be used with adults with ASD.

Table 12.3 Motivational components adapted for adolescents and adults

PRT motivational component	Implementation with a child	Implementation with an adult
Choice	Presenting an opportunity for the child to choose between playing a game or eating snack	Having the adolescent or adult with ASD choose which social club to attend and what days of the week to schedule social activities
Task variation	Presenting opportunities for the child to request different preferred items, engaging in a variety of different games, targeting colors, shapes, and item labels	Varying different types of social opportunities around the individual's interests and targeting different goals. For example, an individual who enjoys dancing may attend different types of dance classes. Target behaviors are varied, such as social, academic, time management, daily living skills
Interspersal of maintenance and acquisition	Incorporating easy tasks, such as high-fives, with more difficult tasks, such as turn-taking	Including easy tasks, such as checking email, on an adult with ASD's daily living checklist along with more difficult tasks, such as attending social events
Contingent reinforcement	Giving the child access to a preferred item or activity immediately following the desired behavior	Checking in with a peer mentor and/or self-management and scheduling a special event after completion of self-help chores
Natural reinforcement	Rewarding a child with access to a favorite toy train after she says, "train"	Being able to engage in a preferred activity, such as Dungeons and dragons, at the social club

12.3.3 Adapting PRT for Academics

Many children engage in interfering avoidance and escape-related behaviors during difficult academic assignments. These behaviors can influence teachers, leading them to reduce the demands of the interaction, thereby providing a less challenging curriculum for their students with ASD (Carr et al., 1991). Behaviors that interfere with learning can range from lethargy and inattention, or "zoning out," to full meltdowns (Vivar, 2016). Research shows that over time, these behaviors are likely to worsen without direct intervention (Horner et al., 2002). In addition, a lack of interest in academic assignments may lead to low levels of participation in school and during homework (Ochs et al., 2001). Many common strategies used in traditional teaching, such as time-out, being sent to the principal's office, or having a chat with a teacher, are typically not successful for students with ASD because, although these strategies are commonly considered "punishers" by school personnel, they actually may function as rewards for children with ASD, as the students are able to avoid academic tasks while being excluded from the activity.

A lack of motivation to engage in schoolwork has been identified as one of the root causes of avoidance behaviors and low levels of interest. Therefore, from a theoretical point of view, using the PRT principles to target motivation during academics should increase a child's interest in both learning and the academic material itself, as well as leading to long-term gains at school and home (Heimann et al., 1995; Koegel, Singh, et al., 2010). Specific variables, such as using choice and incorporating the student's interests, interspersing easy and difficult tasks, and including natural reinforcers, can increase interest in academic materials, improve performance, and decrease interfering behaviors during academic activities.

For example, Koegel, Singh, et al. (2010) demonstrated that incorporating motivational variables into writing and math during homework assignments decreased response latency (i.e., time between the instruction and when the child began the task), increased the rate of work completion (i.e., number of math problems completed or letters written), and decreased the percentage of time the child engaged in disruptive and interfering behaviors. Also, incorporating motivational variables increased the children's interest in the academic assignment (based on Likert scale adapted from Koegel & Egel, 1979). Further, these gains were maintained post intervention and generalized to in-class assignments. In addition, after intervention, parents reported observing low levels of interfering behaviors and high levels of on-task behavior during homework assignments.

To be specific, at the beginning of intervention, child-preferred topics are identified through observation and/or parent or caregiver interview and then embedded into the task. For example, if a child who enjoys trains is working on writing letters, the teacher could have the child write "T" for train. A child working on more advanced writing skills could write "I want to play with the train engine" or a story about a train. Once the children successfully complete the task, their behavior is immediately reinforced with the corresponding desired item, action, or activity, such as an opportunity to play with the train as a natural reward. During a math intervention, the child who likes trains can add the train cars (2 cars +1 car = 3 cars), and after completion of the problem(s), they are provided with an opportunity to play with the trains as a natural reward, or a child working on more advanced skills can determine what percent of the cars are green, and so on. Consistent with the PRT motivational components, task variation and including both easy and challenging problems are important during academic activities. In addition to incorporating preferred topics into the curriculum, other choices can be provided throughout the assignment to increase motivation. For example, the child can be provided with an opportunity to choose what type or color of paper to write on, whether to use a pen or pencil, where to sit, and so on. Again, incorporating these PRT motivational variables into academics has been shown to improve engagement, correct responding, and overall behavior.

12.4 The Pivotal Behavior of Initiations (Question Asking)

12.4.1 Importance of Initiations

Question asking plays an important role in learning and socialization. Children who develop language typically begin asking questions at a very young age, often within their first lexicon. By preschool, they are quite sophisticated at asking questions, and when given a task to solve, ask an average 75 questions per hour (Chouinard et al., 2007). When children ask questions, they simultaneously gain a better understanding of the social world around them, learn information from their environment, and expand their verbal repertoires. Thus, these initiations are crucial in overall cognitive and social development.

In contrast to children who learn language without difficulty, individuals with ASD use very few to no initiations. Most of the verbal communication of children with ASD is limited to behavior regulation functions, including requesting items (e.g., "want milk") and protesting (e.g., "no," "down," "all done;" Maljaars et al., 2011). By teaching children with ASD to initiate questions, their communicative functions are expanded. However, early research in this area reported difficulty with generalization of question asking to natural settings as well as the lack of acquisition of the information provided after the question was asked (Hung, 1977). Various procedures, such as time delay (Taylor & Harris, 1995), video modeling (Charlop & Milstein, 1989), and self-management (Doggett et al., 2013), have been used to encourage generalized question asking. Of interest, the research suggests that when motivational procedures are incorporated into the intervention sessions with young children, spontaneous generalization of question asking to natural environments and acquisition of the response following the question appears to improve (Koegel et al., 1997).

12.4.2 Teaching Question Asking

Shortly after children begin using first words (around 15–18 months), they will typically start to imitate parents who frequently ask them "What's this?" or "What's that?" The question is simplified to their language level and emitted as a one-word utterance: "dis?" or "dat?" Frequently, pointing will accompany this utterance. Question asking is both social and educational, as the back-and-forth interactions inherent in a question also result in the acquisition of vocabulary or other linguistic information elicited by the question. During the preschool years, a variety of questions are acquired and used frequently. The importance of question asking cannot be underestimated, as questions provide an important role in cognitive and linguistic development (Chouinard et al., 2007). Therefore, as discussed above, if question asking is absent or used infrequently, it becomes an important pivotal goal.

Incorporating motivational components into question asking intervention is essential. Our preliminary pilot data suggested that if motivational components were not incorporated, the children did not exhibit success with the acquisition or generalization of the target question. Using the motivational PRT components, our first area of research (Koegel et al., 1997) focused on teaching "What's that?", the first question used by typically developing children. Our goal in teaching "What's that?" was to add an additional language function (outside of behavior regulation), with the end result being acquisition of large numbers of vocabulary words. Children who participated in our question asking studies were able to verbally request items, had a vocabulary of at least 50 words, were beginning to combine words, but did not use questions in their communication. In order to teach and promote generalization of question asking, the PRT motivational components were added. The specific steps are summarized below.

In an initial study (Koegel et al., 1997), the children's favorite (child choice) items were placed in an opaque bag, and they were prompted to ask, "What's that?" This preliminary step was incorporated only to improve the children's motivation to ask the question; at this point it was not a concern whether or not they could label these preferred items. After the children asked, “What’s that?”, the item was taken out of the bag and labeled, and after the children repeated the label, they were given the item as a natural reward. Again, it was important when first teaching “What’s that?” to use highly and naturally reinforcing items so that the children continue to engage and ask questions. Once the children were consistently responding to the model for “What’s that?”, the verbal prompt was faded. Then, when the children asked, “What’s that?” independently and consistently, neutral items were added into the bag, startings with every fourth item, third, and so on. The final step was to fade the preferred items completely, so that the children only asked “What’s that?” in reference to items they did not know how to label. Additionally, the opaque bag was faded out, with the goal being that the children would ask “What’s that?” in reference to items in their natural environment to which they did not know the label. Our research showed that incorporating motivational components into the intervention resulted in generalized and appropriate use of the question “What’s that?” at home and school. Other questions, including “Where is it?”, “Whose is it?”, “What’s happening?”, and “What happened?”, can also be taught using motivational strategies to improve their use during social communication (Koegel et al., 2003; Koegel, Singh, et al., 2010, 2014). Similar motivational components are added, such as hiding the child’s favorite items, prompting the question “Where is it?”, and then providing the targeted prepositions. Children can be prompted to ask, “Whose is it?” using favorite items and “What happened?” using favorite pop-up books and manipulating the tabs so that an action is shown.

Most children with ASD use verbal communication that is limited to requesting items (e.g., “want milk”) or protesting (e.g., “No,” “down,” “all done”; Koegel, et al., 2014; Wetherby, 1986). When these children are taught to initiate in the form of question asking, the function of their communication expands beyond behavior regulation and provides them with a mechanism to gain linguistic and other information from their environment. A recent study found that initiating questions in children with ASD not only had positive effects on their language skills but also had positive effects on their overall affect (Popovic et al., 2020). Thus, initiations seem to be another important pivotal area and are crucial for language development, social engagement, and improved long-term outcomes (Koegel et al., 1999).

12.5 Self-Management

Self-management is a technique that is used to teach individuals to be aware of, and monitor, their own behaviors to either increase the frequency of desired behaviors or decrease the frequency of undesired behaviors (Chai et al., 2018). Self-management is another pivotal area, as it empowers individuals to take an active role in controlling and managing their own behaviors and thereby reduces the need for an interventionist in natural settings. For example, through self-management procedures, the occurrence of a newly learned behavior can be programmed to occur in settings beyond where intervention is implemented (Koegel, Koegel, & Surratt, 1992).

There are several steps to consider when setting up a self-management program. First, the target behavior must be clearly defined and measured. Baseline data are important, as it serves as a guide for the initial goals within the self-management system. Second, the individual must be taught to discriminate between the occurrence and absence of the specific target behavior. This discrimination is important so that the individual self-records desired behaviors and not undesired (or irrelevant) behaviors. Once the individual can successfully differentiate between the desired and undesired behaviors, the self-management system is introduced, and the individual is taught how to track or monitor these behaviors. For example, wrist counters were used by Koegel et al. (1992) to improve responsiveness to questions of children with ASD, ages 6 years 10 months to 11 years 2 months, in community settings. For behaviors that are appropriately monitored using time intervals, a system that notifies the individual to record the presence or absence of the behavior during the previous time period is used. For instance, Koegel et al. (1999) taught children in full inclusion classes to mark an "x" on a series of boxes printed on a sheet of paper if on-task behavior occurred during the previous interval using a timer to signal the end of the interval. The next step was to provide a reward for the individual's engagement in the desired behavior and monitoring. Initially, rewards were provided frequently and then systematically faded. The length of the initial time interval or number of responses the individual needs before earning a reward depends on the baseline data. That is, if a child engages in on-task behavior for 20 s during baseline, a shorter interval (such as 10 s) is chosen initially, so that the child experiences success. Once the child has mastered tracking appropriate behavior at 10 s, the interval can be increased to 20 s, then 30 s, and so on, until the child can independently track the behavior for the amount of time the intervention team deems appropriate, such as an entire class period. Some children can also learn to self-administer rewards (Koegel & Koegel, 2018), but others may need assistance with turning in points for rewards. The final step of a self-management program is fading reinforcement and the structured monitoring system. This can be accomplished by adding time to each interval and requiring increasing numbers of intervals before a reward. For event recording, such as each time the individual asks a question or a child raises his hand, the number of points needed before a reward can be increased. Generally, as the new behavior becomes more established and practiced, the individuals will begin to engage in the self-recording less frequently while still exhibiting the desired behavior. In other cases, the reward can be provided at more natural times, such as at home at the end the school day. For some individuals, completely fading the program is not possible; some sort of self-management system must stay in place.

Self-management has been used with individuals with ASD with a wide variety of behaviors. There are positive impacts in the domains of social communication, academics, play, interfering behaviors, self-help, and daily living, among others. Below are a few additional examples.

12.5.1 Self-Management and Social Communication

In a study by Koegel and colleagues (2014), a multiple-baseline design was used to investigate the effectiveness of self-management intervention targeting on-topic responsiveness during a conversation, expansion of the conversational topic, and on-topic question asking. Participants were between the ages of 4 years 10 months and 14 years 11 months and diagnosed with ASD. Data were collected during 10-min conversation probes, and the conversational partners were instructed to ask at least ten open-ended questions and provide a delay of 3–5 s before asking another open-ended question, to assess whether the participants would respond, further elaborate on topics, and ask questions. The intervention phase consisted of providing the participant with a visual schematic which included "answer a question," "add information," and "ask a question," with additional empty boxes below, so that participants could self-manage when they engaged in the social conversation behaviors outlined in the schematic and earn "conversation points." Once the individuals earned the predetermined number of points, they were able to access a self-chosen reward. During the first intervention sessions, the clinician prompted the participants to follow the visual schematic and self-manage conversation points. After several successful sessions, both prompting and the structured self-management system were faded. After the self-management program was completely faded (by systematically increasing the number of points before reinforcement), the generalization phase began by introducing new conversational partners in novel settings, using the same data collection model as used during the baseline phase. Results from this study showed that a visual conversational framework paired with self-management led to increases in elaboration of responses and reciprocal question asking during conversation. This points to the importance of teaching self-management techniques and the positive effects it has for a variety of different behaviors.

12.5.2 Self-Management and Academics

Self-management can also be useful within an academic context. Roberts et al. (2019) investigated the effects of a self-management program with a peer training intervention on academic engagement for high school students with ASD. Their research found that the peer trainer implemented the peer training component with fidelity, suggesting the intervention was acceptable and effective. Thus, this provides another way for children with ASD to learn from their peers. Not only can self-management be taught by parents and interventionists, but new research supports that it can be effectively taught by peers in academic settings.

12.5.3 Self-Management and Interfering Behaviors

Interfering behaviors, such as protests, tantrums, and self-injurious behavior (SIB), are sometimes exhibited by children with ASD, particularly if they are not able to effectively communicate their needs or desires, when academics are challenging, and when presented with non-preferred activities (Koegel, Singh, et al., 2010; LaBelle & Charlop-Christy, 2002). Recent research by Singh et al. (2018) focused on verbal and physical aggression in children with ASD and the effects of teaching self-management to control their behavior. In this study, the adolescents with ASD were taught to engage in breathing exercises and self-control, as opposed to engaging in physical or verbal aggression. The results showed that following the self-management training and practice, the adolescents showed statistically significant changes with a decrease in both verbal and physical aggression.

Meta-analyses have shown that self-management is an efficacious procedure for improving socially desirable behaviors in individuals with ASD (Lee et al., 2007). It is a versatile technique that can increase the independence of individuals with autism and can positively improve the quality of lives of individuals with ASD (Lee et al., 2007).

12.6 Empathy

Research suggests that empathy may be a particularly challenging area for individuals diagnosed with ASD (Baron-Cohen & Wheelwright, 2004). Empathy is a complex social construct, so it follows that individuals with ASD experience difficulties in this area, given that challenges in social communication and social interaction are diagnostic characteristics (American Psychiatric Association, 2013). In fact, Wheelwright et al. (2006) determined that where an individual's score falls on the Autism Spectrum Quotient (AQ) can be predicted by their Empathy Quotient (EQ) score. Challenges in this area include difficulty understanding and expressing interest in peers, which can make it difficult to develop and maintain meaningful friendships (Baron-Cohen & Wheelwright, 2004; Laugeson et al., 2009). Without intervention, these challenges are likely to continue throughout the lifespan and impact the individual's quality of life. However, recent research suggests that empathy and empathetic responses may be learned, and once demonstrated, improvements in other areas are noted (Koegel et al., 2016). Therefore, empathy appears to be another pivotal area.

While empathy as a whole is complex, some aspects can be simplified and broken down into two specific behaviors that can be taught to individuals diagnosed with ASD: active listening and asking on-topic questions (Hill, 2009; Nugent & Halvorson, 1995). These two areas combined help the individual show interest and engagement with the conversational partner. Furthermore, individuals with ASD may have a strength in visual perception, so pairing these areas with a visual cue has been found to be especially beneficial (Ayres & Langone, 2007; Koegel et al., 2015; Rayner et al., 2009).

Koegel et al. (2016) implemented an intervention that utilized a visual schema to support the individual's empathic responses, combined with video feedback. The schematic consisted of three boxes. The first box represented a statement made by the conversational partner that consisted of an emotion or physical state. This provided support for the individual to recognize when there was an appropriate opportunity to express empathy. For example, if the conversational partner said, "I have been really stressed lately," that was a statement that reflected an emotion (i.e., stress) and would therefore be an opportunity for an empathetic response. The second box in the schematic represented the first part of the individual's expressive spoken response, which was a statement that expressed understanding of the conversational partner's emotion or physical state. For example, if the conversational partner said, "I'm so happy I talked with my brother today," and the individual responded with, "That sounds nice," it showed recognition that the event was a positive experience for the conversational partner. However, if the individual responded with, "That doesn't sound like fun," it was not clear the individual correctly picked up on the conversational partner's emotion. Lastly, the third box in the schematic represented an opportunity to express additional empathic responding and to continue the conversation with a cue to ask a relevant question. In the above example, an appropriate question might be, "Where does your brother live?" or "Do you get to talk with him often?" (Fig. 12.1).

After the visual schema is presented and explained, responses can be practiced by providing a statement of emotion or physical state and then guiding the individual through the framework. It is important to provide statements that cover a variety of emotion and physical states (e.g., stressed, sick, excited, bored, happy, scared) so that the individual has opportunities to practice responding to these different types of emotional statements. At the beginning of intervention, it may be necessary to help some individuals come up with appropriate empathetic responses; however, as experience is gained, assistance can be faded. Practice during conversations with similarly aged peers can also be helpful, particularly if the peer provides opportunities for empathetic responding. Video modeling has also been a helpful intervention, wherein the practice conversations are recorded and then reviewed, discussing responses for improving future conversations (Koegel & Koegel, 2018). During the video modeling sessions, it is helpful to begin by reviewing positive examples, wherein the individual responded with appropriate empathy, then move to the examples that could use some improvement, and finally review additional positive examples. By sandwiching the "needs improvement" between successful examples, a positive learning environment is created.

These strategies have been shown to improve empathetic listening and expressive verbal statements. Measurement has calculated the percent of opportunities when the individual responds with the on-topic empathic statement and asks an empathetic question (i.e., on-topic questions when given an empathetic opportunity). Social validation has also been demonstrated after acquiring this communicative skill, as individuals with ASD self-report improved confidence levels during their conversations with peers (Koegel et al., 2015). Lastly, some individuals have also improved on a measured empathy quotient following support in this area (Baron-Cohen & Wheelwright, 2004).

12.7 Summary

Empirical evidence has shown that PRT is an effective, evidence-based intervention for individuals with ASD. A key component to the success of PRT is utilizing a variety of motivational strategies which can be applied to a variety of different target areas. When used in combination, these components capitalize on the individual's motivation to respond, creating an environment for increased performance and decreased interfering behaviors (Koegel, Singh, et al., 2010). To date, several pivotal areas have been researched, including the important core areas of motivation,

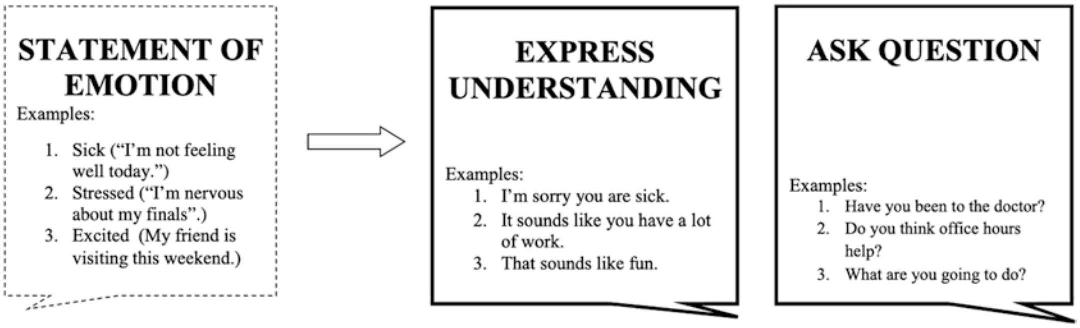

Fig. 12.1 This figure shows the schematic used to with adults to improve empathetic responding during social conversation

initiations, self-management, and empathy. No doubt, other important pivotal areas will be identified, and the relative importance of areas will be further researched. However, at this point, the goal of PRT is to speed up the habilitation process, with a focus on the individual with ASD's strengths, to ensure that the intervention is enjoyable for both the individuals providing and receiving the intervention, and to make meaningful and widespread differences. While there is still a great need for research to further improve the interventions for individuals with ASD, there has progress in defining attainable and measurable goals, coordinating across environments particularly with respect to involving families, providing inclusive environments, and implementing effective and efficient naturalistic interventions, such as PRT (Koegel et al., 1983).

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13 Video Modeling Instruction for Individuals with Autism Spectrum Disorder

Ruth M. DeBar, Courtney L. Kane, and Jessica L. Amador

13.1 Video Modeling Instruction for Individuals with Autism Spectrum Disorder

Video modeling (VM) is a well-established instructional strategy that has been used to effectively teach individuals with autism spectrum disorder (ASD) diverse skills from commenting while playing games (e.g., Ezzedine et al., 2020) to prosocial skills like helping (e.g., Reeve et al., 2007), to abduction prevention skills (Abadir et al., 2021), to adaptive skills like mobile device usage (e.g., Horn et al., 2021) and appropriate social communicative skills (e.g., making small talk and accepting criticism) while simultaneously teaching vocational skills (Stauch & Plavnick, 2020), and to increasing appropriate transitions (Cihak et al., 2010).

The purpose of this chapter is to review terminology of VM; review VM research across play, social communication, safety skills, functional living skills, role in reducing problem behavior, caregiver-implemented VM, and evaluations exploring sufficient and necessary prerequisites to VM; and review comparative research. Areas of future research will be discussed as well as support for VM as an evidence-based practice.

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13.1.1 Advantages of VM

There are several advantages that VM may offer when instructing individuals with ASD. Instruction incorporating VM may lessen attending and language requirements, may be provided in the absence of social interactions with clinicians or educators, and may increase motivation for participation as it includes a visually preferred medium (i.e., videos; Sherer et al., 2001) for individuals with ASD. Additionally, video models may more readily capture meaningful aspects of the environment (e.g., sound, movement) than is permissible through vocal descriptions or static pictures, can be produced by caregivers and practitioners, and can be used across a range of settings and situations (Schreibman et al., 2000). VM has also been found to be resource and time efficient compared to in vivo modeling (Charlop-Christy et al., 2000). It also helps to standardize modeling procedures (Gardner & Wolfe, 2013). VM may also prove especially advantageous to teach certain skills where learning opportunities are limited, like safety skills. For example, VM may permit safe simulation of potentially dangerous scenarios without directly placing the participant in harm's way. As it is especially important for safety skills, VM may also easily allow practitioners to program for generalization using strategies including programming common stimuli (Abadir et al., 2021; Carlile et al., 2018).

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13.1.2 Terminology

As discussed by Rayner et al. (2009), the efficacy of video-based instruction (VBI) including video modeling (VM) may best be accounted for via observational learning and imitation. VBI is a broad term used to encompass a range of procedures involving interventions that present videos as the independent variable (Rayner et al., 2009). As shown in Table 1, subtypes of VBI may include video modeling (VM), video self-modeling (VSM), and video prompting (VP). VM involves presenting participants with a video recording of a model (e.g., adults or peers) engaged in specific scripted behaviors (actions and/or vocalizations) and then providing the opportunity to emit the modeled response (MacDonald et al., 2015). Although VM may include different types of models (e.g., peers, adults), VSM involves viewing a video recording of the participant as the model who is engaged in some form of adaptive behavior (Dowrick, 1999). It has been suggested that VSM may enhance motivation to view the video as participants may prefer viewing themselves rather than another (Sherer et al., 2001). VSM can be further categorized as feedforward or as positive self-review (Dowrick, 1999). Feedforward VSM typically involves component skills that are in the participant's repertoire albeit arranged in a new sequence or context to form a new behavior. The behavior video recorded maybe prompted or reinforced. Contrastingly, positive self-review entails creating a video recording during which the participant's behavior is edited so that desired performance present in the repertoire is demonstrated. Positive self-review involves presenting an exemplary performance of behavior that may be occurring below criterion level or that has failed to maintain. Feedforward VSM may involve additional technological support as the video is edited such that the participant views themselves emitting a future target not readily demonstrated (Bellini & Akullian, 2007).

Table 1 Definitions of Procedural Variations of Video-based Instruction

Video-based instruction (VBI)[a]	A range of instructional procedures involving videos as the primary independent variable (Rayner et al., 2009)
Video modeling (VM)[b]	An instructional procedure that involves presenting a video of a model engaging in target behaviors and then providing an opportunity for the participant to emit those behaviors (MacDonald et al., 2015)
Video self-modeling (VSM)[c]	An instructional procedure that involves presenting a video of the participant themselves as the model engaging in the target behavior and then providing an opportunity for the participant to emit those behaviors (Dowrick, 1999)
Feedforward[c]	A subtype of VSM that includes component skills in the participant's repertoire arranged into a new sequence or context
Positive self-review[c]	A subtype of VSM that includes an edited video recording of participant's responding to depict exemplary performance of the target behavior
Video prompting (VP)[a]	An instructional procedure in which the participant views a brief portion of the video and then providing an opportunity for the participant to engage in the target behavior before viewing the next video segment (Rayner et al., 2009)

[a]Rayner et al. (2009)
[b]MacDonald et al. (2015)
[c]Dowrick (1999)

If not using self as a model, VBI may include others as models (e.g., peers, adults, familiar adults; Abadir et al., 2021; Ezzedine et al., 2020; Kourassanis et al., 2015). Using others as models may offer advantages over VSM. One, it may be less effortful and efficient to use others as models and then create successful performance via video editing or prompting (Sherer et al., 2001). Additionally, VM may vary from perspective. Subjective point of view (or first-person; perspective of the viewer) involves presenting videos from the perspective of the participant. Videos presented from a subjective point of view typically omit a model or may show just the hands or relevant body parts relevant to the target behavior (Rayner et al., 2009). Contrastingly, videos filmed from a third-person perspective (also known as the perspective of the spectator; Cannella-Malone et al., 2006) show models of others or of the participant engaged in a scripted behavior to be imitated as if the viewer was an on-looker. Lastly, instead of viewing the entire video recording of the targeted response, VP refers to interventions during which the participant views a brief segment of the video and then is permitted to demonstrate the behavior modeled (Rayner et al., 2009). Although VP may at times be discussed in this chapter, by in large, the focus will be restricted to VM. If interested more about VP, please see the review conducted by Domire and Wolfe (2014).

13.1.3 Play

For some children with ASD, play may not emerge as it does for typically developing children; it may be ritualistic and repetitive and may lack imaginative themes (Boudreau & D'Entremont, 2010). VM has been found to be an effective instructional strategy to address deficits in play across solitary play (e.g., Blum-Dimaya et al., 2010; Sherrow et al., 2016), imaginative play (e.g., MacDonald et al., 2005; Palcehcka & MacDonald, 2010; Reagon et al., 2006), and social play (e.g., Ezzedine et al., 2020; Kourassanis et al., 2015).

VM has effectively taught play skills to a diverse range of participants including preschoolers (ages 3–5 years; Centers for Disease Control, 2020; e.g., Boudreau & D'Entremont, 2010; D'Ateno et al., 2003; Hine & Woolery, 2006; Lee et al., 2017, 2020; Palcehcka & MacDonald, 2010; Reagon et al., 2006) and young children (ages 6–8 years) (e.g., Besler & Kurt, 2016; Dupere et al., 2013; Ezzedine et al., 2020; Kourassanis et al., 2015; MacDonald et al., 2005, 2009; MacManus et al., 2015; Neff et al., 2017; Paterson & Arco, 2007). Fewer studies have included middle childhood (ages 9–11 years) (e.g., Blum-Dimaya et al., 2010; Macpherson et al., 2015), teenagers (ages 14–17 years), or adults (18 years and over; Centers for Disease Control, 2020) (Sherrow et al., 2016).

Requirements for inclusion varied across studies. Generalized imitation has been identified as a prerequisite for participating in some VM play skill research (e.g., Ezzedine et al., 2020; MacDonald et al., 2005; Palcehcka & MacDonald, 2010). Using an activity schedule with video models, one study that targeted playing Guitar Hero™ required participants to match colors, tolerate manual prompting, and have a history with activity schedules (Blum-Dimaya et al., 2010). Additional prerequisites included attending to a television monitor for a specified duration (Besler & Kurt, 2016; Neff et al., 2017; Sancho et al., 2010) and delayed object imitation (Palcehcka & MacDonald, 2010).

13.1.3.1 Types of Play

A variety of play skills have been taught using VM including solitary play (Blum-Dimaya et al., 2010; Sherrow et al., 2016), imaginative or symbolic play (e.g., Boudreau & D'Entremont, 2010; D'Ateno et al., 2003; Dupere et al., 2013; Lee et al., 2017; MacDonald et al., 2005; MacManus et al., 2015), and social play with peers (e.g., Ezzedine et al., 2020; Kourassanis et al., 2015; MacDonald et al., 2009). An early demonstration of VM to address play skills with children with ASD was conducted by MacDonald et al. (2005). Using adults as models and third-person perspective, two preschool boys with ASD were taught to engage in pretend play (motor actions and vocalizations with figurines) across three play sets (i.e., a town, a ship, and a house). Results suggested that VM was successful at teaching sequences of imaginative play with scripted statements and actions across participants and that behaviors maintained during follow-up probes. Using VM, symbolic or imaginary play has been effectively targeted using a wide range of play sets including a farm and farm animals, a doctor's clinic (Lee et al., 2017), a veterinary set (Boudreau & D'Entremont, 2010), and a kitchen set (D'Ateno et al., 2003). Additionally, VM has effectively established video game playing of Guitar Hero™ (Blum-Dimaya et al., 2010) and bowling via the Wii™ (Sherrow et al., 2016).

Social play has successfully been established using VM and has included a dyad or a small group. Kourassanis et al. (2015) taught two children with ASD to play Duck, Duck, Goose, and The Hokey Pokey. Generalization was assessed with an untrained game, Ring Around the Rosie. VM was found to be effective for teaching both games although the skill did not generalize to an untrained game.

Ezzedine et al. (2020) evaluated the effects of VM across dyads of individuals with ASD across on-task behavior and scripted statements during previously mastered board games (i.e., Candyland™, Memory™, Zingo™). Generalization of skills by an untrained peer with ASD was assessed. It was found that VM alone was effective for three of the six participants and that tangible reinforcement and prompts were required for the other participants to achieve mastery. Further, positive outcomes were maintained, and generalization was observed to increase over baseline levels.

Because they are often the most frequently available play partner, siblings may especially be valuable as play partners for individuals with ASD (e.g., Reagon et al., 2006; Taylor et al., 1999). For example, Reagon et al. (2006) evaluated imaginative play across play sets with a sibling as a play partner. Generalization of skills was assessed with the participant's mother and another sibling. VM was found to be effective, and skills were generalized to both the mother and sibling.

13.1.3.2 Procedural Variations of VM Targeting Play

When targeting play using VM, research has varied across complexity of behavior, perspective, and type of model. The length of behavioral chains targeted has ranged from 4–6 steps (e.g., Hine & Woolery, 2006; Reagon et al., 2006), 10–12 actions (Boudreau & D'Entremont, 2010; Sancho et al., 2010), 14–17 actions (e.g., MacDonald et al., 2005, 2009) to 28–40 scripted actions and vocalizations (e.g., MacManus et al., 2015; Palcehcka & MacDonald, 2010; Sherrow et al., 2016). Studies have presented video models using the third-person perspective (e.g., Ezzedine et al., 2020; Palcehcka & MacDonald, 2010; Sherrow et al., 2016; Spriggs et al., 2016) and first-person perspective (e.g., Sancho et al., 2010). Adults (e.g., Boudreau & D'Entremont, 2010; D'Ateno et al., 2003; Ezzedine et al., 2020; MacDonald et al., 2005, 2009), peers of typical development (e.g., Kourassanis et al., 2015; Lee et al., 2020; Reagon et al., 2006), participants (e.g., Lee et al., 2017), and caregivers (i.e., Sunyoung, 2016) have served as models.

Most studies have included videos generated by the experimenters (e.g., Ezzedine et al., 2020; Lee et al., 2017; MacDonald et al., 2005, 2009; Macpherson et al., 2015; Sancho et al., 2010) or a parent (Besler & Kurt, 2016). To date, one study has evaluated the comparative effectiveness of commercially available videos to instructor-created videos using a third-person perspective (Palcehcka & MacDonald, 2010). Results found that instructor-created videos led to acquisition while the commercially available videos did not and that results were maintained in the absence of the video.

Research has found that VM alone has been effective in establishing play skills including solitary (e.g., Blum-Dimaya et al., 2010; MacDonald et al., 2005, 2009; Sherrow et al., 2016) and social play (e.g., Ezzedine et al., 2020; Kourassanis et al., 2015). To enhance teaching procedures, some studies have redirected participants' attending to the video (e.g., Besler & Kurt, 2016; Paterson & Arco, 2007), whereas others have provided a least to most prompting procedure (i.e., gestural to verbal, to partial physical, to full physical contingent upon errors; Kourassanis et al., 2015). Another study included an error correction procedure of prompting the correct action, representing the model, and providing 2 s to imitate the action independently (Sancho et al., 2010). Although some studies have excluded reinforcement (e.g., D'Ateno et al., 2003; Dupere et al., 2013; Lee et al., 2017; MacDonald et al., 2005, 2009; Palcehcka & MacDonald, 2010; Sunyoung, 2016), others have included praise and physical contact for correct responding of the target behavior (e.g., Boudreau & D'Entremont, 2010; Kourassanis et al., 2015; Lee et al., 2020; Paterson & Arco, 2007). Others have provided edibles for attending and on-task behavior (e.g., Blum-Dimaya et al., 2010).

13.1.3.3 Generalization and Maintenance of Play

Across play research, stimulus generalization has widely been assessed and has included assessments across settings (e.g., Besler & Kurt, 2016; Blum-Dimaya et al., 2010; Hine & Woolery, 2006; Reagon et al., 2006), people (e.g., Dupere et al., 2013; Ezzedine et al., 2020), and untrained toys (e.g., Lee et al., 2017, 2020; Sancho et al., 2010; Spriggs et al., 2016). Overall, studies have reported an increase in generalization measures when compared to baseline (e.g., Besler & Kurt, 2016; Blum-Dimaya et al., 2010; Ezzedine et al., 2020; Hine & Woolery, 2006; Reagon et al., 2006).

Few studies targeting play skills with VM have directly discussed strategies to enhance generalization. One arrangement used to promote generative outcomes, matrix training, has been combined with VM to establish scripted actions and vocalizations (MacManus et al., 2015). Matrix training is a method to organize and select targets where some are directly taught while others are not (Curiel et al., 2020). Untrained combinations of targets are assessed to evaluate whether they have recombined in a novel way. MacManus et al. (2015) evaluated the effectiveness of VM and matrix training for teaching children with ASD scripted actions and vocalizations across three play scenarios and play sets. After VM across three play scenarios, scripted actions and vocalizations recombined in novel ways across play sets and materials across participants.

Researchers have also evaluated the efficacy of suitable loops to enhance generalization. By providing multiple exemplars of play to promote generalization of skills to untrained play materials (i.e., characters), suitable loops are similar to multiple-exemplar training (Dupere et al., 2013). Dupere et al. (2013) assessed the effects of video models with scripted suitable loops with trained and untrained characters. The suitable loop permitted participants to perform the same actions and vocalizations with trained characters that could be appropriately performed with untrained characters. Results indicated that participants incorporated untrained characters into their play, but to varying degrees.

A robust number of studies have explored the effectiveness of VM on the maintenance of play skills. Maintenance has been assessed as early as 7 days post-mastery (e.g., Paterson & Arco, 2007), while other studies assessed it up to a month later (e.g., Blum-Dimaya et al., 2010; Boudreau & D'Entremont, 2010; MacDonald et al., 2009). Most studies have reported positive outcomes of maintenance (e.g., Besler & Kurt, 2016; Ezzedine et al., 2020; Lee et al., 2020; Sani-Bozkurt & Ozen, 2015) though few studies have reported mixed outcomes of maintenance (e.g., Boudreau & D'Entremont, 2010).

13.1.3.4 Social Validity

Video modeling has been found to be a socially valid strategy to teach children with ASD play skills. A range of social validity measures have been included in the VM play skills literature (e.g., Besler & Kurt, 2016; Blum-Dimaya et al., 2010; Boudreau & D'Entremont, 2010; Kourassanis et al., 2015; Macpherson et al., 2015; Reagon et al., 2006; Sherrow et al., 2016) though there have been many studies that have excluded social validity measures (e.g., D'Ateno et al., 2003; MacDonald et al., 2005, 2009; MacManus et al., 2015; Palcehcka & MacDonald, 2010). Of the studies that have included social validity measures, many have been conducted with parents (e.g., Besler & Kurt, 2016; Boudreau & D'Entremont, 2010; Kourassanis et al., 2015), teachers or staff (e.g., Ezzedine et al., 2020; Sancho et al., 2010), and children directly involved in the study (e.g., Sherrow et al., 2016; Spriggs et al., 2016). Respondents reported procedures, goals, or outcomes to be socially valid (e.g., Besler & Kurt, 2016; Blum-Dimaya et al., 2010; Boudreau & D'Entremont, 2010; Ezzedine et al., 2020; Hine & Woolery, 2006; Kourassanis et al., 2015; Lee et al., 2020; Reagon et al., 2006; Sancho et al., 2010).

13.1.3.5 Reliability

Reliability measures of the dependent and independent variables have been robustly included in VM and play research. Studies have included interobserver agreement for at least 30% of sessions (e.g., Besler & Kurt, 2016; Blum-Dimaya et al., 2010; Macpherson et al., 2015; Palechka & Arco, 2010), while others have included 95% of sessions (e.g., Lee et al., 2017). Interobserver agreement measures have been reported to be acceptable (exceeding 80%, e.g., Besler & Kurt, 2016; Blum-Dimaya et al., 2010; Ezzedine et al., 2020; Hine & Woolery, 2006; Kourassanis et al., 2015; Lee et al., 2017, 2020; Reagon et al., 2006; Sancho et al., 2010).

Similar findings have been reported for procedural integrity (PI). PI data have been collected for a minimum of 25–30% of sessions (e.g., Hine & Woolery, 2006; Kourassanis et al., 2015; Sani-Bozkurt & Ozen, 2015), 33–50% of sessions (e.g., Blum-Dimaya et al., 2010; Ezzedine et al., 2020; Lee et al., 2017, 2020) to a maximum of 100% of sessions (Sunyoung, 2016) and were reported to be acceptable (e.g., Besler & Kurt, 2016; Blum-Dimaya et al., 2010; Ezzedine et al., 2020; Hine & Woolery, 2006; Kourassanis et al., 2015; Lee et al., 2017, 2020). Several studies have omitted PI measures (i.e., D'Ateno et al., 2003; Dupere et al., 2013; MacManus et al., 2015; Neff et al., 2017; Paterson & Arco, 2007; Reagon et al., 2006).

13.1.3.6 Future Research

While the corpus of research supporting the use of VM and play skills is well established, additional research is needed. Research exploring play with siblings and peers with ASD and of typical development would be valuable. Given the lack of research that has explored response generalization, additional research is needed. There is a dearth of research that has evaluated unscripted responses. Research should continue to explore teaching play in dyad and in small groups and consider teaching games on iPads®. Lastly, when using a video model, it may be beneficial to fade the video from the teaching procedures (Ezzedine et al., 2020). Although studies have included no-video probes during follow-up or maintenance probes (i.e., Boudreau & D'Entremont, 2010; Dupere et al., 2013; Hine & Woolery, 2006; Lee et al., 2020), few studies have incorporated procedures to fade the video.

13.1.4 Social Communication

Deficits in social communication and social interaction include limited reciprocal conversation, reduced sharing of interest, limited initiation and response to social interactions, deficits in nonverbal communicative behavior, and difficulties developing and maintaining relationships which are major diagnostic criteria for ASD (American Psychological Association [APA], 2013). VM has been used to address the core deficits of ASD since the late 1980s (Charlop & Milstein, 1989).

In one of the earliest studies, Charlop and Milstein (1989) taught three boys with ASD to engage in conversational speech using brief (45 s) video models in combination with an error correction procedure (i.e., re-presentation of videos contingent upon incorrect conversational performance). Subsequently, conversation skills were generalized to untrained conversation partners, settings, toys, and topics of conversation. Skills were maintained up to 15 months post-acquisition.

Since this study, researchers have used VM to teach social initiations (Buggey, 2012), sharing (Cardon et al., 2019; Jones et al., 2013), helping (Reeve et al., 2007), social responsiveness (Jones et al., 2013), greetings (Kouo, 2019), social interactions (Maione & Mirenda, 2006; Nikopoulos & Keenan, 2003, 2004, 2007; Tetreault & Lerman, 2010), verbal commenting (Charlop et al., 2010), joint attention (Ho et al., 2019), and social engagement (Ho et al., 2019). More recently, Kouo (2019) successfully taught five boys with ASD to engage in a three-step greeting skill (e.g., orienting toward person, engaging in vocal greeting, maintaining attention toward person) using a packaged intervention of VM plus reinforcement and error correction.

13.1.4.1 Procedural Variations of VM Social Communication Skills

VM to teach social communication skills has included adults (e.g., Charlop et al., 2010; Charlop & Milstein, 1989; Maione & Mirenda, 2006; Nikopoulos & Keenan, 2003; Reeve et al., 2007; Tetreault & Lerman, 2010), peers (e.g., Cardon et al., 2019; Nikopoulos & Keenan, 2003, 2004, 2007), and self-models (SVM; e.g., Buggey, 2012). Ho et al. (2019) reported to match models to physical descriptions of participants although they did not specify whether this included matching across age. Both point of view (POV; e.g., Kouo, 2019; Tetreault & Lerman, 2010) and third-person (e.g., Buggey, 2012; Charlop et al., 2010; Charlop & Milstein, 1989; Ho et al., 2019) video models have been used successfully. Video models ranged in duration from 18 s (e.g., Cardon et al., 2019) to 3 min (e.g., Buggey, 2012).

VM has been effective when used in isolation (e.g., Charlop et al., 2010) or as a part of an intervention package (e.g., Reeve et al., 2007). Charlop et al. (2010) were effective in teaching verbal commenting to three boys with ASD using VM in isolation. Similarly, Jones et al. (2013) were effective in establishing sharing, offering help, or responding to requests using VM in isolation. However, overall, VM in isolation has produced mixed outcomes in teaching targeted social communication skills (e.g., Buggey, 2012; Ho et al., 2019; Nikopoulos & Keenan, 2003, 2004). Procedural modifications including the addition of prompts (e.g., Maione & Mirenda, 2006; Tetreault & Lerman, 2010), error correction (e.g., Charlop & Milstein, 1989), video feedback (e.g., Maione & Mirenda, 2006), or modified videos (e.g., Nikopoulos & Keenan, 2003, 2004) have improved participant performance when VM procedures were limited in their effectiveness. For example, Maione and Mirenda (2006) added video feedback when frequencies of verbalizations did not increase for one activity with VM alone. When variability and perseverative behaviors continued, vocal prompts and video feedback were added. Subsequently, responding increased and prompts were faded (Maione & Mirenda, 2006).

13.1.4.2 Generalization and Maintenance of Social Communication

It is important that social communication skills occur in a variety of contexts and maintain over extended periods of time to be of optimal usefulness for individuals with ASD. Generalization of social communication skills has been evaluated in untrained contexts (e.g., Cardon et al., 2019), with peers (e.g., Charlop et al., 2010; Jones et al., 2013; Kouo, 2019; Nikopoulos & Keenan, 2003, 2007), in untrained activities (e.g., Nikopoulos & Keenan, 2003, 2004; Tetreault & Lerman, 2010), in untrained settings (e.g., Ho et al., 2019; Kouo, 2019; Nikopoulos & Keenan, 2003), with untrained people (e.g., Ho et al., 2019; Jones et al., 2013), and with untrained people in untrained locations (e.g., Charlop et al., 2010). Nikopoulos and Keenan (2007) evaluated the generalization of social initiations, reciprocal play, and object engagement with a peer not included in video models. Participants engaged in similar levels of behavior with the untrained peer as they did during VM training sessions.

Reeve et al. (2007) used multiple exemplars of verbal, nonverbal, and affective discriminative stimuli presented in video models showing an adult and child of typical development to establish a helping repertoire by children with ASD. It was found that helping occurred in the presence of untrained discriminative stimuli, in an untrained setting, and with an untrained instructor.

Maintenance of social communication skills established via VM has been evaluated from 7 days (e.g., Maione & Mirenda, 2006) to 15 months (Charlop & Milstein, 1989) post-mastery. Some studies have reported positive maintenance outcomes for social communication skills taught via VM (e.g., Charlop & Milstein, 1989; Maione & Mirenda, 2006; Nikopoulos & Keenan, 2004). For example, Charlop and Milstein (1989) found that conversational speech maintained up to 15 months post-acquisition. Similar to acquisition data, some researchers reported mixed outcomes of maintenance (e.g., Kouo, 2019; Nikopoulos & Keenan, 2003, 2007; Tetreault & Lerman, 2010) or that additional prompts were needed during maintenance sessions (e.g., Cardon et al., 2019).

13.1.4.3 Future Research

Future research should continue to evaluate best practices for using VM to teach social communication skills. Due to mixed outcomes (e.g., Buggey, 2012; Maione & Mirenda, 2006) and procedural modifications (e.g., Nikopoulos & Keenan, 2003; Tetreault & Lerman, 2010) needed to establish social repertoires, it would be valuable for researchers to identify for which skills (e.g., greetings, sharing) and for whom (e.g., learning history, characteristics) VM would be optimal. When additional procedures (e.g., prompts, error correction) are necessary for VM to be successful when teaching social communication skills, it will be important for researchers to identify variables or participant characteristics during which additional support is needed. To do so, component evaluations of treatment packages, of procedural modifications, and assessment of participant characteristics may help facilitate decision-making. Future research should continue to explore strategies that enhance generalization and maintenance of social communication skills to promote positive, lifelong social interactions across any number of social situations (e.g., work, school, community events).

13.1.5 Safety Skills

An emerging area that has incorporated VM with individuals with ASD is safety skill instruction. Safety skill instruction with VM has effectively established a range of skills including abduction prevention (e.g., responding to lures; Abadir et al., 2021; Akmanoglu & Tekin-Iftar, 2011; Godish et al., 2017), help-seeking when lost (e.g., Carlile et al., 2018), responding to bullying (e.g., Rex et al., 2018), use of first aid skills (e.g., Ergenekon, 2012), and promoting gun safety (e.g., Morgan & Miltenberger, 2017).

Addressing safety skills for individuals with ASD is important as they may be especially prone and susceptible to danger. Characteristic features of ASD like language and communication deficits (APA, 2013) may make responding and reporting dangerous situations to caregivers challenging. Second, it has been reported that about half of children with ASD engage in elopement (Autism Speaks, 2017; Carlile et al., 2018; Centers for Disease Control, 2019). Elopement may increase the risk of getting lost, experiencing an abduction attempt, or drowning, which is one of the leading causes of death in children with ASD (Autism Speaks, 2017; Guan & Li, 2017). Further, 65% of school-aged or teenagers with ASD report experiencing bullying (Autism Speaks, 2017). Safety skill instruction including abduction prevention and responding to bullying may help prevent mitigate risks and teach children with ASD how to respond when faced with such scenarios.

13.1.5.1 Procedural Variations of VM Targeting Safety Skills

Researchers have successfully taught safety skills using VM since the 2000s (e.g., Akmanoglu & Tekin-Iftar, 2011). In one of the earliest studies, Akmanoglu and Tekin-Iftar (2011) evaluated the effects of VM, graduated guidance, and community-based instruction (CBI) to teach abduction prevention skills. Participants first viewed the video model, and then the teacher left the area, while a probe session was conducted during which a stranger participant (i.e., university students, graduate students, lectures, and researcher's friends) attempted to lure the participant. If an appropriate response did not occur, the teacher returned to implement graduated guidance to occasion the correct targeted abduction prevention response. This and later studies (e.g., Abadir et al., 2021; Akmanoglu & Tekin-Iftar, 2011; Carlile et al., 2018; Ergenekon, 2012; Godish et al., 2017; Morgan & Miltenberger, 2017; Rex et al., 2018) successfully taught participants targeted safety responses. More recently, Abadir et al. (2021) used VM to successfully teach four individuals with ASD to differentially respond to lures of strangers, known persons who presented an incorrect safety code word, and known persons who presented a correct code word. Although effective, procedural modifications were required and included an error correction procedure for one participant and vocal instructions for two participants. Responding was generalized to untrained locations, lures, and people.

Across safety skills using VM, the number of steps targeted in task analyses varied from two

(Akmanoglu & Tekin-Iftar, 2011) to nine (Carlile et al., 2018). Using a three-step behavior chain, Morgan and Miltenberger (2017) taught a gun safety response of not touching the gun, leaving the room, and telling an adult. Regardless of the number of steps targeted, all abduction prevention studies taught participants to say "No" and leave the area (Abadir et al., 2021; Akmanoglu & Tekin-Iftar, 2011; Godish et al., 2017). Godish et al. (2017) added the step of telling an adult; Abadir et al. (2021) were the first to include asking for and responding to correct and incorrect code words. Carlile et al. (2018) used technology across skills targeted by teaching participants to either answer or make a FaceTime™ call and show their location. They also taught low-tech help-seeking behaviors which included handing an identification card to a store employee. The range of steps targeted across studies demonstrates that VM can be used effectively in teaching relatively short (e.g., Akmanoglu & Tekin-Iftar, 2011) to complex safety responses (e.g., Carlile et al., 2018).

VM instruction has been conducted in a range of settings including participant's homes (e.g., Morgan & Miltenberger, 2017), classrooms (e.g., Abadir et al., 2021), and community settings (e.g., Godish et al., 2017). Safety skills taught via VM in classrooms were then evaluated in untrained settings (e.g., community playground; e.g., Abadir et al., 2021) or trained in situ in the community (e.g., Akmanoglu & Tekin-Iftar, 2011). Some researchers have conducted sessions in the relevant natural setting. For example, Morgan and Miltenberger (2017) trained gun safety responses in the home setting, a place likely where a child might encounter a gun. Settings were extended to untrained rooms or community settings to evaluate stimulus generalization as well (e.g., Carlile et al., 2018).

Individuals with ASD (e.g., Abadir et al., 2021; Akmanoglu & Tekin-Iftar, 2011; Carlile et al., 2018; Ergenekon, 2012; Godish et al., 2017; Morgan & Miltenberger, 2017; Rex et al., 2018) and multiple disabilities (e.g., Akmanoglu & Tekin-Iftar, 2011) were represented across studies targeting safety skills. Participants were mostly male and ranged in age from 3 (e.g., Carlile et al., 2018) to 14 years old (Carlile et al., 2018). The youngest participants (under age 6; Carlile et al., 2018) learned to seek help when lost using VM and simulated community environments. Research has focused on participants in the middle childhood age group (ages 6–11 years; CDC, 2020). Participants in this age group learned to respond to abduction attempts (e.g., Abadir et al., 2021; Akmanoglu & Tekin-Iftar, 2011; Godish et al., 2017), help-seeking when lost (e.g., Carlile et al., 2018), first aid skills (e.g., Ergenekon, 2012), responses to bullying (e.g., Rex et al., 2018), and firearms safety (e.g., Morgan & Miltenberger, 2017). Although safety skill research included a range of participant ages, inclusionary criteria for participation varied across studies. Several studies did not specify what criteria participants had to meet prior to participation (e.g., Godish et al., 2017). Most research frequently required some level of imitation skills for participation (e.g., Abadir et al., 2021; Akmanoglu & Tekin-Iftar, 2011; Carlile et al., 2018). Attending to videos (e.g., Ergenekon, 2012), waiting (e.g., Abadir et al., 2021; Akmanoglu & Tekin-Iftar, 2011), discrimination skills (e.g., Abadir et al., 2021; Akmanoglu & Tekin-Iftar, 2011), and direction following (e.g., Akmanoglu & Tekin-Iftar, 2011) were each also reported.

Video characteristics (e.g., model, voice-over, duration) have varied with successful outcomes. Studies have almost exclusively included peer models (e.g., Abadir et al., 2021; Akmanoglu & Tekin-Iftar, 2011; Ergenekon, 2012; Godish et al., 2017; Morgan & Miltenberger, 2017). When targeting bullying skills, Rex et al. (2018) included both teenage and adult models within their video models. The duration of videos ranged from 7 s (Abadir et al., 2021) to 6 min (Godish et al., 2017). Some studies included voice-over (e.g., Godish et al., 2017; Morgan & Miltenberger, 2017); however, most studies reviewed did not specify whether voice-over or text captions were included.

Procedural components (e.g., prompts, error correction) have also varied across studies. VM in isolation was effectively used (Rex et al., 2018) to teach assertive responses in response to bullying scenarios. Error correction procedures, if included, have involved representing the video model and/or prompts to complete steps. For example, Carlile et al. (2018) interrupted the error, presented the video model demonstrating the correct step performance, and provided another opportunity to complete the step. Studies that included reinforcement during VM or in situ probes often used praise for correct responding (e.g., Ergenekon, 2012). Akmanoglu and Tekin-Iftar (2011) provided praise and an edible for correct responding which was faded to the end of session upon achieving mastery criterion. Abadir et al. (2021) specifically indicated that contrived reinforcers were omitted, while remaining studies did not specify the use of reinforcement. Multiple component treatment packages consisted of VM plus prompts and reinforcement (e.g., Akmanoglu & Tekin-Iftar, 2011; Morgan & Miltenberger, 2017). For example, when teaching gun safety, 10 s delays were incorporated within video models to allow participants the opportunity to respond and caregivers to provide prompts and praise for correct responding (Morgan & Miltenberger, 2017). POV VM was used to successfully teach a high- and low-tech help-seeking response when lost in a store (Carlile et al., 2018). No other studies were reported to use POV VM.

Few studies reported procedural modifications when VM alone or VM and in situ training were not effective in teaching or maintaining safety skills. Godish et al. (2017) first added in situ training for participants who did not engage in safety responses during follow-up in situ assessments during in situ training. For one participant, an edible was presented when correct responding to lures did not occur. The limited need for procedural modifications suggests that VM procedures as described were successful in teaching safety responses without additional modifications.

Given that safety skill instruction involves the presentation of potentially dangerous situations, safety monitoring and evaluation of negative side effects are important considerations. VM studies have reported to monitor the safety of participants during community sessions by having a confederate or researcher within the line of sight (e.g., Carlile et al., 2018; Godish et al., 2017). Few studies have evaluated potential negative side effects of participation (Godish et al., 2017; Rex et al., 2018). One study reported terminating sessions when negative side effects were observed; however, no sessions were terminated (Rex et al., 2018). Another study asked parents to rate whether any negative side effects were experienced by participants at the end of the study (Godish et al., 2017). Outcomes indicated that participants did not demonstrate any negative side effects. In fact, no studies have reported negative side effects from the use of VM to teach safety skills; however, it is ethically important that these effects are monitored so modifications can be made if participants demonstrate them.

Confederates are individuals recruited by the experimenter who are trained to implement specific portions of the study, while participants are unaware that this individual is a part of the study. Within the safety skill VM research, confederates have been used to help ensure safety of participants. For example, Carlile et al. (2018) had confederates positioned where they could monitor participant safety during all community-based sessions. Within abduction prevention studies, confederates were trained to act as “strangers” or “known persons” to present lures to participants during in situ assessment or training sessions (e.g., Abadir et al., 2021; Akmanoglu & Tekin-Iftar, 2011; Godish et al., 2017). Abadir et al. (2021) recruited 35 adults, whom they trained via behavior skills training to serve as both “strangers” and “known persons” to deliver lures across participants and conditions. Akmanoglu and Tekin-Iftar (2011) recruited 4 adults to participate in video models and 27 adults to serve as “strangers” during instruction, generalization, and maintenance. Confederates were limited to two non-consecutive sessions per week, seemingly to maintain unfamiliarity. Godish et al. (2017) reported that men and women in their 30s participated during in situ assessment sessions. No confederates were reported across gun safety, fire safety, bullying, or first aid skills studies.

13.1.5.2 Generalization and Maintenance of Safety Skills

Safety skill instruction incorporating VM has robustly programmed for and assessed stimulus generalization. Generalization of safety responses has been assessed across locations (e.g., Akmanoglu & Tekin-iftar, 2011), materials (e.g., Ergenekon, 2012), untrained people (e.g., Abadir et al., 2021), and in situ probes (e.g., Godish et al., 2017). Across studies, generalization was programmed via multiple exemplar training (e.g., Godish et al., 2017) and programming common stimuli (e.g., Carlile et al., 2018). To be functional, skills must be demonstrated under untrained situations including across settings, with people, and variations of relevant features of the environment. We were unable to identify any studies that have included strategies for programming for or assessing response generalization.

Safety skills must maintain over the course an individual's life, especially as opportunities to practice skills acquired in the natural setting will presumably be infrequent. The evaluation of maintenance using VM to target safety skills has been included across the majority of safety skill research and has occurred 1 (e.g., Morgan & Miltenberger, 2017) to 11 weeks post-mastery (e.g., Godish et al., 2017). Ergenekon (2012) evaluated the maintenance of first aid skills 2, 4, and 6 weeks post-mastery with positive outcomes across participants and skills. Results of maintenance evaluations suggest that abduction prevention responses (e.g., Abadir et al., 2021; Akmanoglu & Tekin-Iftar, 2011; Godish et al., 2017), gun safety responses (e.g., Morgan & Miltenberger, 2017), first aid skills (e.g., Ergenekon, 2012), and help-seeking when lost (e.g., Carlile et al., 2018) were maintained at mastery criteria levels when assessed.

Although the inclusion of caregivers or peers may facilitate generalization or maintenance as these individuals may provide natural communities of reinforcement or may serve as common stimuli in the generalization environment, few studies included caregivers (e.g., Carlile et al., 2018; Godish et al., 2017; Morgan & Miltenberger, 2017). When present, caregivers implemented VM sessions, provided prompts and reinforcement, and set up all in situ probes during gun safety instruction (Morgan & Miltenberger, 2017). Godish et al. (2017) trained parents to implement in situ training for participants who did not engage in correct abduction prevention responses during in situ probes. Caregivers were also included in post-intervention sessions (e.g., Carlile et al., 2018). Carlile et al. (2018) asked caregivers to implement one community-based post-intervention session during which they walked or looked away from the participant to evaluate whether the participant would use the high- or low-tech help-seeking behaviors taught.

13.1.5.3 Social Validity

The social acceptability of goals for safety studies, procedures to teach safety skills, and outcomes of these studies is important when considering how to apply studies clinically or identify avenues for future research. Social validity of procedures has been overwhelmingly positive indicating that stakeholders value this method for teaching safety skills to individuals with ASD (e.g., Abadir et al., 2021; Akmanoglu & Tekin-Iftar, 2011; Carlile et al., 2018; Godish et al., 2017). Parents (e.g., Abadir et al., 2021; Akmanoglu & Tekin-Iftar, 2011; Carlile et al., 2018; Ergenekon, 2012; Godish et al., 2017), school staff (Carlile et al., 2018), teachers (Abadir et al., 2021), first responders (Carlile et al., 2018), and Board Certified Behavior Analysts™ (Abadir et al., 2021) have served as respondents assessing studies' procedures, goals, and outcomes. For example, Akmanoglu and Tekin-Iftar (2011) asked parents to evaluate goals, procedures, and outcomes using a researcher-developed questionnaire. Parents rated procedures, goals, and outcomes positively. Ergenekon (2012) included normative data as social comparisons and included 20 first and third graders who completed the targeted first aid skills. Performance of these children was compared to that of study participants. Study participants performed better than the control group on targeted first aid skills; researchers concluded participant performance was socially acceptable.

13.1.5.4 Future Research

Although the VM literature has covered a large breadth of safety skills, additional research is needed to replicate and extend research across additional participants, stimuli, and behaviors (e.g., safely responding to dangerous substances). Research should seek to include participants from other age groups as safety skills are likely still an important skill for those individuals. Specifically, adults may require training in safety skills as they gain increased independence in the home and community. Given the dearth of research across these areas and the need to enhance external validity, future research should replicate and extend research exploring the effectiveness of video modeling on bullying, first aid, and dangerous stimuli. Future research should also seek to evaluate the use of VM interventions to teach responses to cyber bullying, swimming skills or water safety, fire safety, how to call 911, sexual abuse prevention, on-line predatory behavior, street crossing, and other dangerous stimuli (e.g., poison, chemicals, medicine, suspicious packages). These areas are lacking from the current VM literature but remain important for a functional repertoire of safety skills for individuals with ASD and to reduce risk of harm or injury. If individuals can safely respond to dangerous situations in the absence of caregivers, they may require less supervision and have greater opportunities for independent living, travel, or work. Limited information regarding pre-experimental assessments or participant history with VM leads to additional questions regarding sufficient and necessary prerequisite skills for successfully responding to VM. Prerequisite skill assessments will allow for clinicians to determine whether their clients would potentially learn this skill. This information may be increasingly important as duration of videos and lengths of chained behaviors to be taught may vary greatly across the type of safety skills; thus, the necessary prerequisite skills may also vary. Future research should seek to include additional evaluations of possible negative effects resulting from study participation. These could include ongoing measures of potential side effects (e.g., aversive reactions, undesirable generalization) via formal surveys, interviews, parental report, or evaluations of behavioral indicators (e.g., crying) during sessions. Finally, response generalization should also be considered in future research and instruction as there may be multiple effective behaviors that would result in ultimate safety in any given situation. For example, after learning to apply a bandage to a small cut on the arm, it would be functional to apply bandages to different body parts when injured or to cuts of different sizes.

13.1.6 Functional Living Skills

A broad range of functional living skills have been addressed through VM including cleaning (e.g., Aldi et al., 2016), vocational and employment skills (e.g., Allen et al., 2010; Bross et al., 2020; English et al., 2017), self-help skills like snack making (Shrestha et al., 2013), toileting skills (Drysdale et al., 2015), oral hygiene (Popple et al., 2016), and skills that provide access to the greater community (e.g., teaching mobile device use, Horn et al., 2021, and completing exercise behaviors in a community fitness center, Pinter et al., 2021). Examples of vocational skills targeted include acting as a mascot and engaging with customers (e.g., waving, shaking hands, giving high-fives; Allen et al., 2010), customer service skills (Bross et al., 2020), and vocational gardening (English et al., 2017).

13.1.6.1 Procedural Variations of VM Targeting Functional Living Skills

Participants have included young children of 4 and 5 years old (Drysdale et al., 2015; Shrestha et al., 2013) and participants up to young teenagers (Popple et al., 2016) although most studies included young adults (Pinter et al., 2021; Stauch & Plavnick, 2020) and adults (Aldi et al., 2016; Allen et al., 2010; Bross et al., 2020; English et al., 2017; Horn et al., 2021). Settings have included participant's homes (e.g., Aldi et al., 2016; Drysdale et al., 2014; Popple et al., 2016), employment settings (e.g., Allen et al., 2010; Bross et al., 2020; English et al., 2017), a university (Horn et al., 2021), and a healthcare agency (Stauch & Plavnick, 2020). Video models have largely been presented on mobile devices—iPad®, iPods®, or iPhones® (e.g., Aldi et al., 2016; English et al., 2017; Horn et al., 2021; Pinter et al., 2021), which enhances community access and social validity. Further, most studies have included voice-over and/or text (e.g., Aldi et al., 2016; Bross et al., 2020; Drysdale et al., 2014; English et al., 2017; Horn et al., 2021; Pinter et al., 2021).

Researchers have taught functional living skills using POV VM (Aldi et al., 2016; English et al., 2017; Shrestha et al., 2013), third-person perspective (e.g., Bross et al., 2020; Pinter et al., 2021; Stauch & Plavnick, 2020), or a combination of both (Allen et al., 2010; Drysdale et al., 2015; Horn et al., 2021). For example, Aldi et al. (2016) used POV VM with voice-over instruction presented on an iPad® to teach three different activities of daily living (e.g., making a snack, setting the table, and folding jeans) for two 18-year-old males with ASD. Video models showed hands and arms of family members completing tasks. Across participants, tasks were successfully mastered. One participant maintained responding in the absence of the video model.

Horn et al. (2021) employed a combination of first- and third-person perspectives combined with voice- and text-over instruction to teach receiving a phone call, sending a text message, and initiating a phone call to adults with ASD. The intervention effectively led to the acquisition of the targeted skills across participants.

Although intervention outcomes have been positive, few studies have evaluated VM in isolation (e.g., Aldi et al., 2016; Allen et al., 2010; Popple et al., 2016). Many have included error correction and prompts (e.g., Horn et al., 2021; Pinter et al., 2021), while others have incorporated forward chaining (e.g., Shrestha et al., 2013).

13.1.6.2 Generalization

Generalization measures have mainly included stimulus generalization (e.g., Bross et al., 2020; English et al., 2017; Horn et al., 2021; Shrestha et al., 2013; Stauch & Plavnick, 2020). For example, Horn et al. (2021), who targeted mobile device usage, assessed generalization in an untrained setting and with an untrained mobile device. Few studies have explicitly identified strategies to program for generalization. Using VM to target vocational and social skills (i.e., small talk, accepting criticism, accepting a compliment) for two adolescents with ASD, Stauch and Plavnick (2020) incorporated multiple exemplars of models, social partners, materials, and vocal statements by creating three to five variations of videos per skill. Although both participants acquired skills, vocational skills were acquired more readily than the social skills.

13.1.6.3 Reliability

Reliability of the dependent variables has been robustly included in the research (e.g., Aldi et al., 2016; Allen et al., 2010; Bross et al., 2020; English et al., 2017; Horn et al., 2021; Pinter et al., 2021). Data have been collected minimally for 20% of sessions (e.g., Bross et al., 2020; Drysdale et al., 2014) often exceeding minimal standards (e.g., Horn et al., 2021; Stauch & Plavnick, 2020); data have been appropriate. Reporting of procedural integrity data has been under-reported (e.g., Aldi et al., 2016; Allen et al., 2010; English et al., 2017; Pinter et al., 2021; Popple et al., 2016). When included, data have been collected across an appropriate percentage of sessions (e.g., Shrestha et al., 2013; Stauch & Plavnick, 2020), and the data have been acceptable.

13.1.6.4 Future Research

Although there have been some diverse areas addressed within functional living skills, continued research is needed. Vocational research is needed with participants who are prevocational (e.g., at least 14 years of age). Future researchers may wish to explore conditions during which voice-over or text-over are most effective. Additionally, it will be important for future research to explore optimal treatment components that produce best outcomes and how treatment components may be informed by participant characteristics. Also, it will be important that reliability of the independent variable is collected.

13.1.7 Addressing Problem Behaviors

An innovative application of VM with individuals with ASD has been addressing problem behaviors including aggression (Buggey, 2005; Sadler, 2019a, b), disruptions (Schreibman et al., 2000), off-task behaviors (Coyle & Cole, 2004), transitions (Schreibman et al., 2000; Taber-Doughty et al., 2013), and increasing on-task behaviors (Schatz et al., 2016) and compliance (Diorio et al., 2019). Participants have been as young as 3 years old (Schreibman et al., 2000) and have included elementary-aged participants (e.g., Cihak et al., 2010), middle-school-aged participants (Buggey, 2005), and high schoolers (Taber-Doughty et al., 2013). Interventions have been implemented in variety of school (e.g., Diorio et al., 2019; Sadler, 2019a, b; Schatz et al., 2016) and community settings (e.g., Schreibman et al., 2000; Taber-Doughty et al., 2013). For example, Taber-Doughty et al. (2013) evaluated the effectiveness of a self-operated (i.e., participant initiated) VM with voice-over presented on an iPad® on independent task completion, duration of task transitions, and independent transitions with four high school students implemented in a schoolwork room, grocery store, and bowling alley.

13.1.7.1 Procedural Variations of VM Targeting Functional Living Skills

Research addressing problem behaviors has predominately included VSM (e.g., Sadler, 2019a, b), while few researchers have used a third-person perspective (e.g., Taber-Doughty et al., 2013; Schatz et al., 2016). Sadler (2019b) evaluated the efficacy of using VSM to reduce aggression and establish replacement behaviors (e.g., requesting a break or an item) with three children with ASD. The video self-model showed the participant engaged in a socially appropriate behavior (or a replacement behavior) during conditions that typically evoked problem behavior. Additionally, the videos included a title page and a participant-specific preferred song with an animated character (i.e., Baby Einstein sock puppets) and/or background effects (e.g., applause) to enhance attending. It was concluded that the VSM produced strong outcomes for reducing aggressive behavior and moderate support for increasing a replacement behavior.

Research findings exploring the use of VM to decrease problem behavior and/or increasing compliance and on-task behaviors have several areas of strength. Overall, findings indicate that VM can lead to positive outcomes related to reducing problem (e.g., Sadler, 2019a, b) or increasing appropriate behaviors (e.g., Diorio et al., 2019) across school (e.g., Buggey, 2005) and community settings (e.g., Taber-Doughty et al., 2013). Positive outcomes were observed in the absence of reinforcement for the targeted response although few did incorporate it (praise; Cihak et al., 2010). Several researchers provided praise, a tangible (e.g., Schreibman et al., 2000), or an edible for video viewing (Diorio et al., 2019), whereas others embedded preferred songs, animated characters (Sadler, 2019b), or praise (e.g., Buggey, 2005) in the videos. Moreover, positive outcomes were achieved with VM alone (Schatz et al., 2016; Schreibman et al., 2000). Some research incorporated error correction procedures involving representing the video (e.g., Diorio et al., 2019), use of a modified system of least prompts (Taber-Doughty et al., 2013), or a combination of representing the video with least to most prompts (e.g., Cihak et al., 2010). No studies, to our knowledge, made procedural modifications to achieve favorable outcomes. Maintenance of the intervention effects had been assessed across several days (Sadler, 2019b) to 2 weeks (e.g., Coyle & Cole, 2004), 3 weeks (Buggey, 2005), 1 month (Schreibman et al., 2000), and 9 weeks (e.g., Cihak et al., 2010). There is preponderance of support for problem or adaptive behaviors established through VM to be maintained (e.g., Schreibman et al., 2000) following the termination of the intervention although a single study reported mixed findings (Schatz et al., 2016). Measures of reliability for the dependent variable(s) were robustly reported. Across students, interobserver agreement data were collected for an acceptable percentage of sessions, and mean IOA was at least 80%.

13.1.7.2 Future Research

Although this is an interesting application of VM, there are areas that future researchers may wish to explore. One, it would be important to incorporate best practices when assessing problem behavior including the incorporation of functional behavioral assessments. None of the aforementioned studies included an experimental functional analysis to inform interventions or replacement behaviors targeted, whereas few studies referred to the inclusion of functional behavioral assessments (Sadler, 2019a, b), even though these components are best practices for treating challenging behaviors. Most of the research has been conducted with children (e.g., Diorio et al., 2019; Schreibman et al., 2000). It behooves researchers to explore the effectiveness of VM with additional participants, especially adolescents and adults. Further, it would be important to explore VM across additional targets behavior (e.g., self-injurious behaviors, stereotypy) and across additional settings (e.g., homes, residential placements). Several studies included portable technology like the use of iPad® and iPods® (e.g., Cihak et al., 2010; Diorio et al., 2019; Taber-Doughty et al., 2013). Use of portable technology should be further explored and may offer additional advantages including accessibility in community settings and increased social validity. Most research reviewed did not actively include parents (e.g., Buggey, 2005; Cihak et al., 2010); none included siblings or peers (except as a model; Buggey, 2005). Incorporating caregivers, siblings, and peers should be a research priority, as they can help maintain favorable outcomes in the natural environment. Because most of the research did not assess nor program for generalization, it is important that this be an area of focus for future researchers. Reliability measures for the independent variables were lagging in the aforementioned studies (e.g., Buggey, 2005; Sadler, 2019a, b; Schatz et al., 2016) although, when included, data were appropriate (e.g., Cihak et al., 2002; Coyle & Cole, 2010).

13.1.8 Caregiver Implemented

Some VM research has focused upon caregiver implementation (e.g., Besler & Kurt, 2016; Cardon, 2012; Clark et al., 2020). Cardon (2012) evaluated whether caregivers could be taught to implement an imitation protocol, Video Modeling Imitation Training (VMIT), targeting five one-step imitative actions with young children with ASD. It was found that caregivers could learn to create video models and could implement the protocol with integrity (i.e., at least 95% of sessions). With VMIT, imitation skills increased (two met mastery criteria), and during follow-up probes, skills were maintained and generalized to targets modeled in vivo.

Targeting solitary play, Besler and Kurt (2016) trained parents to prepare a task analysis, create materials, select the model, choose the location, create the video, and transfer it to a computer. It was found that parents implemented VM with a level of high integrity and successfully taught building a Lego™ train.

In another study implemented by parents, written instructions and VM were evaluated on parent-implemented feeding interventions for children with ASD to address food selectivity (Clark et al., 2020). Written instructions and VM were effective for one caregiver to achieve mastery, while two caregivers required in vivo modeling and feedback.

13.1.9 Prerequisite Skill

Evaluating prerequisite skills sufficient and necessary for acquisition of skills through VM has more recently been explored (MacDonald et al., 2015; Tereshko et al., 2010). It has been suggested that attending to a video or model and an imitative repertoire may be an important prerequisite to acquiring skills through VM (McCoy & Hermansen, 2007). As discussed by Tereshko et al. (2010), remembering (or successive discriminations) viewed behaviors modeled in the video prior to the opportunity to emit the scripted behaviors likely impacts acquiring skills from a video model. Use of delayed match-to-sample procedures permits assessment of this repertoire and has been used in past research to assess memory (MacDonald et al., 2015).

To further explore the role of prerequisite skills, Tereshko et al. (2010) assessed skills deemed important to learning from VM. Second, they evaluated a segmented VM procedure involving forward chaining on teaching an eight-step behavioral chain to participants who were unable to learn from traditional VM. During the segmented VM procedure, the full video model was broken down into segmented steps. Across sessions, the first step of the model was presented, and then the participant was provided the opportunity to complete that step. Once mastered, steps systematically increased in a forward chain progression. Regarding prerequisite skills, they pre-experimentally evaluated motor imitation, action with objects, delayed and simultaneous match-to-sample performance (i.e., picture to object, computer screen to object, delayed picture to object, delayed computer screen to object), motor skills, and attending to videos. It was found that three of the four participants demonstrated deficits in delayed match-to-sample performance (i.e., delayed picture to object, delayed computer screen to object) although they demonstrated mastery across motor and object imitation and attending to a video. While these participants were unable to learn from traditional VM, the use of a segmented video model was effective at establishing an eight-step chain.

MacDonald et al. (2015) extended Tereshko et al. (2010) by further exploring the role of prerequisite skills on the acquisition of VM across 29 children with ASD. Results indicated that delayed object imitation was positively correlated with success with an eight-step VM task. In addition, participants attended to the video irrespective of their success with VM; this suggests attending to a video is not sufficient albeit necessary for learning through VM (e.g., McCoy & Hermansen, 2007). As discussed by MacDonald and colleagues, future researchers may wish to explore which aspects of delayed object imitation may be critical to learning through VM.

13.1.10 Comparative Research

The comparative effectiveness of VM has been explored across procedural variations of VM (e.g., Miltenberger & Charlop, 2015; Sancho et al., 2010) and types of models incorporated (e.g., Cihak & Schrader, 2008; Marcus & Wilder, 2009; Sherer et al., 2001) and compared to VP (e.g., Cannella-Malone et al., 2006, 2011; Mechling et al., 2014; Thomas et al., 2020) and other instructional strategies (Cardon & Wilcox, 2011; Cihak, 2011; Charlop-Christy et al., 2000; McDowell et al., 2015).

Procedural variations of VM have been explored across the timing of a video model and the use of reinforcement and prompts (Sancho et al., 2010) and display of the video model (Miltenberger & Charlop, 2015). Sancho et al. (2010) compared the effectiveness of two procedural variations of VM on play skills with two 5-year-old children with ASD: one that presented the video model and then permitted the participant to engage in the scripted behavior with no prompting or reinforcement (priming) and the other involved presenting the video model while the opportunity to emit the scripted behavior was simultaneously provided and included prompts for the targeted response and reinforcement (simultaneous). Although both conditions lead to acquisition and maintenance of scripted behaviors across both participants, one participant acquired scripted responses more efficiently in the simultaneous condition, whereas, for the other participant, comparable outcomes were observed across both variations.

Miltenberger and Charlop (2015) evaluated the effectiveness of VM across five children with ASD across a range of skills (e.g., pretend play, asking questions, interactive play) when presented on a television (20 inches) compared to presented on an iPad® (9.5 × 7.31 × 0.37). It was found that both procedures were effective in establishing the targeted skills, that skills generalized across people and settings, and were maintained across participants; however, for four of the five participants, VM presented on the television was marginally more efficient than when presented on the iPad® but generalization and maintenance outcomes favored VM on the iPad®.

13.1.10.1 Model Type

There has been interest in whether the type of model (e.g., adult, peers, self) may impact acquisition with individuals with ASD when using VM (Cihak & Schrader, 2008; Marcus & Wilder, 2009; Sherer et al., 2001). One of the first to explore this area, Sherer et al. (2001) compared the efficacy of self as a model compared to a peer model on answering questions within a conversation with five male children with autism. The researchers concluded that use of self as a model is as effective as using another as a model. Three participants demonstrated comparable acquisition across both conditions; one participant acquired skills more readily during the self as a model, whereas another participant acquired the skill more efficiently in the peer video modeling condition. Participants who acquired the skill also generalized skills in the presence of an untrained peer and in an untrained setting.

Cihak and Schrader (2008) evaluated the efficacy and efficiency of learning vocational chains via VSM as compared to other as a model (adult) with four young adults with ASD. Tasks were vocational or prevocational tasks and included 10–12 steps. Across conditions, voice-over was included in the videos, prompts were provided contingent upon errors, and praise was delivered for independent correct responding. Results found that both model types were effective, and skills were maintained during a 3- and 6-week follow-up. Further, results slightly favored VSM for three of four participants, but differences were marginal.

Marcus and Wilder (2009) evaluated the efficacy of peer modeling compared to VSM with three children with autism on correct responding to Greek and Arabic letters. Across participants, targets in the VSM were acquired first; only one participant met mastery in the peer modeling condition. Despite these findings, there are some limitations of the study that future researchers may wish to explore. Maintenance and generalization were omitted. Further, to acclimate participants to the videos, participants were shown videos at home by the parents three times a day for 2 consecutive days prior to intervention. These viewings were implemented by the parent in the absence of independent observers. The extent to which these presession viewings impacted the outcomes remains unknown.

13.1.10.2 Video Modeling and Video Prompting

Few researchers have evaluated the efficacy of VM with VP for individuals with ASD (Cannella-Malone et al., 2006, 2011; Mechling et al., 2014; Thomas et al., 2020). Cannella-Malone et al. (2006) were the first to explore this question on daily living skills (i.e., setting a table and putting away a groceries) with six adults with developmental disabilities, the majority of which were also diagnosed with an ASD. Videos were created from the perspective of the spectator and included voice-over instruction. For VP, duration ranged from 10 to 42 s, whereas it ranged from 1 min 37 s to 2 min 42 s during VM. Results indicated the VP led to acquisition across both tasks and participants; contrastingly, VM did not lead to mastery across any tasks or participants.

Extending and replicating Cannella-Malone et al. (2006, 2011) compared the efficacy of VP and VM on daily living skills (i.e., washing dishes and doing the laundry) with seven adolescents with severe intellectual disabilities, six of whom were dually diagnosed with autism. Results again favored VP over VM for six of the seven participants. For one participant, neither procedure was effective in teaching the skills, although in vivo modeling led to acquisition. It should also be noted that generalization, maintenance, and social validity were omitted across both studies.

Other researchers have compared the effectiveness of VM, VP, and a variation of VM described as continuous video modeling (CVM) with young adults with moderate intellectual disabilities, including one participant with autism, across daily living tasks (i.e., putting items away, cleaning, and folding tasks) using videos with a subjective point of view and voice-over instruction (Mechling et al., 2014). During CVM, the video was continuously looped until the task was completed. Participants could complete the step simultaneously with the video or wait until it replayed to complete the step if previously omitted. Across participants and tasks, all procedures increased performance although VP was superior to both VM and CVM although CVM was found to be more effective than VM.

In extending past research comparing the efficiency and efficiency of VP and VM, Thomas et al. (2020) compared POV VP and POV VM presented on an iPad® to young adults with ASD on meal preparation skills. Differing from past research (i.e., Cannella-Malone et al., 2006, 2011), results supported VM for three of the four participants although both procedures resulted in acquisition across both meals. Additionally, VP evoked substantially more errors than VM. Further, both interventions lead to generalization of skills to an untrained setting and were found to maintain during a 3-week follow-up.

13.1.10.3 Video Modeling and In Vivo Modeling

In exploring the comparative efficacy of VM and other instructional strategies, some researchers have evaluated in vivo modeling to VM (e.g., Charlop-Christy et al., 2000; McDowell et al., 2015) and compared static prompts to VM (e.g., Cihak & Schrader, 2008), and others have compared VM to a naturalistic imitation procedure (e.g., Cardon & Wilcox, 2011).

Charlop-Christy et al. (2000) were the first to compare VM to in vivo modeling across a range of diverse skills (e.g., expressive labeling, independent play, spontaneous greetings, social play) for children with ASD using others as a model. Interventions were implemented in the absence of prompts or reinforcement. Across four of the five participants, VM was more efficient than in vivo modeling, required far less time to implement, and was more cost-efficient than in vivo modeling. For one participant, both procedures were equally effective.

McDowell and colleagues (2015) evaluated the comparative effectiveness of in vivo modeling with prompting compared to VM with young children with ASD on imitation skills. Their findings contrast with Charlop-Christy et al. (2000) in that in vivo modeling with prompting was found to be effective for three of the four participants. However, measures of generalization and maintenance were omitted.

13.1.10.4 Video Modeling and Other Instructional Procedures

Besides comparing types of modeling procedures, the effectiveness of activity schedules with static pictures compared to an activity schedule with videos has also been explored on appropriate transitions with middle-school-aged participants with ASD (Cihak, 2011). Cihak (2011) found that for two of the three participants, the static picture activity schedule resulted in more independent transitions than the video-based activity schedule. One participant's transitioning improved more with the video-based activity schedule.

Lastly, the effectiveness of reciprocal imitation training (RIT), the focus of which aims to establish imitation through naturalistic social interactions instead of in response to a directive, has been compared to VM on the acquisition of object imitation in young children with ASD (Cardon & Wilcox, 2011). Cardon and Wilcox (2011) concluded that both procedures increased responding and that results were maintained and produced generalized outcomes to untrained toys and to caregivers at 1- and 3-week follow-up.

13.1.10.5 Future Research

Despite the aforementioned studies, there are opportunities to better understand the variables that contribute to the effectiveness of procedural variations, types of models, and when one instructional strategy proves more effective. Additional research is needed to assess the external validity across additional participants and behaviors. Although there is support for the use of others as models being as effective as self as a model (e.g., Sherer et al., 2001), there are opportunities for future research. The conditions under which various types of models may produce faster acquisition should be explored. There are likely participant characteristics that impact the efficacy of VSM. It has been suggested that preference for watching one-self (Sherer et al., 2001) and self-recognition (Buggey, 2005) impact the efficacy of VSM. Future research may wish to empirically explore these variables. Additionally, the role of voice-over instructions, screen size, perspective, continuous or simultaneous VM, and factors that inform optimal use of VM or VP should continue to be explored. Few studies conducted pre-experimental assessments (e.g., Sancho et al., 2010; Thomas et al., 2020) on imitative repertoires. Exploring repertoires that are sufficient and necessary for VBI should be explored. Additionally, assessment and strategies to enhance generalization have been omitted across a number of studies that involved a comparison of some sort (e.g., Cannella-Malone et al., 2006, 2011; Marcus & Wilder, 2009; McDowell et al., 2015). Further, especially for comparative research, it is important that future research includes measures of maintenance including assessment of long-term maintenance. Few studies evaluated performance maintenance longer than a month (Miltenberger & Charlop, 2015; Sherer et al., 2001).

13.1.11 Future Research

When using VM with individuals with ASD, there are several areas that future researchers may wish to explore. We have aimed to provide more specific suggestions throughout this chapter and will highlight areas that have emerged. There is a continued need to further evaluate sufficient and necessary perquisite skills. Although the existing research (MacDonald et al., 2015; Tereshko et al., 2010) has provided a foundation upon which this area could be further explored, this is still a relatively new research area especially when balanced with the corpus of VM research by individuals with ASD. There is a dearth of research exploring strategies to enhance response generalization. Given the support for establishing scripted behaviors, research is needed to enhance generative repertoires. Although some researchers have explored this area and have incorporated strategies like programming for common stimuli (e.g., Carlile et al., 2018), use of suitable loops (e.g., Dupere et al., 2013), matrix training (e.g., McManus et al., 2015), and multiple exemplar training (e.g., Reeve et al., 2007), there are opportunities to extend this research. Systematic evaluations of procedural variations, such as additional prompts, error correction, reinforcement, and/or in situ training, should be explored to determine best practices and for whom which variations would be most beneficial. Further, it is unclear the conditions under which voice- and text-over should be included in VM. It would be important to evaluate the conditions under which this is needed. Additionally, more research incorporating caregivers, siblings, and peers is needed. In addition, across domains, we consistently found that PI data were under-reported. This will be important to address as these data (or lack thereof) impact believability of outcomes. Further, additional comparative research is needed.

13.1.12 Evidenced-Based Practice

There is a large corpus of research supporting VM as an evidenced-based practice. Wong et al. (2013) identified 27 evidenced-based practices via a systematic review of research including both single-subject research designs and group designs of participants diagnosed with ASD. VM was identified as an evidenced-based practice producing positive outcomes across multiple developmental and skill areas. According to their findings and across areas reviewed in this chapter, VM was found to be effective across social, communication, behavior, play, motor, adaptive, school-readiness, and vocational domains. Several domains were found to be effective across all three age categories (i.e., 0–5 years, 6–14 years, and 15–22 years old) and include social, play, and adaptive skills. Further, although not directly reviewed in this chapter, VM was found to be effective establishing joint attention, cognitive, and academic skills.

Further support for VM as an evidenced-based practice is found in past meta-analyses. Bellini and Akullian (2007) conducted a meta-analysis of VM and VSM with children and adolescents with ASD across intervention, maintenance, and generalization. Results support that both VM and VSM were effective at establishing social-communication skills, functional skills, and behavioral functioning and that skills were maintained and generalized across people and settings. A meta-analysis was also conducted on POV VM, and its findings support the efficacy of POV VM on independent living skill with individuals with ASD and developmental disabilities (Mason et al., 2013). Future research should explore the efficacy of POV VM across play, social communication, increasing academic behavior, and decreasing problem behavior. More recently, Qi et al. (2018) conducted a systematic review of single-subject research on VM and social communication skills for individuals with ASD using What Works Clearing House Single Subject Research Design Standards. Based upon their findings, VM is an evidenced-based practice for social communication skills for individuals with ASD. Despite the support of VM as an evidenced-based practice, future research should continue to evaluate the efficacy of VM and VM variations (e.g., POV, VSM) across populations (e.g., young children, adults) and domains (e.g., play, reducing problem behavior) as this body of research is vast and is continuously evolving.

13.1.13 Summary

VM is an evidence-based instructional procedure effective for teaching individuals with ASD a diverse range of skills. The purpose of this chapter was to review current research on VM. Skills that have been targeted with VM include play (e.g., MacDonald et al., 2009), social communication (e.g., Kouo, 2019), vocational (e.g., English et al., 2017), safety (e.g., Rex et al., 2018), and functional living skills (e.g., Popple et al., 2016). Another interesting application of VM has been on the reduction of problem behaviors (e.g., Sadler, 2019a). Comparisons of VM have been conducted within procedural variations (e.g., type of model, VM and VP) and across instructional strategies (e.g., VM and in vivo modeling). Although many areas for future research (e.g., inclusion of peers, targeting additional safety skills, vocational research with varied age groups) remain, overwhelmingly, research supports the use of VM to effectively teach participants with ASD a variety of skills. Practitioners are encouraged to incorporate VM into their instruction and continue to explore questions related to participant characteristics and optimal instructional arrangements for efficacy, generalization, and maintenance.

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14 Using the Teaching Interaction Procedure and Behavioral Skills Training to Develop Skills for Individuals with Autism: An Evidence-Based Approach

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14.1 Using the Teaching Interaction Procedure and Behavioral Skills Training to Develop Skills for Individuals with Autism: An Evidence-Based Approach

The prevalence of autism spectrum disorder (ASD) has grown over the past 20 years, ascending from 2 in 10,000 in 1990 to 1 in 59 in 2020 (Centers for Disease Control and Prevention, 2020). ASD is diagnosed by meeting several diagnostic characteristics including impairments in social communication, and the existence of restricted and repetitive behaviors (American Psychiatric Association, 2013). According to the *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-V)*, children and adults with a diagnosis of ASD must display deficits in two of three areas of social communication (American Psychiatric Association, 2013). These include deficits in social initiations and reciprocity as well as a limited understanding of nonverbal behavior such as facial expressions, body language, and gestures (Williams White et al., 2007). Unsupported skill acquisition in this area can lead to difficulties in forming relationships and loneliness (Bauminger & Kasari, 2000), anxiety and depression (Ghaziuddin, 2002; Sterling et al., 2008), behavioral challenges (Cowen et al., 1973), and suicidal ideation (Mayes et al., 2013). Moreover, failure to develop adequate skills in social communication is associated with an increased risk of being victimized by bullying (Ashburner et al., 2019). Restrictive and repetitive behavior may manifest through fixations on specific topics or routines, as well as stereotypic sounds or movements (Esbensen et al., 2009). Without effective intervention, these characteristics can impact individuals' participation at home, school, or in the community. Thus, an effective intervention that remedies these impairments is critical for increasing the individual's overall quality of life.

Teaching skills to individuals diagnosed with ASD requires knowledge of evidence-based practices. DiGennaro et al. (2017) defined evidence-based practice as "the process of using results from high-quality research to inform clinical practice, while also taking into consideration clinical experience and expertise, and the individual characteristics, culture, and preferences of a client" (p. 142). Evidence-based practices are determined by criteria including operationally

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defined procedures, a specific context for use, procedural integrity, evidence of a functional relation, and repeated outcomes (Horner et al., 2005).

The teaching interaction procedure (TIP) and behavioral skills training (BST) are evidence-based interventions used to teach skills to individuals diagnosed with ASD (Dotson et al., 2010; Kornacki et al., 2013; Leaf et al., 2009; Nuernberger et al., 2013; Palmen et al., 2008; Peters et al., 2016). Both procedures manipulate antecedent and consequent variables to systematically teach skills and measure learner competency. The TIP and BST utilize a series of steps, some of which are shared. This chapter aims to describe these procedures, summarize supporting research, and underscore their differences. Considerations for practice and areas for future research are also provided.

14.1.1 The Teaching Interaction Procedure

The term and procedure, *teaching interaction,* first appeared in *The Teaching-Family Handbook* (Phillips, 1968). The process was initially evaluated as a component of the Teaching-Family Model (Phillips et al., 1971), an applied behavior analysis (ABA)-informed teaching model used to decrease rates of recidivism in youth. Early facilitators of the program videotaped their interactions with youth and the analysis of such videos assisted in operationalizing the TIP. Features of interactions included labeling and modeling of skills, descriptions as to why the skills are valuable, the practice of the skill by youth, and feedback regarding the accuracy of the rehearsed skills (Cihon et al., 2017). Since the publication of Phillips et al. (1971), several more demonstrations have been completed. Minkin et al. (1976) employed the TIP to increase conversation skills with 10 typically developing females ranging from ages 12–20 years old. The intervention increased conversational behaviors in all participants. Similarly, Maloney et al. (1976) provided conversation skills training to four predelinquent females aged 13–15 years. Conversation skills in the form of answer-volunteering and non-verbal language improved for all participants. Since its early validation in the 1970s, the TIP has been applied to benefit individuals diagnosed with ASD (Dotson et al., 2010, 2013; Harchik et al., 1992; Leaf et al., 2009; Peters et al., 2016), and has functioned to guide educators in curricula (Taubman et al., 2011), and provide training guidelines (Dowd et al., 1994; Hazel et al., 1983).

14.1.2 Components of the TIP

The TIP includes six components (Leaf et al., 2015). First, the instructor describes the skill to the learner. Second, the learner is provided with a meaningful rationale for using the skill. Third, the instructor describes smaller parts of the skill, which is followed by the learner stating each component. The fourth component consists of the instructor modeling the skill with the learner or another person. Within this component, the instructor models the skills correctly and incorrectly. The learner must identify correct and incorrect examples. Fifth, the learner role-plays the target skill with the instructor. The sixth component includes the instructor delivering feedback to the learner following the emission of each response. Feedback consists of positive reinforcement for correct responses (i.e., vocal responses and physical imitation of the skill), and corrective feedback for incorrect responses. Although the TIP typically consists of six components, the instructor is encouraged to use the components as guidelines and adjust the sequence when necessary (Leaf et al., 2015). Imitation and feedback are provided until the skill is demonstrated to mastery. A flowchart illustrating the usual sequence for the TIP is displayed in Fig. 14.1.

14.1.2.1 Label/Identify Skill

Suppose you are teaching a learner to share crayons with peers using the TIP. First, the instructor labels or identifies the skill being taught and then asks the learner to re-state the skill that was identified. (e.g., “Today, we are going to talk about sharing. What are we going to learn about

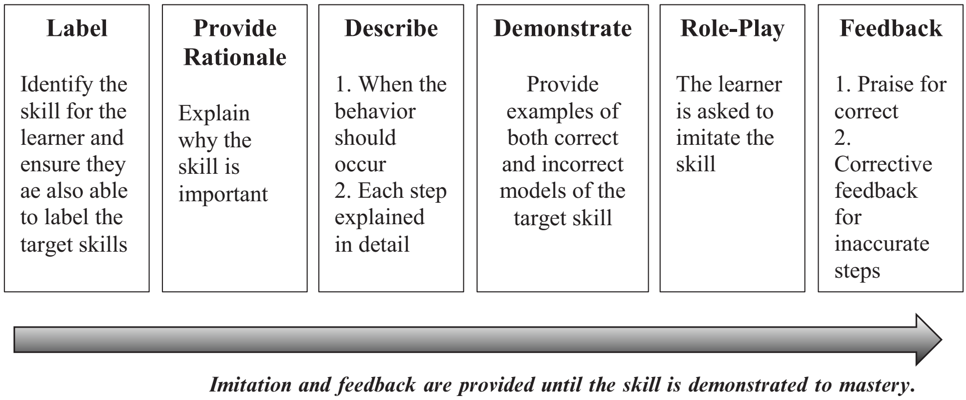

Fig. 14.1 A flowchart illustrating the usual sequence for the TIP

today?”). If the learner accurately states the skill being taught, the instructor provides praise (e.g., “Yes, very good. We will be talking about sharing today.”). If the learner does not restate the skill, or does so inaccurately, then the instructor provides corrective feedback (e.g., “That is not quite right.”). The sequence starts over, beginning with the instructor stating the skill to be taught until the learner accurately labels the skill.

14.1.2.2 Provide Rationale

In the second step, the instructor provides a meaningful rationale for why the learner should demonstrate the behavior. A number of reasons are linked to the importance of providing this rationale. Rationales may function to explain how one’s own behavior can impact the future and remind the learner why they should engage in the target behavior during non-contrived situations (Leaf et al., 2015). Said another way, the rationale should emphasize that the learner’s behavior impacts the environment rather than an arbitrary event. In the case of sharing, the instructor should describe why sharing is a meaningful skill as it pertains to uncontrived outcomes provided by the environment. Instead of saying, “Sharing crayons is good because you will get tokens,” a meaningful rationale might include, “If you share crayons with friends, then they might want to color at your table with you.” Or “You can help someone by sharing your crayon when their crayon breaks. Friends usually like to color with those who share their crayons.” The instructor can elaborate by describing specific situations where the skill is appropriate or useful. For example, the instructor states: “If a friend asks you for the red crayon during art class, and you let them use it, they might want to color with you more.” The rationale should not include far-reaching outcomes (e.g., “If you share, then everyone in the class will invite you to their birthday party.”). It is important that rationales are individualized to the learner. Suppose the learner has difficulty sharing crayons during free time but not during instructor-led activities. In this case, the rationale should be illustrative of this context-specific deficit.

14.1.2.3 Description

The third component includes deconstructing the skill into smaller steps. Each step should include all critical components involved. In the case of sharing, the smaller steps can be broken down as follows: “When a friend asks to use something that you have, you can say ‘sure’ and pass it to them. If you are using the crayon when they ask, then you can say ‘hang on,’ wait a few seconds while you finish coloring, and then pass the crayon to them. You could also say ‘I’m just finishing this part, then you can have the crayon.’ Then you can hand it to them when you are done.” The list of ways to explain the skill need not be exhaustive. While some learners will benefit from several descriptions, others might benefit from one or two. For learners who can read but are having difficulty remembering the steps in a skill, the TIP provides the flexibility to write out the skill steps and then fade. Ensuring only the critical variables are presented within the instruction will also help learners remember complex skills with many steps. Additionally, it will permit flexibility in responding (e.g., saying “hang on” or saying “one moment” would both be considered correct). The end of this component is achieved when the learner restates the steps of the skill.

14.1.2.4 Demonstration

Instructor demonstration of the skill can occur during the description or afterward. Within this component, the instructor models the target behavior accurately and inaccurately. Doing so allows the learner to observe multiple exemplars of correct and incorrect versions of the skill. It may be beneficial to select models based on the learner’s performance. For example, if earlier in the day the learner said, “No! It’s mine!” when a peer asked to borrow their crayon, the instructor might model that same scenario during the incorrect demonstration part of the intervention. This would be followed by a correct demonstration of this scenario such as handing the peer the crayon while saying, “Sure! You can use it.” Often, exemplars range from obvious to less obvious. In this case, a correct model might include someone asking the instructor to share and then saying “sure, here you go” while passing the crayon immediately to the requesting person. An obvious incorrect demonstration of sharing would include someone asking the instructor to share followed by the instructor walking away with the crayons. The instructor should select example demonstrations thoughtfully and ensure that there are salient features of each, increasing the likelihood that the instructor labels the skill correctly and receives reinforcement. Less obvious examples of sharing could include someone asking the instructor for the crayon, the instructor throwing a nub of a crayon in the trash, and then handing the person who requested it a new crayon. Although this might be more difficult to discern, technically this is sharing. The instructor was in possession of the crayons and the person requesting it was handed a crayon by the person who was asked.

14.1.2.5 Role-Playing

The fifth component includes the learner role-playing the target behavior and receiving feedback for the components demonstrated correctly and incorrectly. This component is arguably the most important component in the TIP as it allows the individual to contact contingencies to establish the behavior in the learner’s repertoire (Cihon et al., 2017). Role-plays can occur with the instructor or another peer. In the TIP sequence used to establish sharing, the instructor or peer would request to use an item that the learner is using. Contingent upon correct demonstration of the skill (i.e., the learner passes the item to the person who requests it), the instructor gives praise. Contingent upon incorrect demonstration of the skill, the instructor gives corrective feedback. These practice sessions continue until all of the steps are demonstrated correctly (Leaf et al., 2015) and are shaped up over time such that they eventually mimic the terminal environment in which the learner must demonstrate the skill (Cihon et al., 2017).

14.1.2.6 Feedback

Throughout the sequence, the instructor provides the learner with feedback on their performance while practicing the skill. It is crucial to embed this component in the sequence, as role-play without feedback will likely result in less progress. Contingent on accurate responses, feedback can take several forms (e.g., specific praise, point, token, preferred activity). If praise is used, phrasing should be specific to the skill demonstrated correctly. For instance, if the learner accurately shares the crayon during role-play, then the instructor should say “Nice work passing your crayon to me right when you were finished coloring in the sky,” versus “Great job, coloring in the sky.” In addition, corrective feedback follows incorrect responses. It is important the forms of feedback are specific to the learner (e.g., activity-based reinforcers are age-appropriate, the time between the correct or incorrect demonstration of the skill is adequate, tokens are used only after proper conditioning has taken place). Role-plays/practice and feedback are repeated until the learner achieves the designated mastery criteria.

14.1.3 The TIP and ASD

To date, there are a number of empirical applications of the TIP (e.g., Dotson et al., 2010, 2013; Harchik et al., 1992; Leaf et al., 2009; Peters et al., 2016). In the first empirical investigation with individuals diagnosed with ASD, Leaf et al. (2009) used the TIP to successfully develop social skills with three children with ASD. Four domains of social skills (i.e., play, social-communication, emotion skills, and choice/selection skills) were targeted across three participants in a multiple baseline design. Before the intervention, participants displayed selected skills at near-zero levels, and following the intervention, skills were demonstrated consistently. In addition, play and communication skills were generalized to peer interactions. A group format is also an effective modality for use of the TIP. For example, Peters et al. (2016) evaluated the effectiveness of the procedure to teach four social skills to a group of four young children diagnosed with ASD using a multiple-probe design. The group took place during daily school instruction, where all participants were taught the same social skill. The TIP was effective in teaching all the targeted social skills to the participants and the participants maintained the skills at least 2 weeks after the intervention ended. The efficacy of the TIP has also been demonstrated to teach adolescents diagnosed with ASD conversational skills. Dotson et al. (2010) assessed the efficacy of the TIP to teach five adolescents conversational skills (i.e., answering and asking open-ended questions, extending positive feedback to a conversation partner). A multiple-probe design across behaviors indicated that mastery of skills occurred as a result of the TIP for the participants diagnosed with ASD. Although three skills did not fully generalize to a more natural setting, all five participants showed some generalization to naturalistic situations with peers.

Empirical studies have been extended to adults diagnosed with ASD. Dotson et al. (2013) used a multiple-probe across behaviors design to evaluate the efficacy of the TIP to teach six adults employment skills at recycling jobs. Skills were divided into three categories: worker skills (e.g., checking the recycling bins), supervisory skills (e.g., gathering weekly pick-up schedules), and office skills (e.g., entering employee timecard information onto spreadsheets). Results indicated that the TIP was an effective method to teach the adult participants relevant job skills in the natural environment.

While the majority of recent research demonstrating the efficacy of the TIP has been with individuals diagnosed with ASD, the literature is not limited to populations with disabilities. Using a multiple-baseline design across behaviors, Harchik et al. (1992) assessed the efficacy of a slightly modified version of the TIP to increase staff's use of token economies in a group home. The modification included a seventh component, where the staff was presented with the opportunity to ask questions or make comments before ending the TIP session. Results indicated that the TIP could be an effective means to increase the frequency of exchanging tokens for backup reinforcers, social behaviors during token delivery, and social behaviors during the exchange. As demonstrated in research and practice, the TIP is a well-established method for teaching skills to a variety of learners with ASD, as well as those working in the human service industry.

Despite the TIP's long history in the field of ABA and the convincing evidence demonstrating its effectiveness as a method for teaching a myriad of skills to individuals with ASD, research on the TIP is still limited (Leaf et al., 2015). Partially responsible for this limitation is the tendency to confuse the TIP and BST (Leaf et al., 2015). The clinical implications of TIP and BST procedures are discussed later. First, we provide an overview of BST.

14.2 Behavioral Skills Training

BST (Bornstein et al., 1980; Sarakoff & Sturmey, 2004) is an evidence-based and empirically validated method for teaching skills to individuals with disabilities (Kornacki et al., 2013; Nuernberger et al., 2013; Palmen et al., 2008; Peters & Thompson, 2015; Ryan et al., 2019). BST utilizes the three-term contingency in a role-play scenario. This arrangement allows the learner to repeatedly practice the target behavior in the presence of the relevant stimulus conditions until fluency is achieved (Miltenberger et al., 2017). In order to promote generalization, BST systematically utilizes four components (Miltenberger, 2008, 2016): instruction, model, role-play, and feedback (Bornstein et al., 1980; Himle et al., 2004; Miltenberger, 2016; Parsons et al., 2012). The components of BST are similar to those used in the TIP, with two major differences. First, while implementing the TIP, the instructor provides a rationale for learning the skill. In contrast, BST does not include a rationale component. A second major difference is that BST includes a correct demonstration only, while the TIP includes a correct and incorrect demonstration. As in the TIP, BST begins with the instructor describing the target behavior to the learner. This is then followed by the instructor providing the learner with a correct model only. The remainder of the components are identical to the components of the TIP. After the model, the learner is provided with an opportunity to practice the target behavior in a role-play scenario and the instructor provides feedback during or after the role-play. The role-play and feedback components are typically repeated until the learner is able to demonstrate the skill accurately. A comprehensive description of these components is to follow as well as a review of the efficacy of BST across populations and skills.

14.2.1 Components of BST

14.2.1.1 Instruction

The first component of BST is the instruction, which provides the learner with a detailed description of the target behavior and the context in which it should occur (Miltenberger, 2016). For example, when teaching a child to share, the instructor may say to the learner, "Today we are going to practice sharing. When a friend asks for your toy (i.e., the context) you should hand it to them (i.e., the target behavior)." Miltenberger et al. (2017) included a number of key points to consider while using BST. To begin, instructions should be delivered by an authority figure, such as a parent or instructor, and only delivered after attaining the learner's attention. Additionally, instructions should be clear and match the receptive capabilities of the learner so that they are understandable. Finally, to ensure instructions are understood, Miltenberger et al. (2017) suggested the learner repeats the instruction immediately after it is delivered. Instructions can be delivered either verbally (Miltenberger, 2008) or in written form (Parsons et al., 2012).

14.2.1.2 Model

To further aid in the understanding of the instruction, the instruction is subsequently followed with a correct model of the target behavior. This allows the learner to observe the target behavior after it is described. Modeling provides a correct demonstration of the target behavior in the presence of relevant stimulus conditions. For example, the instructor might model sharing his blue crayon in the presence of a child wanting to color a blue car but not having a blue crayon (i.e., the relevant stimulus condition). This can be done in-vivo (e.g., a live real-time model) or in a simulation of the natural context. For example, when teaching sharing, an instructor may use a live model if another child approaches the instructor and asks for a toy the instructor is using. In this instance, the instructor may model sharing by saying "Sure!" and allowing the child to use the toy. However, a natural opportunity may not always be available. If a live model is not possible, the instructor may create a simulation and model the target behavior using a video (Nigro-Bruzzi & Sturmey, 2010) or computer simulation (Vanselow & Hanley, 2014), as well as using another adult, or being creative with other stimuli, such as dolls (Miltenberger et al., 2017).

Miltenberger et al. (2017) provided recommendations for effective modeling. The first recommendation was that the model should match the learner's ability (i.e., the model should not be too lengthy or complex for the learner). Additionally, Miltenberger and colleagues suggested that the model be completed by an individual that shares similar characteristics with the learner (e.g., a child of similar age). If this is unavailable, then an authority figure (e.g., a parent or instructor) should provide the model in a simulation of a context that matches the natural context in which the relevant stimulus condition would actually occur (Miltenberger et al., 2017). Miltenberger and colleagues further recommended the learner be oriented toward the instructor before the behavior is demonstrated and the instructor should model as many times as necessary for the learner to correctly demonstrate the target behavior. Each time, the target behavior should be modeled in a variety of ways to increase the likelihood of generalization (Miltenberger et al., 2017). For example, when a child is being taught to engage in sharing, the instructor might model asking someone if they want some of their snack, giving someone a toy they are playing with, or giving someone a crayon from their crayon box. Final recommendations included describing important components of the model (e.g., After modeling sharing, the instructor might say, "I used a kind voice and gave her the toy gently") and if the learner has the verbal ability, the learner should describe the modeled behavior. A positive consequence should be provided following correct responding by the learner and this can either be provided by the instructor or, at times, it can be a naturally occurring consequence as part of the interaction (Dogan et al., 2017).

14.2.1.3 Rehearsal

BST provides the learner with an opportunity to practice the target behavior in the presence of the relevant stimulus condition immediately after it is modeled (Parsons et al., 2012). The role-play is completed in a simulation of the natural context and allows for the learner to receive feedback for correct and incorrect performance(s) of the target behavior. Considerations for effective role-play include practicing the behavior in a simulation of the natural context and in the presence of the relevant stimulus condition, following each practice with an immediate and appropriate consequence (i.e., reinforcement for correct responses and corrective feedback for incorrect responses), and repeated practice (i.e., practicing until the target behavior has been demonstrated several times).

14.2.1.4 Feedback

Feedback includes (a) reinforcement for any part of the target behavior that is emitted correctly and/or (b) corrective feedback for any incorrect responses (e.g., If while sharing the child throws the toy, the instructor might say, "Remember to give the toy to your friend gently." The instructor might then model how to hand over a toy gently). Feedback should be delivered immediately after the role-play (Miltenberger et al., 2017). Feedback may be followed by further practice until the learner emits the target behavior correctly several times (Stocco et al., 2017). A flowchart illustrating the usual sequence for BST is displayed in Fig. 14.2.

14.2.2 BST and ASD

BST procedures have been demonstrated effective to teach a variety of skills including increasing appropriate social behaviors (Matson & Stephens, 1978), teaching child management skills to parents (Forehand et al., 1979), and teaching emergency safety skills (Jones & Kazdin, 1980; Wurtele et al., 1986). BST has also been used to teach neurotypical adults (Hogan et al., 2015; Sarakoff & Sturmey, 2004) and children (Johnson et al., 2005, 2006; Wurtele et al., 1986), as well as adults and children with various disabilities (Elder et al., 1979; Haseltine & Miltenberger, 1990; Matson & Stephens, 1978; Palmen & Didden, 2012; Sanchez & Miltenberger, 2015).

BST has also been demonstrated effective in promoting skill development for individuals with ASD (Kornacki et al., 2013; Nuernberger et al., 2013; Palmen et al., 2008; Peters & Thompson, 2015; Ryan et al., 2019). Ryan et al. (2019) used

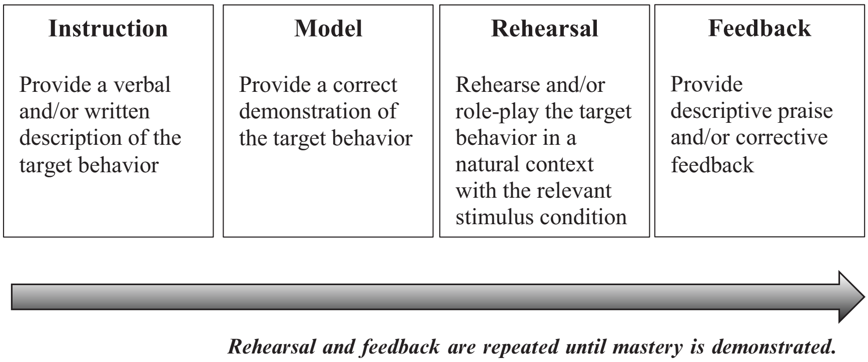

Fig. 14.2 A flowchart illustrating the usual sequence for BST

BST to increase appropriate conversation skills for six adults with ASD. Targeted interaction skills included approaching, greeting, posing a question or comment, waiting for a response, and ending the conversation. All six participants demonstrated low levels of accurate responding in the baseline condition. Following baseline, BST was implemented, which began with participants receiving verbal or written instruction on how to have an appropriate conversation (e.g., "Say hello to your friend."). Next, an appropriate conversation was modeled for the participants. Following the model, the participants practiced engaging in a conversation and were provided with feedback in relation to their performance of conversation interactions. If the participants demonstrated an appropriate conversation (i.e., accurate response), verbal praise was delivered. If the participants demonstrated an inappropriate conversation (i.e., inaccurate response), corrective feedback in the form of verbal and gestural prompts was delivered. The participants then completed another practice with the researcher and verbal instruction and model prompts were used until the participants performed an appropriate conversation. The training continued until the participants completed three consecutive sessions with 80% accuracy or one session with 100% accuracy. Through the use of BST, several other studies have demonstrated improved social skills for individuals with ASD (Kornacki et al., 2013; Nuernberger et al., 2013; Palmen et al., 2008; Peters & Thompson, 2015).

Studies have also shown that BST is effective in developing job skills for individuals diagnosed with ASD, such as mascot performance skills (Allen et al., 2010; Burke et al., 2010), task engagement (Palmen & Didden, 2012), and behavior therapist skills (Lerman et al., 2015). Allen et al. (2010) evaluated the effects of BST to teach three young adults with ASD to exhibit the skills necessary to perform in a mascot costume. Skills included waving, handshaking, moving the costume's tongue up and down, wagging the costume's tail, winking the costume's eye, and wiggling the costume's ears. Additional skills included jumping, shaking the body of the costume, and pulling the hands and arms into the costume. In baseline, the participants put on the costume, were brought to the main aisle of a store, and were instructed to "Do whatever you'd like." The training was then implemented wherein the instruction and model were delivered using a video model demonstrating scripted and natural mascot performances. Following the video model, instructors offered the opportunity to practice. The participants were brought back to the main aisle of the store while wearing the costume and were once again instructed to "Do whatever you'd like." Following the intervention, all participants were able to complete the skills necessary to perform in a mascot costume.

BST has also been demonstrated in the literature as an effective intervention for teaching safety skills to individuals living with ASD. Some of these skills include firearm safety, (Gatheridge et al., 2004; Rossi et al., 2017), abduction prevention (Gunby & Rapp, 2014), and fire and poison safety (Rossi et al., 2017). Rossi et al. (2017) examined the effects of BST in developing a generalized safety skills repertoire for three children with ASD. Participants were taught to avoid touching a dangerous stimulus, leaving the area, and reporting the dangerous stimulus to an adult. Dangerous stimuli included firearms, fire-starting agents, and liquid poisons. In baseline, the participants were provided the instruction, "Go play in the [name of classroom center or room]. I will be right back" and were left alone with a dangerous stimulus. Researchers recorded if the participants engaged in an inaccurate response (i.e., touched the dangerous stimulus) or accurate response (i.e., left the area and/or reported the dangerous stimulus to an adult). In baseline, all of the participants touched at least one dangerous stimulus and none of the participants left the area to report the dangerous stimuli to an adult. Following baseline, BST was implemented using multiple exemplars within each category. The experimenter began by providing an instruction (e.g., "don't touch, move away, tell an adult") while showing the participant the dangerous stimulus. The participants were asked to repeat the instruction. After the instruction, the experimenter modeled approaching a dangerous stimulus, stopping before touching it, and stating "don't touch." The participants then practiced, and behavior-specific praise was delivered for correct responses. If the participants emitted an incorrect response, the experimenter corrected the error and modeled a correct response. This procedure continued until the participant demonstrated the skill accurately in two consecutive practices. The same procedure was used to teach the participants to move away and tell an adult. BST was continued until the participants independently demonstrated the full safety response (i.e., stopping before touching, moving away, and telling an adult) for two consecutive role-play trials. Following BST, all three children demonstrated the complete safety response for two exemplars in each stimulus category.

The extant literature indicates that BST is an effective, evidence-based approach. BST manipulates antecedent conditions by providing practice opportunities that allow the learner to contact the reinforcing contingencies to strengthen skills in their repertoire. It is a proactive approach to teaching important skills such as safety skills, job skills, and social skills. Its effects have been empirically demonstrated with typically developing adults and children, as well as with adults and children with ASD.

14.3 Considerations for Using the TIP and BST

Several considerations should be made when implementing the TIP and BST. First, it is recommended that the practitioner assesses the literature base as well as the learner's prerequisite skills prior to selecting intervention procedures to ensure the most effective intervention is selected for the learner. Given the components of the TIP and BST, there are several prerequisite skills that may increase the likelihood of their effectiveness. We will highlight four. First, the learner must have a well-developed instruction-following repertoire. Second, in order to correctly role-play the model, the learner must have a well-developed generalized imitative repertoire. Additionally, because practice does not always occur just prior to times where the learner is presented with an opportunity to demonstrate the skill in real-time, delayed imitative repertoires should be considered. Third, it may be beneficial for the learner to engage in rule-governed behavior. This might help the behavior generalize to the natural environment in the absence of reinforcement. Finally, it is essential for the learner to have well-established attending skills. For these reasons, the TIP and BST may be more appropriate to use with individuals with more well-developed skill repertoires. These recommendations are general and should not be substituted for thorough consideration of a learner's current skill repertoire. It is useful for practitioners to assess learners' skills on an individual basis prior to choosing intervention methods.

If the learner demonstrates these prerequisite skills, further considerations must be made. Prior to implementation, it must be determined if the pertinent context can be modeled in-vivo and, if not, how that context will be simulated. For example, the instructor must determine if they will use a video, audio, or computer simulation or if they will use another person or other materials, such as a doll, to model the skill. Furthermore, generalization may occur more reliably when the training context shares adequate similarity to the terminal context (Stokes & Baer, 1977; Stokes & Osnes, 1989). Therefore, the instructor must also consider who will provide the model and in what setting they will do so. The similarity between the model and the learner and the setting the training is complete may increase the likelihood that the learner will imitate the behavior. Therefore, it is best if a model is similar to the learner and the setting is similar to the natural setting the behavior should occur.

Further, in the area of generalization, multiple exemplars should be embedded into the model and role-play components (e.g., teach the learner to respond to multiple interview questions). The learner should also be provided with opportunities to engage in the target behavior in the presence of a variety of stimuli that would be present in the natural context. Additionally, the instructor is encouraged to model and allow for practice of the skill in its environment-specific context. For example, when using the TIP or BST to target interview skills, then teaching opportunities should occur in a variety of office-like settings. It is also recommended that the instructor allows for repeated modeling and practice of many different models of the target behavior, as well as immediate feedback in the presence of the discriminative stimuli outside of the natural context. The instructor should teach multiple variations of a skill (i.e., teach several different responses to an interview question) and many different stimuli from the natural environment (e.g., a desk, desk chair, notepad) should be incorporated into the model and role-play. It is also important to select target behaviors that are likely to be reinforced in the natural environment (e.g., shaking the interviewer's hand at the end of an interview). Finally, when possible, any instances of the target behavior in the natural environment should be reinforced. The use of these strategies will increase the likelihood of generalization by allowing the learner to practice the skill and for the target to be reinforced in the presence of these stimuli.

The TIP and BST are effective interventions for teaching a variety of skills and are ideal interventions for teaching skills where in-the-moment training is difficult due to limited opportunities or stigmatization. To illustrate, there is usually just one opportunity to interview for a job. Additionally, it may be stigmatizing to have someone with you on a worksite telling you what to do, or to be prompted or receive feedback while engaging in social interaction. The TIP and BST facilitate the teaching of skills outside of limited or delicate situations. With in-the-moment training, the individual can successfully demonstrate the correct behavior in their natural environment.

14.4 Conclusions and Recommendations

The increasing prevalence of ASD (Maenner et al., 2020) necessitates innovative and socially significant interventions. The use of evidence-based treatment is critical to the effective treatment of deficits associated with ASD. The application of non-evidence-based treatment can result in harm to individuals diagnosed with ASD, wasting valuable time, money, and other resources (Zane et al., 2008). The TIP and BST are two evidence-based interventions that have been reliably shown to develop a variety of skills for individuals diagnosed with ASD (e.g., Allen et al., 2010; Dotson et al., 2010; Harchik et al., 1992; Kornacki et al., 2013; Leaf et al., 2009; Ryan et al., 2019). These skills include, but are not limited to, play skills (Leaf et al., 2009), social skills (Leaf et al., 2009; Nuernberger et al., 2013; Ryan et al., 2019), communication skills (Leaf et al., 2009), conversation skills (Dotson et al., 2010; Kassardjian et al., 2013; Nuernberger et al., 2013), employment skills (Allen et al., 2010; Burke et al., 2010; Harchik et al., 1992), and safety skills (Gatheridge et al., 2004; Gunby & Rapp, 2014; Rossi et al., 2017). The research and results described in this chapter have demonstrated the effectiveness of the TIP and BST procedures across settings, individuals, and skills. Both procedures can also be implemented in the group or one-to-one setting (Leaf et al., 2009; Nuernberger et al., 2013; Palmen et al., 2008; Peters et al., 2016). The generality of the TIP and BST makes them valuable teaching procedures, particularly when in-the-moment teaching would be stigmatizing or is not possible, but repeated practice is necessary.

The benefits of TIP and BST are well established but further areas of research remain. To begin, while both the TIP and BST can be implemented in the one-to-one or group format, no literature has compared the efficacy and effectiveness of implementation in each format. It is possible that teaching in one format may lead to more efficient skill acquisition or greater generalization and maintenance. Additionally, there is limited research on the use of the TIP or BST in populations with significant intellectual delays or minimal vocal language. An evaluation of the TIP and BST that includes participants with more severe impairments and/or minimal vocal language may increase the generality of these procedures. To do so, it may be necessary to evaluate the prerequisite skills needed for the TIP and BST to be an effective intervention as well as any intervention modifications (e.g., modality of instruction delivery) that can effectively be made to the procedures.

As previously stated, the TIP and BST closely resemble one another, with the only difference being that in BST the instructor does not provide the learner with a rationale, and the instructor provides a correct demonstration only (Leaf et al., 2015; Miltenberger et al., 2017). As a result, there is confusion between the two procedures (Leaf et al., 2015). Additionally, there is inconsistent use of components within both procedures. For example, Allen et al. (2010) did not include a practice and feedback portion in their use of the TIP procedure. Not only could these inconsistencies hinder the precision of implementation, but they also risk decreasing the overall effectiveness and efficacy of the procedures. Leaf et al. (2015) provided a recommendation for differentiating between the TIP and BST. The authors suggested, "When rationales are included with labeling, demonstration, role-play, and feedback, researchers and professionals should label the procedure as a TIP. When rationales are not included with labeling, demonstration, role-play, and feedback, the procedure should be labeled as BST" (Leaf et al., 2015, p. 410). Important comparisons and component analyses are made possible by accurately labeling procedures and relative components.

To date, no studies have completed a component analysis to determine the effectiveness of each component within the TIP or BST. Doing so may improve the efficiency of the interventions and determine if there is a need for a distinction between the two procedures. For example, it may be possible that the rationale and incorrect demonstration of the skill are not necessary components within the TIP procedure. When doing so, researchers should evaluate a variety of outcome measures. For example, it would not only be necessary to look at the acquisition of the skill but also the generalization and maintenance of the skill. It is possible certain components are less important for the acquisition of the skill but are necessary for generalization and maintenance. Additionally, while there is evidence of effective outcomes through the use of in-vivo and video-based modeling, there has not yet been a comparison of these delivery methods in the TIP or BST literature. To improve the efficacy and effectiveness of the procedures, it should be evaluated which modality of instruction delivery demonstrates the most promising results.

Finally, as another measure of effectiveness, further social validity measures should be completed. While it is suggested that the TIP and BST limit stigmatization by allowing for teaching to be implemented in simulations of a context rather than in front of others in the actual context, limited social validity measures currently exist (Carr et al., 1999; Cihon et al., 2017). Social validity measures would identify the extent to which the procedures are socially acceptable and improve the meaningfulness of intervention. Furthermore, if component analyses reveal that both the TIP and BST are equally effective at teaching skills, the intervention can be selected by using social validity measures to determine which procedure may be more preferred by the consumer.

Although areas for future research remain, the evidence supporting the use of the TIP and BST to develop skills in individuals living with ASD is prominent. The generality of the TIP and BST allows for flexibility of teaching. This generality, in conjunction with the large base of existing evidence, makes the TIP and BST eminent interventions in the treatment of ASD. Further research would only strengthen the evidence and generality of these procedures, advancing their effectiveness and application.

The TIP and BST can be used for a variety of learners (Dotson et al., 2013; Johnson et al., 2005; Kassardjian, 2013; Ryan et al., 2019) to teach a variety of social skills (Dotson et al., 2010; Kornacki et al., 2013; Leaf et al., 2009; Nuernberger et al., 2013; Palmen et al., 2008; Ryan et al., 2019). The TIP and BST allow for flexible teaching which yields generalization (Dotson et al., 2010; Rossi et al., 2017)). For this reason, the TIP and BST are especially helpful for teaching social skills that only allow one opportunity for practice in the natural environment (e.g., a job interview) or for complex skills that require flexibility in instruction delivery or responding (e.g., saying "hang on," "one moment," "I need a second" to tell someone you are busy). Furthermore, the TIP and BST are useful for teaching skills that may be embarrassing or stigmatizing to teach in the natural setting. For example, teaching social skills in the natural environment while peers are present may feel embarrassing for the learner. The TIP and BST allow for social skills to be practiced in a simulation of the natural setting in the presence of relevant stimuli. This provides the ability for a social skill to be taught in a more private setting while allowing for generalization to the natural setting.

Given the tremendous clinical utility of the TIP and BST, clinicians should consider the use of these technologies when teaching social skills. The TIP and BST can be used with learners with ASD ranging in age from preschool (Johnson et al., 2005; Kassardjian, 2013) to adult (Dotson et al., 2013; Ryan et al., 2019) and can be used for teaching more simple social skills (Kassardjian, 2013; Ryan et al., 2019) such as greetings or more complex social skills (Allen et al., 2010; Dotson et al., 2013) such as completing a job interview. While more research is required to evaluate the prerequisites needed to benefit from the TIP or BST, it is likely a learner with a well-developed instruction following repertoire, well-developed generalized imitative repertoire, delayed imitative repertoire, rule-governed behavior, and well-established attending skills will learn best from the TIP and BST. To increase the likelihood of generalization, clinicians should embed multiple exemplars within their instruction when using the TIP and BST. Modeling multiple appropriate responses, incorporating a variety of relevant stimuli that would be present in the natural context, teaching in the environment-specific context or a setting that closely resembles the natural setting, selecting target behaviors that will likely be reinforced in the natural setting, and providing reinforcement when the learner displays the skill in the natural environment will all help increase the likelihood of generalization. Finally, to increase learner buy-in, it is recommended that instruction is collaborative and interactive for the learner. For example, the instructor might use open-ended questions such as, "What do you think are important things to do in a job interview?" or "why might it be important for you to learn interview skills?" rather than just telling the learner what they should do. It is possible this may allow the learner to feel more involved in their learning and will make teaching more individualized to the learner. With consideration for the learners' needs, the TIP and BST can be effectively used within the clinical practice to develop social skills for individuals with ASD.

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15 Developing Social Skills Groups for Behavioral Intervention for Individuals with Autism

Christine M. Milne and Ashley Creem

15.1 Social Skills Groups

Social behavior, which includes anything from sitting in a public space to engaging in interpersonal conversations, is shaped by our verbal community (Skinner, 1953). Within that verbal community, there are contingencies arranged for which social behaviors will result in reinforcing or punishing[1] consequences, but individuals will continue to experience variability and variation, or even exceptions, within and across those contingencies (Skinner, 1953). Therefore, in order to teach social skills that will result in desirable outcomes for the individual, it is important to teach the variable contingencies that the individual is more likely to encounter. Initially, it may be necessary to use an arbitrary contingency to develop a skill or reduce the probability of a particular behavior, but it would be advantageous to transition to more naturally occurring contingencies as quickly as possible (Taubman et al., 2011). This leads to the benefits of teaching complex social behaviors, or social skills, in a group setting.

Given that social contingencies mitigate or strengthen social behavior, it is important to recognize the variables that contribute to the complexity of social interactions, especially when attempting to develop a new skill or decrease the probability of an existing one. When teaching social skills in a group setting, there is an increased number of instructors and peers, which immediately allows individuals within the group to experience and/or observe contingencies across more people. This opportunity for interaction with a variety of individuals may be limited in most 1:1 therapeutic sessions. Not only is the mere number of individuals with whom to interact greater in a group setting, but there is more likely to be variability in the types of responses one individual will encounter. Therefore, within a group setting, an individual is more likely to experience a spectrum of contingencies that one will more likely encounter in the terminal setting (Ellingsen et al., 2017; Taubman et al., 2011). With that, it is also important to consider the variability in the rate of consequences when working in a group setting versus an individual setting. With the higher ratio of students to instructors, the rate of reinforcement or punishment is likely to differ from the rate within a low ratio or one on one setting. Of course, this rate may be manipulated (and should be manipulated) through the development of skill acquisition, but overall, it is more likely to be intermittent and resemble the

[1]The term punishment, in this case, describes the contingencies that result in a reduction in the likelihood of a particular response or response class. This includes peers ignoring certain responses to telling them to "stop."

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ratio they are likely to encounter outside of the teaching setting.

Finally, when addressing variability in social contingencies, it is paramount to recognize and analyze the potential effects of those contingencies over time. Individuals that engage in social skills groups for a limited period of time will ideally benefit from the short-term effects of developing social skills. They are likely to experience immediate consequences such as engaging in a few conversations, playing with peers in certain activities, and so on. However, it is important to consider the potential effects of engaging in a social skills group for longer periods of time. With continued engagement with a number of familiar peers for longer periods of time, individuals are not only able to develop social skills but hopefully increase the likelihood of developing social relationships (Taubman et al., 2011). Shared experiences and social skills maintained over time help build those social relationships, and while true, reciprocal friendships cannot be forced, it is important to at least provide increased opportunities to do so (Leaf, 2017; Taubman et al., 2011). An additional benefit to prolonged interactions within a social skills group is that instructors may point out complexities of social behavior that typically occur over time. For example, there may be a student that typically shares play items, a behavior likely associated with "being a good friend." However, for whatever reason, the student might not share that day. The isolated incident should not change that the student is considered a "good" friend. Instead, it may highlight that the student has occasional lapses in friendly behavior. With a limited number of interactions, it may be more difficult to highlight patterns of behavior. With sufficient sessions, such patterns may be helpfully observed, and may lead to more targeted interventions or may identify changes in interactional patterns that need attention.

Another benefit to teaching social behaviors in social skills groups is that it allows teaching peers as a social stimulus. Often peers may ignore social initiation attempts by individuals with autism, therefore the individual with ASD might turn to the surrounding adults that may be more responsive to their attempts at engagement. After repeated exposure to these contingencies, individuals on the spectrum may reduce attempts to engage with peers, and immediately initiate interactions with surrounding adults. However, this could be minimized if the complexity of contingencies with peers is addressed, and the reinforcement from adults is minimized. The presentation of a peer should act as a stimulus for a variety of consequences, given a particular response. For example, the presence of a peer may allow for a conversation about a preferred topic, or engagement in a preferred activity that requires more than one person. In the absence of a peer, conversation on a preferred topic, or engagement in a particular activity is not available. Within social skills groups, a variety of salient social stimuli and consequences can be introduced for certain behaviors. For example, when engaging in a particular conversation topic, one peer may simply smile while another peer provides continuous statements about the topic without displaying behaviors associated with positive affect (e.g., smile). While both peers display different behaviors (i.e., positive affect with no comments vs. commenting without positive affect), an individual continuing to engage in discussion on the particular topic may result in similar consequences (e.g., those peers seeking out the individual to interact in the future). Alternatively, both peers may respond similarly (e.g., smile), then by continuing the conversation, may result in different consequences (e.g., one peer seeks the individual for future conversation while the other does not). One of the benefits of social skills groups is that it allows individuals to experience the complexity of social interactions, and opportunities to learn the nuances of social behavior and the skills needed to adapt based on the history of consequences within the social skills group.

Social skills groups offer the opportunity to pair peers with reinforcing events. For some individuals with autism spectrum disorder (ASD), the opportunity to interact with peers may not motivate them to engage in appropriate social skills, and therefore, pairing may be necessary (Leaf, 2017). In these cases, social skills groups provide an opportunity to pair, or condition peers with other reinforcing activities. For example, in order to engage in a preferred activity like freeze dance, they must do so with peers. In other cases, some individuals with ASD are socially motivated though may not have the skills to interact appropriately (Leaf, Leaf, et al., 2016). Therefore, one may use peers as a motivating factor for individuals to engage in certain behaviors in order to access peers and maintain positive interactions with those peers. In addition, peers may be used to introduce socially motivated individuals to engage in activities that they may have previously considered neutral or even aversive (Leaf, Oppenheim-Leaf, et al., 2016). Therefore, using peers to condition common activities to be more preferred or at least less aversive.

Skinner (1953) discusses how individuals may behave as a unit, or behave together, to meet a common goal. Within a social skills group, there are more opportunities to manipulate the environment in such a way to practice behaviors that require group cooperation. For example, perhaps a desired game is too high to reach, and a box is needed to climb on to reach the game. However, the box is too heavy for one student to move it by themselves. Therefore, more students work together to push the box toward the shelf in order to reach the game. For a more complex example, in order to engage in an exciting activity, like a bubble party, they may have to solve a series of puzzles to access items for that activity. By assigning roles to individuals in the group, one can address individual targets (e.g., initiating comments, responding to others) within the overall group target (e.g., communication). For example, one individual can see a completed block structure but cannot access blocks and another individual has the blocks but cannot see the completed block structure. The individual who sees the completed block structure must tell the other individual with the blocks how to imitate the block structure. Upon building the structure accurately, they will earn bubble wands. Activities such as these continue until they acquire all items needed to engage in the group activity, a bubble party. By creating opportunities like these, instructors can manipulate the activities to best address skills in acquisition and maximize skill strengths embedded within a setting that requires interaction with peers that will ideally parallel experiences they will encounter in the future. The outcomes are more easily manipulable so that all individuals within the group access reinforcement for engaging in specific behaviors, especially when those behaviors are in acquisition. As the target behavior is strengthened, those same variables that were manipulated should eventually more closely resemble those in the terminal environment.

In order to produce the most meaningful outcome, social skills groups must also improve social skills performance (Wolstencroft et al., 2018). Social skills performance differs from social skill acquisition in that social skill acquisition mitigates social behavior deficits resulting from a lack of knowledge to perform a social behavior, whereas social skills performance allows an individual to apply the social skills knowledge already acquired during naturally occurring situations (Wolstencroft et al., 2018). Therefore, it may be necessary to train toward generalization so that the targeted behavior is brought under the control of the terminal stimulus and this control spreads to other stimuli (Skinner, 1953). Generalization and maintenance strategies such as using natural contingencies, training diversely, and embedding functional mediators (Stokes & Baer, 1977; Stokes & Osnes, 1989) may be more easily applied within a social skills group format, as opposed to a 1:1 format. For example, since peers are present, natural contingencies can easily be programmed for by implementing teaching during naturally occurring social situations such as having the individual ask to join an ongoing game of tag. The therapist can coach the peers in the social skills group to accept this initiation so it is followed by the consequence of being able to participate in the game of tag. Training diversely can also be easily applied to the social skills group format. Again, by having peers present, the individual may now practice the skill of initiating to join play across different peers and activities. The individual can also initiate using different responses such as “Can I play with you?” or

"Hey, I'd like to join!" All of which will be reinforced by natural consequences and promote response generalization and maintenance. Finally, by incorporating stimuli similar to those that may be present in the natural environment (i.e., functional mediators) such as a playgroup or circle area, or cues such as gesturing, can be easily embedded to transfer stimulus control from programmed stimuli to stimuli that may be present in the natural environment. Since social behavior is socially mediated (Skinner, 1953), having peers present to deliver a variety of discriminative stimuli and consequences allows for the strategies for generalization and maintenance to be easily programmed.

15.2 Literature Overview

The effects of group-based social skills training have and continue to be evaluated (Atkinson-Jones & Hewitt, 2018; Reichow et al., 2012; Reichow & Volkmar, 2010; White et al., 2007; Wolstencroft et al., 2018). While there have been inconsistent results regarding the efficacy of group teaching of social skills, the research generally has shown positive results, though future research is needed (Gates et al., 2017; Reichow & Volkmar, 2010; White et al., 2007). Group teaching formats are typically referred to as social skills groups (Reichow & Volkmar, 2010; Reichow et al., 2012) or group social skills interventions (GSSI; Atkinson-Jones & Hewitt, 2018; Gates et al., 2017; Wolstencroft et al., 2018). These terms may be used interchangeably as they were described in the literature, though outside the literature review, these will be referred to as social skills groups.

Reichow and Volkmar (2010) conducted a review to evaluate the research for social skills interventions that include the use of social skills groups for individuals with autism. In this review, Reichow and Volkmar not only synthesized the results of interventions but the quality of the studies such as the methodological rigor and design of each study. Of the 66 studies examined, only five evaluated teaching social skills within a social skills group. Within these five studies, the overall results were positive; however, not all studies had strong effects, or there were inconsistent results. Additionally, most of the studies included individuals with more advanced skill-sets or typical cognitive functioning levels; therefore, the efficacy of a social skills group for individuals with an atypical cognitive functioning level is still unknown. Finally, they recommend the evaluation of social skills groups implemented in applied settings such as classrooms to determine the social validity of this intervention procedure. These results and recommendations are consistent with a previous meta-analysis conducted by White et al. (2007).

In 2012, Reichow et al. did a follow-up review analyzing studies that used randomized control trials (RCTs) to assess the effects of social skills groups for individuals aged 6–21 years with autism on social competence, social communication, and quality of life. A total of five studies met the search criteria for analysis that specifically required a treatment group (i.e., social skills group) and a no-treatment or waitlist treatment group (i.e., no social skills group). Sessions occurred across 5–20 weeks, with most sessions occurring weekly for 60–90 min. Different standardized assessment scales were used across different social skills measures. Social competence was measured through the Social Skills Rating System (SSRS; Gresham & Elliott, 1990), Social Responsiveness Scale (SRS; Constantino & Gruber, 2012), or Social Competency Inventory (SCI; Rydell et al., 1997). Social communication was measured using the Idiomatic Language subtest of the Comprehensive Assessment of Spoken Language (Carrow-Woolfolk, 1999). Emotion regulation was measured using Diagnostic Analysis of Nonverbal Accuracy 2 (DANVA-2; Nowicki, 1997). Quality of life was reported differently across studies, depending on different aspects of quality of life. Friendship was measured using The Friendship Qualities Scale (Bukowski et al., 1994) and a popularity subscale from the Piers-Harris Self-Concept Scale (Piers, 1984). Loneliness was tracked using Loneliness Scale (Asher et al., 1984) and depression was measured using Beck Depression Inventory (Beck et al., 1996). None of the studies reported individual behaviors for participants.

When comparing the treatment group to the no treatment group, improvements were found in the treatment group when it came to social competence and friendship quality (Reichow et al., 2012). However, no significant differences were noted between the groups when measuring emotional recognition or social communication related to idioms (Reichow et al., 2012). In addition, there was some report of decreased loneliness, but no effects on child or parent depression (Reichow et al., 2012). Though there were results that showed improvement from social skills groups in areas like social competence and decreased loneliness, the overall quality of evidence was considered low. This is because of factors such as inconsistency in data, varying assessments used across studies, and varying interventions used within social skills groups. A major component that compromises the quality of evidence is that the reliance of parent and interventionist reports for standardized assessments could result in biased results if they are aware of which interventions are implemented and when these interventions are implemented. Based on Reichow et al. (2012), future research on social skills group intervention is needed to strengthen the reliability of the results. Additional research is also required before conclusions can be generalized and recommendations can be made, especially since research has typically been conducted with individuals of a standard cognitive function level. Furthermore, studies evaluating social skills groups report varying results across children and adolescents, limiting the generality of these data.

Jonsson et al. (2016) completed a literature review to investigate the extent to which social skills group intervention results gathered in RCTs can be generalized to other settings and individuals. Jonsson and colleagues evaluated aspects such as the source population (i.e., those individuals that met eligibility criteria for the study), including population (i.e., those who actually participated in the study), context, treatment provider, type of intervention used, and outcome to identify for whom and what settings the results of social skills group interventions can be applied, who can implement social skills groups and how they should do so, and if the results can be generalized to the natural environment and maintained over time. After screening, 15 RCTs were included in the review.

In Jonsson et al.' (2016) review, participants were children (6–13 years of age for 11 trials) and adolescents (13–18 years of age for four trials), mostly male, and all diagnosed with ASD or a related diagnosis (e.g., pervasive developmental disorder—not otherwise specified). While two studies did not include how the diagnoses were confirmed, all other participant diagnoses were confirmed using standardized diagnostic tools. Participants had a minimum intelligence quotient (IQ) or verbal IQ level of 60–85 in all but one trial. Participants were recruited from academic centers, clinics, schools, or local organizations (i.e., 13 trials), or through a public announcement (i.e., two trials). The trials were completed in several countries (i.e., Australia, Canada, France, Netherlands, South Korea, USA) and across different settings (e.g., universities, clinics, schools). Information on treatment providers was often not provided; however, for studies that did provide treatment provider information, trials had up to four providers with varied qualifications throughout trials (i.e., post-graduate, graduate, or undergraduate students, psychologists, psychotherapists, psychiatrists, social workers, registered nurses, and speech and language pathologists) and had varied experience conducting social skills groups for individuals with ASD. All trials collected data on the provider's treatment fidelity. Information provided on the type of social skills group used (e.g., PEERS; Program for the Education and Enrichment of Relational Skills for Young Adults) was also limited, and the type of interventions varied greatly. Social skills groups also focused on different social skills areas such as verbal and non-verbal interaction, social interactions, conversation skills, and social problem-solving. Similar to the type of social skills group used, outcome measures varied across trials. Outcome measures used included blinded observation, blind assessment, follow-up assessments, and pre- and post-test measures. Some studies measured anxiety and depression using either a global assessment of everyday functioning or an assessment of the change in the clinical global impression.

Jonsson et al. (2016) identified several areas for future research. To begin, there is an overall need for more rigorous investigations on the external validity of social skills group research. Studies should specifically evaluate the ability to clinically apply and implement social skills groups. Studies should also include information such as the characteristics of the source population to allow for the generalizability of the results to be more effectively assessed. Future studies should be less selective with their populations to better represent realistic clinical populations. For example, populations most commonly included white males. This is not representative of individuals of varied genders or ethnicities. To represent an even broader population, individuals with a variety of skillsets and social-economic statuses should also be included. Jonsson and colleagues acknowledge this may weaken the internal validity of the study, it will strengthen the external validity. Similarly, since individual differences can impact the generalizability of results, studies should include participant descriptors of characteristics such as comorbidities to better assess who the results can be applied to and how these characteristics impact treatment efficacy. Future research is also needed to assess the efficacy of social skills groups with cultural modifications. Finally, Jonsson et al. recommend studies include more blind observations in everyday environments, more data on follow-up and long-term effects, and reports on the client and caregiver treatment preference to determine its impact on treatment outcome.

Gates et al. (2017) conducted a meta-analysis to evaluate the effects of GSSIs within well-designed RCTs while considering the assessment measures (i.e., parent report, teacher report, self-report, task-based assessment, observer report) used to evaluate efficacy. In addition, they compared if these effects differed across assessments within the study, as well as across different features of the intervention. The participants within this meta-analysis ranged from 5.30 to 20.42 years of age, with a mean overall standardized cognitive ability of 102.27 (range, 87.55–112.45), and mean standardized verbal ability of 100.01 (range, 86.3–106.26). Overall, Gates et al. found that there was a medium effect for those who participated in a treatment group from those within the control group. Across assessment measures, regardless of informant, were considered to evaluate social competence. Sixteen studies used parent reports. Within these 16 studies, there was a small difference in effect for those who were in the treatment group when compared to those who were in the control group. The four studies that included teacher reports also reported a small effect, but overall did not report a difference from GSSIs. In comparison, the 10 studies that used self-report measures resulted in a large effect on social competence for those in the treatment group than those in the control group. The five studies using observer reports ranged from no effect to large effects, but overall resulted in a small effect for those within the treatment groups compared to control groups. When using task-based measures, within the eight studies, effect sizes ranged from small to large, but overall had a medium effect.

Overall, there were positive effects in improving social competence for individuals who participated in GSSIs versus those within a control group. Interestingly, those who used self-report assessments mentioned that participants did report gains in social knowledge, but did not necessarily change their social behaviors. This information would be consistent with the smaller effect sizes from parent and teachers reports, where they may observe small to moderate effects in their social behavior. Gates et al. mention that it may be beneficial to consider opportunities for participants to practice implementing the social behaviors taught within GSSIs, which may have an effect on performance in general settings. In addition, it would be important to assess if the strategies used in the studies that utilized task-based measures aimed to improve skills or are merely "teaching to the test."

Wolstencroft et al. (2018) completed a meta-analysis of 593 articles, which examined the effectiveness of GSSIs in developing social performance. Wolstencroft et al. reviewed articles measuring participant social performance using the parental report and analyzed measures of outcome based on the degree of change in the SRS and SSRS scores. Wolstencroft and colleagues also evaluated the effect of specific intervention factors to determine their impact on the improvement of social knowledge and performance skills. The participants in the studies ranged from 6 to 25 years of age. Five different programs were used across the 593 articles examined. These included PEERS, Children's Friendship Training, summerMAX and SENSE Theatre, and an unnamed manualized Cognitive Behavioral Therapy (CBT) social skills program. SENSE Theatre was the only program to utilize a performance teaching strategy. All of the studies included child groups and most included parent groups. The programs included in the studies ranged in intensity and duration, with summerMAX and the SENSE Theatre employing the most intensive models. The GSSIs included in the meta-analysis targeted different social skills domains which included social knowledge, social communication, social cognition, and social emotions. While all studies included needed to have used the SRS and/or the SSRS, other assessment measures may have been included and all studies used a parent informant as well as a participant, staff, or teacher informant.

Wolstencroft et al. (2018) completed a "risk of bias" analysis for all RCTs in seven different areas. These areas included sequence generation, allocation concealment, baseline measurements, blinding of participants and personnel, blinding of outcome assessors, incomplete outcome data, and selective outcome reporting. Notable is that all studies obtained a "high risk" rating due to incomplete blinding of the outcome by participants, personnel, and outcome assessors. Additionally, two-thirds of the studies were rated high risk for incomplete outcome data. However, selective outcome reporting was rated low-risk across all of the evaluated studies. Two studies received a "high risk" rating in four or more of the seven criteria, receiving more "high risk" ratings than the other RCTs. In terms of the SRS scores, a large effect size was shown for GSSIs, and GSSIs produced greater participant improvements than participants in the control group with a significant effect ($p < 0.0001$). On the SSRS, the GGSI also showed improvement with a moderate effect size. Moderator analysis of the SRS was completed to find differences in total SRS scores between groups by separating studies based on the GSSI program used (e.g., SENSE Theater). No significant difference was detected between the SENSE Theater and CBT social skills groups and the controls; however, summerMAX and PEERS resulted in large and significant positive effect sizes. Group differences on total SRS scores were also evaluated by analyzing parent involvement and intensity and duration of the GSSI program. Programs with more parent involvement and greater intensity and duration achieved larger effect sizes. Overall, Wolstencroft et al. found that GSSI studies often rely on informant reports for outcome measures. Future research should utilize more objective, blind measures and also include participant social validity measures.

Spain and Blainey (2015) completed the first systematic review to evaluate the effectiveness of social skills groups for adults with ASD who had more well-developed skill sets, or adults diagnosed with ASD with an IQ within the typical range. The review included 5 articles that met the inclusion criteria. Three of these studies described a single-arm intervention and two included quasi-experimental methods using a treatment as usual control or a waitlist control. In terms of the quality of these articles, all had small sample sizes (i.e., 6–10 participants). Furthermore, only two had control groups and Spain and Blainey described them as "perhaps best considered pilot studies" (p. 876). Most of the participants in the studies were young adult males with 85% of the participants being male with a mean age of 25.8 years. Though, the range of the participants was 18–55 years of age. Four of the groups met weekly and one met monthly. The studies included 8–18 sessions which lasted between 50 min to 2.5 hr., with at least two staff leading each group. One study included a parent treatment group in addition to the participant group. The goal of this group was to teach the parents to support the participants' skill development. One other study included a parent group but this group was self-directed and optional, although participation was encouraged.

In Spain and Blainey's (2015) review, the studies analyzed targeted a variety of skills which included emotional understanding and understanding situations, as well as providing information on friendships, social understanding, and social problem-solving. Some studies aimed to integrate these skills into real-life scenarios. The methods for developing these skills included didactic teaching (e.g., discussing social problems and encouraging participants to develop solutions to the problem), small and large group discussions, practical tasks (e.g., role plays or evaluating videos), and a supportive group model. Two studies gave homework to encourage between-session learning. Spain and Blainey noted some concerns regarding outcome measures. For one, no studies included baseline or follow-up measures. There was also a lack of consistent outcome measures across studies, making comparison difficult. Finally, some outcome measures were unavailable due to reasons such as participant refusal, lack of participant motivation, or attrition.

The studies in the review assessed the quality and quantity of the social skills developed and all revealed overall positive effects. However, Spain and Blainey (2015) reported concerns regarding the reliability and validity of some results and none of the studies reported the clinical significance of change for outcome measures. Spain and Blainey grouped the results of the studies based on the areas measured. These areas included social knowledge and cognition, social functioning, anxiety and depression, and satisfaction with the intervention. In the area of social knowledge and cognition, results demonstrated significant improvement. However, two studies did not report the overall mean cognitive scores. This made it unclear whether there was a clinically relevant change or just a general trend. Overall, the social skills groups in the review resulted in improvement in empathy, emotion recognition, and Theory of Mind (ToM). The area of social functioning evaluated the participants' performance of the skill in their natural setting. In all studies, this area was assessed using a rating scale or role-play demonstration. Self-report indicated decreased measures in the area of loneliness and increased positive attitude toward peers, as well as a perceived improvement in social communication skills. Performance on role-plays varied across studies but also reported overall improvement. Participants within the studies also reported lower levels of anxiety and depression but with small effect sizes and large ranges. Finally, the satisfaction with the intervention was rated positive overall across participants. It is important to note that only one study reported on fidelity.

In summary, the results of Spain and Blainey's (2015) review suggest that social skills groups may be effective for adults with ASD within a typical IQ range, yet areas for future research exist. Spain and Blainey expressed an overall need for more social skills groups studies with individuals with high functioning ASD, some of which should specifically examine the ability of an intervention to decrease levels of anxiety, depression, and other comorbidities. These studies should be completed across participants with varying levels of symptom severity and clinical presentation (e.g., male, female, non-binary, white, Hispanic, African American). Future studies should also assess the effect of different group sizes and compare the different techniques used with social skills groups. Finally, Spain and Blainey recommended future research should use consistent outcome measures and incorporate more social validity measures.

Atkinson-Jones and Hewitt (2018) reviewed the social skills groups literature to evaluate the effect of social skills groups in developing positive social behaviors in adults with ASD and a mild or moderate intellectual disability (ID). After a screening process, Atkinson-Jones and Hewitt identified 10 studies. Four of these studies were RCTs, one was a quasi-experimental non -randomized control study, and the remaining five studies utilized quasi-experimental pre- and post-test designs without a control group. Eight of the studies included participants with an ID and most participants were white males. The participants within the studies were all diagnosed with ASD and ranged in age from 18 to 55 years old. The 10 studies reviewed included a variety of social skills programs including Program for the Education and Enrichment of Relational Skills for Young Adults (PEERS-YA; Laugeson & Frankel, 2010), Aspirations (Hillier et al., 2007), Social Cognition and Interaction Training for Adults (SCIT-A; Turner-Brown et al., 2008), Social Skills Programme (Howlin & Yates, 1999), Social Skills Group (Ashman et al., 2017), and Workplace Training Programme (Liu et al., 2013). None of the studies in the review compared any of these programs. Four studies incorporated PEERS-YA, a 16-week program for individuals with high functioning ASD utilizing 90 min small group sessions targeting a variety of social skills. Three of these studies were rigorously designed RCTs. PEERS-YA resulted in positive effects including improved social knowledge and performance, and increased empathy. Results also maintained. PEERS-YA was also the most efficient intervention, taking the least amount of time to complete.

Two studies in Atkinson-Jones and Hewitt's (2018) review assessed Aspirations, an eight-week program for individuals with ASD that aims to develop social and vocational understanding involving weekly hour-long small group sessions. Both studies were quasi-experimental pre- and post-test designs without a control group and were conducted by the same research group. One of these studies confirmed IQ and diagnoses. No significant differences were found in attitudes or feelings toward peers, but one study decreased levels of anxiety and depression and improved empathy as evident during the post-test. Participants of one study demonstrated improved interpersonal skills. Neither study completed follow-up measures.

Atkinson-Jones and Hewitt (2018) found that the SCIT-A program was evaluated using a quasi-experimental pre- and post-design with a treatment-as-usual (TAU) control group. Treatment involved 18 sessions weekly, lasting 50 min each as targeted emotional and ToM development. The post-intervention treatment group showed improvement in ToM skills but did not demonstrate improvement in emotional or social communication skills. The study also lacked internal validity and included a small sample size. One study evaluated the Social Skills Programme, an 18-session monthly program developed for individuals with ASD aimed to improve conversation skills, assertiveness, social problem solving and social understanding skills, and interview skills. The study utilized a pre-post group design without a control group. Findings indicated improved social and conversational skills which generalized to other settings; however, weaknesses in methodology such as a lack of control and standardized outcome measures yield caution when considering results (Atkinson-Jones & Hewitt, 2018).

Atkinson-Jones and Hewitt (2018) found one RCT that evaluated the Social Skills Group, a 16-week program for adults with ASD utilizing weekly 60-min sessions targeting social and relationship skills. No differences were found between groups in the study, but the treatment showed trends toward greater improvement in the areas of ToM and social functioning. Finally, one study assessed the effects of the Workplace Training Programme. The Workplace Training Programme is an intensive 6-month program designed for individuals with ASD and ID to develop vocational, communication, and emotional skills. Reliability validity measures were good (i.e., r = 0.80–0.90 for reliability and correctly identifying more than 80% of work rehabilitation placements). Post interventions demonstrated significant improvement in communication, emotional control, and workplace social behavior. The study was completed outside of the USA and UK which broadened the populations studied. However, some factors limit the validity and generality of the findings of the study. To begin, measures were not completed by blind observers, participants, or stakeholders. Additionally, a small heterogeneous group was used, intervention was implemented in a controlled setting, and the intervention was evaluated using a single-arm intervention with no control group and only one standardized measure for use with people with ID.

Based on the review, Atkinson-Jones and Hewitt (2018) identified areas for future research including more objective outcome measures such as measures of real-life performance in more applied settings, evaluating the effectiveness of social skills groups across a varied population, specifically other than white males. Finally, Atkinson-Jones and Hewitt recommended collecting participant satisfaction ratings.

15.2.1 Strengths of Current Research

There is a growing body of research in the area of social skills groups (Atkinson-Jones & Hewitt, 2018; Gates et al., 2017; Jonsson et al., 2016; Reichow et al., 2012; Reichow & Volkmar, 2010; Spain & Blainey, 2015; Wolstencroft et al., 2018). The social skills group literature includes evaluations of the efficacy of social skills groups across several different factors such as diagnosis, age, intervention type, and many social skills areas (Atkinson-Jones & Hewitt, 2018; Jonsson et al., 2016; Spain & Blainey, 2015; Wolstencroft et al., 2018). There has also been an increase in the strength of the research designs and measures in which progress is monitored (Atkinson-Jones & Hewitt, 2018; Reichow & Volkmar, 2010). Research has also begun to assess the impact of social skills groups on loneliness, depression, and anxiety (Atkinson-Jones & Hewitt, 2018; Reichow et al., 2012; Spain & Blainey, 2015) as well as the areas of ToM and emotional regulation (Atkinson-Jones & Hewitt, 2018; Spain & Blainey, 2015). Research supports the use of social skills groups to develop social competence and knowledge (Atkinson-Jones & Hewitt, 2018; Gates et al., 2017; Reichow et al., 2012; Spain & Blainey, 2015; Wolstencroft et al., 2018).

15.2.2 Areas for Future Research

There are many limitations to the current body of research which leads to areas for future research. First, future researchers should consider using stronger experimental designs and measurement procedures to control for variables such as history, maturation, and observer bias (Atkinson-Jones & Hewitt, 2018;Jonsson et al., 2016 ; Reichow et al., 2012 ; Wolstencroft et al., 2018). If a pretest–posttest design is used, the results of these designs are strengthened when compared to a control group. In addition, including observers blind to the treatment groups would further strengthen the results as it limits the possibility of observer bias. Other designs such as a multiple baseline design across skills or participants may provide results that more clearly control for variables outside of the social skills group. In addition, these types of designs provide direct and observable data on the behavior being measured. This allows for the identification of any variable influencing the behavior change. There is an overall need for consistent and unbiased outcome measures such as blind observations and assessments (Jonsson et al., 2016; Reichow et al., 2012; Wolstencroft et al., 2018), as well as follow up and maintenance measures (Jonsson et al., 2016; Spain & Blainey, 2015).

Another limitation is minimal evidence supporting the generality of social skills groups (Atkinson-Jones & Hewitt, 2018; Jonsson et al., 2016; Reichow et al., 2012; Reichow & Volkmar, 2010; Spain & Blainey, 2015). Rigorous evaluations should be completed on the external validity and generality of social skills groups. The efficacy of social skills groups should be assessed using a larger and less selective population with a variety of skill sets, IQ scores, diagnoses, genders, races, and ages. As Reichow et al. (2012) mentioned, future research must expand its examination of the effects of social skills groups across demographics. Current research has limited its efficacy to individuals aged 7–12 years of average to above-average intelligence within the USA. Thus, it would be beneficial to evaluate the effectiveness of social skills groups across different ages, IQ scores, and cultures. It will also be valuable to determine the effect of the makeup of the social skills group (i.e., autism only or with peers) on acquisition.

Current research displays weak to no information on the efficacy of skills learned to be generalized across settings (Atkinson-Jones & Hewitt, 2018; Gates et al., 2017; Jonsson et al., 2016; Reichow & Volkmar, 2010). It is important to evaluate if skills taught within a social skills group generalize to applied settings, and if these effects maintain over time

(Atkinson-Jones & Hewitt, 2018; Gates et al., 2017; Jonsson et al., 2016; Reichow & Volkmar, 2010; Spain & Blainey, 2015). Further research must also be done across specific curricula, as well as the procedures used to cover the curricula to determine which would be most beneficial with certain types of groups (Jonsson et al., 2016; Reichow et al., 2012). There also remains a limitation in measuring skill acquisition from skill performance (Gates et al., 2017; Wolstencroft et al., 2018). While it is important for individuals to learn skills, the acquisition may be useless if not performed when the opportunity is presented. Therefore, future research should continue to measure the performance of skills acquired. It is possible teaching in a more natural setting will help develop this skill (Stokes & Baer, 1977).

Even further, it would be beneficial to examine if certain procedures used within a social skills group are more efficacious than others within this measure (Jonsson et al., 2016). Future research should compare the efficacy and effectiveness of different types of social skills groups across a variety of factors including different social skills and varying populations, settings, and providers. Additionally, future studies should specifically examine the ability of social skills to decrease loneliness, depression, and anxiety using objective and rigorous measurement (Spain & Blainey, 2015).

Finally, future researchers must continue to evaluate the social validity of social skills groups. This could be done by taking long-term measures that evaluate the quality of life, long-lasting friendships, reciprocal relationships, and professional relationships. Do participants within these groups feel as though the skills taught are meaningful for improving their daily life? In addition, do caretakers and other relevant persons in that person's life feel as though the individual has learned meaningful skills and uses them in a way that improves their quality of life? Not only is it important to measure if the skills themselves are meaningful, but also if the procedures used to teach the skills are acceptable or enjoyable.

15.3 Clinical Implications

Since individuals with autism are a heterogeneous group, it is up to the clinician to examine the research to determine under which conditions the interventions may result in substantial behavior change. By better understanding the varying components and their effects from each study, clinicians are better able to individualize the structure of their social skills group to make it the most appropriate for their clients. In addition, clinicians have the benefit of making adjustments more freely than when conducting research. Clinicians may want to track the type of adjustments and why adjustments were made in order to determine some variables that influenced behavior change. As research should inform clinical work, clinicians may inform the research of other strategies that are effective in an applied setting which may improve the external validity of future research (Jonsson et al., 2016).

Current research may inform clinicians on how to measure participant progress. Clinicians may want to consider taking direct measures of observable behavior to ensure behavior change is occurring. Even further, it would be beneficial for clinicians to measure if progress occurs as the variables within the structured social skills group more closely mimic the terminal environment.

Those implementing social skills groups may also consider the curriculum taught to the group. Rather than following a manualized curriculum, perhaps obtaining information from parents and teachers of which social skill deficits seem to be most impeding the individual's daily life may help prioritize skills to be taught in the group. Not only will there more likely be an observed change in behavior but there may also be an increase in the likelihood of social validity of the intervention and skills.

15.4 Experiences from Clinical Practice

Social skills groups can be constructed for a variety of ages and skills sets (Atkinson-Jones & Hewitt, 2018; Gates et al., 2017; Reichow et al., 2012). There are major components to consider when establishing a social skills group to maximize effectiveness. When determining the overall objectives of the group, it would be important to consider the age of the participants, the current language skills of the participants, the current social skill deficits of the participants, and the problem behaviors of the participants.

15.4.1 Developing the Group

There are two different approaches to developing an effective social skills group. An objective for a group may be created then participants with appropriate strengths and deficits are recruited that fit best within that objective, or potential participants will be already available and the objective of the group will be developed based on the current strengths and deficits of the given participants. If a group is being developed given the latter approach, it is essential that these participants are compatible and complementary as peers. Variables to consider are further described below. Putting individuals together who vary in age, skills, problem behaviors, and social skill deficits for the sake of a group may not necessarily be better than nothing. It will be incredibly difficult to find a common objective and similar teaching strategies that are effective to teach in a group setting, which ultimately defeats the purpose of a group setting. Therefore, despite the approach in which the group is developed, it is paramount that time and evaluation are devoted to the participants that make up the group to ensure they are compatible.

15.4.1.1 Objective of the Group

The main objectives of a social skills group should include developing appropriate social behaviors, decreasing inappropriate social behaviors, and creating an environment that allows for performance practice that leads to generalization and maintenance. Depending on the participants in the group, variation in overall objectives occur in the type of social behaviors to be addressed (e.g., basic interaction skills vs. complex interactions), intervention procedures (e.g., discrete trial teaching [DTT], The Cool versus Not Cool™ [CNC] procedure, behavior skills training [BST]), and the types of environments (e.g., playgrounds vs. shopping malls) they must perform these skills. In addition, the specific skills and curriculum used within each group will depend upon the ages of the participants, their language skills, social skill deficits, and problem behaviors.

For one social skills group, the primary objective may be to develop social skills to function through daily living. This might include skills needed when grocery shopping like asking for help, waiting in line, and interacting with the store clerk. Other skills might include those needed for interviewing for a job, like greetings and responding to questions. Another could be those needed for working as a grocery clerk, such as greeting customers, responding to questions, and referring them to someone if they are not sure of the answer. Given the objective of improving daily living, a combination of DTT, BST, and the CNC procedure might be used to develop these skills, then practiced across environments and people so that these skills are used within the appropriate opportunities.

For another social skills group, the primary objective may be to develop social skills to enhance interactions with peers to create opportunities for friendships and relationships. This might include skills from initiating and engaging in conversation to identifying ways to problem solve when reaching a disagreement. Given the objective of developing skills to increase the likelihood of friendships, the CNC procedure or the Teaching Interaction Procedure (TIP) may be best suited to develop the skills, then practiced across environments where they are likely to encounter opportunities to engage in the skill.

There may be a number of different objectives that may be selected for any given social skills group, but it is important to determine those objectives to better determine the skills needed to meet those objectives, as well as the environment in which participants will need to perform them.

15.4.2 Participants

Prior to implementation, some strategies to determine if participants are compatible could include interviews and assessments completed by parents, teachers, case supervisors, and/or the individual themself. It is important to understand the deficits of the individuals in the group to ensure the skills targeted are more likely to be socially valid for the participants in their social environments.

It is recommended that individuals within a group fall within a similar range in the categories of age, language skills, social deficits, or problem behaviors. While not all deficits or strengths must be the same, it may be more beneficial to have participants with complementary social skills targets. For example, when it comes to conversation, it would be ideal if there were participants in the group that had a target skill of asking questions, while another participant in the group had a target skill of responding to peers. While not always possible, this is another consideration that may be beneficial when building a social skills group.

15.4.2.1 Age

In order to maximize effectiveness, it would be beneficial to find participants of similar age since the developmental expectations are more likely to be similar. In addition, it would promote participants engaging with peers of a similar age. Even if there are older individuals who have the cognitive age of the other individuals, it is not recommended that they be in the same social skills group for several reasons. First, the social expectation for both age groups would differ. For example, the way a 5-year-old would join in an activity would look very different than a 10-year-old. Second, if the older individual is accustomed to playing with younger individuals, they are more likely to gravitate to younger individuals outside of the structured teaching sessions or vice versa. This might limit the number of interactions the older individual could have with similar-aged peers, and may put the individual into harm's way if outsiders are not aware of the diagnosis of the individual. Parents may worry about the safety of their child when an older individual approaches and the interaction could end in unfortunate ways. Therefore, it would be beneficial to keep individuals within the same age range, to not only teach age-appropriate skills but also better familiarize individuals with others within their same-age peer set. Finally, if individuals are paired in groups of similar-aged peers, they are more likely to be exposed to general knowledge appropriate for that age group, and the curriculum within the social skills group could focus on topics appropriate for that age group. If individuals within the group vary too much in terms of age, there is the potential of teaching general knowledge information that does not apply or be appropriate for the age group (e.g., action movies for a 5-year-old, *Sesame Street* for a 15-year-old). While an older individual may enjoy topics such as *Sesame Street*, it will be important to not solely rely on these as topics of conversation and expose more age-typical topics. This will increase the likelihood they can interact with other individuals their age. Also, when an individual is perceived as older, the expectations for that individual are commonly higher. If a 15-year-old is watching *Sesame Street* on a mobile device, there is a high likelihood that others will interact with the 15-year-old as if they are much younger. While the 15-year-old may have more advanced skills, others may not realize and inhibit the potential for independence.

15.4.2.2 Language Skills

When selecting individuals for a social skills group, it is also beneficial to determine the current language skills of the individuals. While they must not all be exactly similar, it would be beneficial if they are similar in terms of receptive and expressive language understanding. This way, when using teaching procedures, they will be able to follow the same lesson with limited modifications. This would not only make the intervention effective but would allow it to function more efficiently as well. Of course, there may be an occasional need to modify language or teaching procedures, as this is expected when implementing a quality intervention. However, in order to maintain the most efficient group, it is recommended to have most, if not all, peers functioning at a similar level. Otherwise, it would be critical to provide enough staffing to pull students out for more individualized teaching; however, it is recommended to immediately incorporate the student back into the group so the purpose of teaching in a group setting is not lost.

15.4.2.3 Social Skill Deficits

While social skill deficits will be individualized for each participant, there will likely be common deficits within the group, especially if developing social skills groups for individuals with ASD. For example, one participant may have a skill deficit within carrying a conversation, while another participant may have difficulty taking turns within a conversation. While both have different deficits, there is a common deficit which is skills within a conversation. It is beneficial to find individuals that have similar, or even complementary, deficits in order to maximize the benefits of a social skills group. Another example is if one participant tends to be overly passive or does not initiate and another participant does not share materials. While these are very different skill deficits, they both fit under the umbrella skill of appropriate interactive play.

15.4.2.4 Problem Behaviors

The rate and topography of problem behaviors of individuals in the group is another thing to consider when developing a group. Ideally, if individuals are being selected to participate in a social skills group, there should not be a high rate of behaviors that interfere with learning. Participants should be able to refrain from problem behaviors with contingencies that are realistic for the group setting. If a replacement or alternative behaviors for problem behaviors are not yet established, it may be beneficial to develop these in a more individualized setting. For example, if reinforcement is needed every 10 s for refraining from stereotypy, the participant may not be ready to learn in a group setting as the instructor will not be able to provide a high frequency of reinforcement while also teaching the rest of the group. However, if the participant can refrain from engaging in stereotypy for up to 5 min, the instructor can continue to provide a rate of reinforcement appropriate for the student to be successful without interfering with teaching the rest of the group.

15.4.3 Curriculum

Since current research provides a spectrum of curricula to choose from, the topic of the curriculum is complex. Rather than arbitrarily selecting a curriculum to use for a social skills group, it should be determined based on which skills are required to function across a variety of social settings, and which do or will apply to the participants within the objective of the group. It will be important to recognize broader topics to address in the group, such as playing with others or engaging in conversation, but, more importantly, the actual teaching and task analysis that comprise these skills are individualized based on the deficits of the individuals within that group.

Beyond curriculum, it is important to use procedures empirically supported to be effective in teaching social skills within group settings. Some procedures include the teaching interaction procedure (TIP; Leaf et al., 2010), cool versus not cool (CNC; Milne et al., 2017), and behavior skills training (BST; Palmen et al., 2008). In order to determine which procedure or procedures is most appropriate for the social skills group, it is important to understand the benefits and difficulties of each procedure, the skills that will be taught, the skill set of the staff that will implement the procedure, as well as the skill set of the participants in the group.

15.4.4 Staffing

To run an effective group, it is ideal to have skilled staff that understand the overall objective of the group, understand the current and long-term goals of individual participants, and can implement the teaching procedures with fidelity. By having a clear understanding of the overall objectives within the group, staff can better prioritize and maximize teaching opportunities, including those that are planned and those that come up organically. Similarly, while maintaining a clear objective, staff can better manipulate variables within the environment that can help participants be successful with certain goals or slightly challenge them in a way that will better prepare them for generalized settings. With a good understanding of the teaching procedures, they can manipulate the components to best meet the needs of the group, then make the adjustments necessary to teach toward generalization (Stokes & Baer, 1977).

Staff should be organized and prepared for each session. Staff should be prepared with the specific lesson plan and all necessary materials for whichever activity they will be leading. They must ensure they have established clear goals and objectives for their particular lesson, as well as individual goals embedded for each participant. Staff will prepare other staff for their role when assistance is needed. If staff are not well prepared for their given lesson, it is time wasted for all the participants within that group.

Staff must also be able to communicate clearly with other staff during each session, as well as prior to and after each session. While communication should be consistent throughout a session, this should not be confused with engaging in constant conversation. When participants are present, all focus should be on maximizing learning opportunities for participants to learn and practice skills. Therefore, during sessions, quick instructions or social cues are used to maintain communication among staff and to minimize disruption. Thorough communication among staff should occur prior to and after sessions to minimize disruptions to teaching. Debriefing following each session allows all staff to fill everyone in on what they may have missed and where each student ended at the end of the session, so they may revisit antecedents, increase or fade prompts, or increase or fade reinforcement for the following session.

Effective staff in a group must also know and follow their role. When multiple staff are present, it is important to establish a clear lead instructor. Establishing a clear lead helps the participants understand who they should be attending to and who is responsible for delivering reinforcement and feedback. If too many staff are providing prompts, feedback, and reinforcement at any given moment, participant attention can become divided. The lead instructor should provide the primary instructions and feedback to participants and direct shadow support staff on when to provide prompts or additional intervention. Shadow support is present to provide additional support for the lead instructor. Shadow support should not reissue an instruction or provide feedback without the approval of the lead instructor and should not physically position themself in a way that is intrusive (e.g., hovering over or sitting directly next to participants). If the shadow support notices that a participant missed an instruction and reissues that instruction, the participant is likely to learn to not attend to the lead staff. Rather, the shadow should notify the lead that the participant missed the instruction so that the lead instructor may decide to provide feedback or reissue the instruction. When the shadow must gain the attention of the lead, ideally they provide non-vocal social cues (e.g., thumbs up or thumbs down) to communicate to not distract the participants from the lead. The shadow serves as “extra eyes” for the lead and informs the lead of the behavior and responses of participants that the lead might have missed. For example, if the lead provides a group instruction and is looking at the left side of the room, the shadow should observe this, and look at the participants on the right side of the room. When the lead provides feedback following the instruction, the lead may look to the shadow to determine if praise or corrective feedback is needed for the participants on the right side of the room. If the shadow is not needed for immediate assistance, the shadow may also take data and prepare materials for the upcoming activity. These tasks may also be passed on to a third staff member if available.

15.4.5 Schedule

When balancing staff, multiple participants, and group and individual goals, it could be difficult to keep track of everyone’s progress, and smoothly transition through activities. By having a detailed schedule, more time can be spent implementing the intervention. A typical schedule should list time blocks, the main activity within that time block, the objective of that activity, the subphase (if applicable), the roles of each staff member, and individual participant targets (if applicable). Table 15.1 displays an example of the level of detail that may be included in a daily schedule. These should be updated prior to every session to ensure group and individual targets are up to date, and staff have time to prepare. It also allows time for staff to ask any questions if they are unclear about any task they must lead and for staff to analyze and discuss if there needs to be any adjustments to current teaching procedures or behavior management techniques.

15.4.6 Behavior Management Strategies

The type of behavior management system used will depend on the participants and objectives of the group. There can be systems used for individual behavior targets such as a token economy (Gillis & Pence, 2015) or self-evaluation systems (Barry & Haraway, 2005) that targets behavior, communication, or social skill goals. Another system could be used based on a group contingency in which one or all members of the group engage in a behavior that earns the entire group a preferred activity. Ideally, given the setting of a social skills group, the group contingency would be based on engaging in one or more targeted social skills.

15.4.6.1 Individual Behavior Management

Several behavior management systems could be used to address individual behavior goals. These include a level system (e.g., Cihon et al., 2019), token economy (e.g., Gillis & Pence, 2015), time out system (e.g., Donaldson & Vollmer, 2011), or self-evaluation (e.g., Barry & Haraway, 2005). The system used and the rate of reinforcement will be individualized based on the need of each participant, but should be at a rate that can be managed by the lead instructor in a group setting. If the rate of reinforcement or intervention is so frequent that 1:1 support is continuously needed, it should be reassessed if the group setting is the most appropriate learning environment for the individual. Occasional pull-outs for individual learning may occur, but it should not be something frequently needed.

15.4.6.2 Group Contingency

Given the context of a social skills group, a group contingency system can target an appropriate social behavior in order to access a reinforcer. A group contingency could occur as a *dependent contingency* in which the behavior of one or more individuals results in the reinforcement for the group, an *independent contingency* in which only those that engage in a certain behavior or meet certain criteria may access the reinforcer, or an *interdependent contingency* in which each individual must engage in a behavior or meet the criteria in order for the group to access the reinforcer (Deshais et al., 2018; Strain & Schwartz, 2001). Within a social skills group, there may be several group contingencies occurring simultaneously, each targeting a different behavior and accessing a different reinforcer. For example, when participants are given "free time" and all begin engaging in conversation with another peer, the instructor may decide to provide a quick dance break for the entire group, using an interdependent contingency. Upon observing one participant helping another participant in the group, the instructor might reward the group with a token that goes toward earning a group party, employing a dependent contingency. An independent contingency can occur when participants are instructed to play on the playground, and the majority of the participants are interacting with one another, those participants who interacted with another participant earn a gummy bear. Using one or a combination of group contingencies may be an efficient way to increase appropriate social skills in a group setting.

Table 15.1 Sample of Social Skills Group Schedule

	Activity	Objective	Staff 1	Staff 2	Staff 3	Notes
2:45–3:00	Staff meet	Go over goals for the day and set up materials				
3:00–3:30	Opening circle	Learning how to learn Raising hands Observational learning Joint attention	**Lead** Increase rate reinforcement for Jamie Fade feedback for sitting for Alex	**Shadow** Continue rate of tokens for Taylor	**Data/prep materials for next activity** Set up two joint attention probes −1:1 for Jamie if needed	Joint attention probes: Bubble machine Play dance music
3:30–4:00	Cool vs. not cool	Joining in -demonstrations: Not cool: too quiet, joining rudely Roleplay	**Shadow** *Lead group B* Erin: Loud voice Max: Refrain from rude tone Kate: Flexibility with play	**Data/prep materials for next activity** *Provide additional support as needed*	**Lead whole group teaching** *Lead group A* Jamie: Assertiveness Alex: Flexibility with play Chris: Refrain from SSB	Materials: Train set Legos Coloring pages
4:00–4:15	Freeze dance	Positive social engagement	**Data/prep materials for next activity**	**Lead**	**Shadow** Chris: Over excitement	Materials: Music Colored spots
4:15–4:45	Outdoor playground -walking in a line until playground	Sustained play with peers Individual goals: Jamie: Novel ideas Alex: Flexibility with play Chris: Staying near peers Erin: Making comments Max: Responding to peers with a friendly tone Kate: Flexibility with play	**Lead line** Shadow group	**Trail line/shadow** Shadow group	**Bring stickers and data** Shadow group	
4:45–5:00	Closing circle	Checking in with behavior chart and stickers	**Lead**	**Clean up then greet parents at the door for debrief**	**Shadow**	
5:00–5:15	Debrief	Review group performance, individual performance, goals and lessons for next session Clean up				

15.4.7 Data Collection

There are a few methods to evaluate progress throughout the social skills group that involve either subjective or objective measures. Social skills are typically dynamic skills that fluctuate across different environmental variables; therefore, it is beneficial to track progress across different assessments (e.g., SSRS, SRS) completed by multiple informants, including the participants themselves, across a period of time. These assessment scores may be helpful in determining social skills to target to increase social validity. Since some assessments may result in observer bias, it will be beneficial to also obtain data on observable behavior, or obtain data from observers who are blind to the intervention; however, using observers blind to the intervention is not always practical in a clinical setting.

Data may inform the acquisition of social knowledge as well as the acquisition of behavioral performance. While social knowledge may be one step to improving social skills, the emphasis of behavior change should primarily focus on behavioral performance. In addition, it is imperative to measure if the effect of these behavior changes is socially valid to the individuals themselves.

15.4.8 Intensity

Determining the appropriate number of sessions and the duration of each session for the social skills group could be challenging. The range of sessions can vary from 1 to 5 days a week (Reichow et al., 2012) and range from 60 to 120 min each session (Reichow et al., 2012). Given the range, it is beneficial to evaluate the overall objective of the group as well as the skill sets of the participants within the group. If the overall objective is focused on a more basic social skills curriculum such as exposure to peers, awareness of peers, tolerance of peers, or waiting, it may be beneficial to have more frequent sessions (e.g., 5 days a week) with a shorter duration (e.g., 30–60 min). A shorter duration of sessions allows for successful exposure without taking away time for more individual services that may be needed to improve behaviors that allow the individual to learn in a more natural environment. However, having more frequent sessions allows for more consistent exposure and more frequent trials to ideally promote success. As the participant's behavior continues to progress, it is recommended to assess and adjust to longer sessions and possibly a more complex curriculum as needed. To the authors' knowledge, there is no clear research that analyzes different intensities of one method of group intervention across skill sets. Therefore, not only is there an opportunity for future research, but clinically it will require continuous analysis of data to ensure the sessions are effective for the participants.

If the objective of the group is focused on a moderate or more complex social skills curriculum such as conversation, engagement with peers, or winning and losing graciously, it may be beneficial to have less frequent sessions (e.g., 1–3 days a week) with a longer duration (e.g., 90–120 min). Longer durations of sessions provide more time to teach skills that typically have more steps or more nuances to the behavior which naturally require more time to teach. Longer sessions also allow for longer practice opportunities since these types of social skills need to be sustained for longer periods of time. Longer sessions permit spending more time on the lesson, multiple opportunities to practice in a variety of settings, and time to teach two different skills simultaneously. As individuals get older, they are often more involved in extracurricular activities such as soccer, theater, or science club. With such busy schedules, it also becomes more difficult to attend frequent social skills classes. Having less frequent sessions increases the likelihood of high attendance and allows more time for the participants to engage in social activities outside of therapeutic sessions where they can ideally practice the target skills. It also allows staff time to adjust and prepare the next lesson based on how the previous session ended. Because individuals learning moderate or complex social skills may learn the skills more quickly, the lessons may need to be adapted day to day to ensure the efficiency of teaching as well.

15.5 Conclusion

The efficacy of social skills groups continues to be researched and the growing body of literature has increasingly shown social skills groups can result in the development of social skills for individuals with autism (Atkinson-Jones & Hewitt, 2018; Gates et al., 2017; Spain & Blainey, 2015; Wolstencroft et al., 2018). However, research on the efficacy and effectiveness of social skills groups is still limited, and future research is needed. For example, future research should use stronger experimental designs and more consistent measures (Atkinson-Jones & Hewitt, 2018; Wolstencroft et al., 2018). It is also important to continue to evaluate the effectiveness and efficacy of social skills groups when it comes to applied skill performance and generality across a variety of populations and settings (Atkinson-Jones & Hewitt, 2018; Gates et al., 2017; Jonsson et al., 2016; Reichow et al., 2012). Finally, social skills groups should be compared to other interventions in order to determine the most efficacious procedure for developing social skills for individuals with autism (Jonsson et al., 2016).

The growing literature provides implications for practitioners. It would be beneficial for practitioners to analyze the variables that have been effective, or even those variables that are interfering with skill performance and generality, and to modify and individualize teaching procedures to increase the effectiveness of these procedures for their clients. Practitioners should select measures that best depict the client's performance and allow for analysis of this progress. Finally, rather than adhering to a manualized curriculum, it may be beneficial for practitioners to develop a social skills curriculum that prioritizes skills that are most socially significant for the individuals.

Social skills groups are an evidence-based method for developing social skills for individuals with autism (Atkinson-Jones & Hewitt, 2018; Reichow et al., 2012; Reichow & Volkmar, 2010; White et al., 2007; Wolstencroft et al., 2018). If constructed correctly, social skills groups can offer an opportunity to efficiently teach individuals with autism a variety of social skills while with their peers. By expanding the verbal community where social skills are taught and learned, the environment itself allows for a more expansive repertoire of contingencies an individual will encounter than when taught in a one-to-one setting. Social skills group interventions allow the practitioner to capitalize on this and develop and use social skills interventions that are effective in promoting the development and generalization of critical social skills that will make socially significant changes in the lives of the individuals they work with.

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16 Parent Implementation Interventions

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16.1 Introduction

Autism spectrum disorder (ASD) is a life-long developmental disorder characterized by core deficits in communication, social abilities, and the presence of restricted and repetitive behaviors that can be observed within the first 3 years of life (American Psychiatric Association, 2013). Individuals with ASD often require intensive and comprehensive intervention in core symptom domains, as well as in additional areas of functioning (e.g., adaptive skills, behavior management), starting as early as toddlerhood when a reliable diagnosis of ASD can be made (Kim et al., 2013). In fact, there is increasing research to suggest that ASD-specific early intervention can have a significant impact on brain development and later adult outcomes (Dawson, 2008; Dawson et al., 2012). As a result, the last several decades have seen the development and dissemination of intervention programs aimed at decreasing core symptoms and improving daily functioning in individuals with ASD. In addition, recent years have seen scoping efforts to quantify and interpret the mounting scientific data on these intervention approaches and outcomes, culminating in the most recent National Clearinghouse on Autism Evidence and Practice (NCAEP) Review classifying sets of practices that have clear evidence of positive outcomes for children, youth, and young adults with ASD (Steinbrenner et al., 2020).

One of the areas of research that has seen dramatic growth over the last several decades is that of parent/caregiver training. Importantly, parent involvement in intervention has a long history in the ASD-intervention field, with Lovaas and colleagues' (Lovaas, 1987; Lovaas et al., 1973) seminal findings supporting a better response to intervention for children whose parents were trained in intervention strategies relative to children whose parents did not receive this training. These findings were soon replicated and expanded upon with further formative studies, including those showing that parents could learn to use basic behavioral strategies with high levels of fidelity (Anderson et al., 1987; Baker, 1984; Harris, 1984). These studies from the 1970s and 1980s underscored the need for collaboration between home and the educational environment and active partnership with parents for successful programming, and set the foundation for what has become known as ASD parent training or parent-mediated intervention research (Lovaas et al., 1973; Schopler & Reichler, 1971). Building from this strong foundation, efforts over the last three decades have interrogated complimentary questions such as (1) how do parent learning and use of different intervention techniques impact

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child and family-level outcomes? (2) what are effective strategies for supporting parent learning and use of intervention techniques? and (3) which intervention techniques and programs are best suited for parent learning and use? While the field still seeks answers to these nuanced questions, data accumulated over the last 50 years offer a strong rationale for continued investment in the development, study, and dissemination of parent and caregiver training to optimize interventions and maximize positive outcomes for children with ASD and their families (Bearss, Johnson, et al., 2013; Bearss, Lecavalier, et al., 2013; Gerow et al., 2018; Mahoney et al., 1999; Oono et al., 2013).

There are several theoretical reasons for the long-standing support for parent involvement in ASD intervention. First, child learning occurs largely through daily routines and, as parents are often at the center of creating and enacting these routines, they have the opportunity to maximize developmental learning in everyday activities. As parents are also often the most consistent presence in a child's life, they have numerous opportunities throughout the day to implement the intervention techniques. In addition, increased parental knowledge and skills for engaging their child with complex neurodevelopmental difficulties allows for continued opportunities for the child to learn in a range of different situations and environments (Mahoney & Wiggers, 2007).

Importantly, parent involvement in intervention tends to be acceptable and desirable to families. For example, almost three-quarters of parents reported parent training to be the most effective contributor to their child's growth relative to other types of interventions, such as occupational, speech, and physical therapy (Hume et al., 2005). Parent training is favored for positively influencing a child's development and reducing the risk of severe ASD-related symptoms (Maglione et al., 2012). It also rates highly among parents for carrying out its intended purpose and providing relevant and useful information (Thomson & Carlson, 2017). Additionally, parent training expands the availability of intervention services to children with autism by making it more accessible for families (Bryson et al., 2007). It requires fewer resources and is less expensive to deliver compared to other types of early intervention (Matson et al., 2009).

Research indicates that parents can be taught to successfully use ASD-specific intervention strategies. Parent participation in ASD-specific intervention programs has been associated with improvements in child language skills (Charlop & Trasowech, 1991; Rogers et al., 2006), imitation (Ingersoll & Gergans, 2007), joint attention and joint engagement (Drew et al., 2002), and play skills (Stahmer, 1995), as well as a decrease in problem behavior (Moes & Frea, 2002). In addition, children whose parents receive training show increased generalization and maintenance of targeted skills across settings (Remington et al., 2007).

The benefits of parent training extend beyond the target child with ASD. For example, Koegel et al. (1996) found that parent training resulted in decreased parent stress and overall increases in positive family communication (Koegel et al., 1996). Similarly, parent training is associated with improvements in family functioning, specifically in marital, parent–child, and sibling relationships (Dunlap & Fox, 1999). Further, parent training provides psychoeducational opportunities for parents to increase their ASD-related knowledge, which can result in improved confidence when raising a child with ASD (Karst & van Hecke, 2012). Additional positive parental outcomes include a decrease in parent mental health concerns and enhanced parent understanding of their child's developmental strengths and weaknesses (Matson et al., 2009).

Taken together, there is a compelling theoretical and empirical rationale for continued investment in parent implementation interventions for ASD. Indeed, parent involvement in ASD intervention was identified by the most recent NCAEP Review as one of the 28 evidence-based practices for children, youth, and young adults with ASD (Steinbrenner et al., 2020). From 1990 to 2017, there were 55 empirical demonstrations of the efficacy of parent implementation interventions in high-quality, peer-reviewed journals, conducted by several independent research groups.

While the rapidly growing literature base in this area has resulted in an expanded and more sophisticated understanding of parent involvement in intervention, it has also created a landscape where multiple terms and definitions are used across different studies and stages of research. This, in turn, can complicate the interpretation of research findings and slow the process of translation from research to clinical practice. Fortunately, Bearss et al. (2015) offer a taxonomy of parent training to help define different models of parent involvement in intervention and better interpret findings from this diverse literature (Bearss et al., 2015). Within this framework, there are two broad categories of parent involvement in intervention: (1) parent support and (2) parent implementation. *Parent support* includes psychoeducation to increase parental understanding of the ASD diagnosis and associated needs. *Parent implementation* involves the parent as an active participant in the treatment, such that parents learn to use intervention strategies directly with their child.

Parent implementation interventions can further be divided into those that target skill building with the child and those that target behavior reduction with the child. Parent implementation interventions that focus on skill-building are referred to as *parent-mediated interventions* for core symptoms. Such parent-mediated interventions target core deficits in ASD with the goal of increasing pivotal behaviors such as social communication, imitation, and play, as these early skills are fundamental to long-term social communication development (Greenslade et al., 2019). Parent implementation interventions focused on behavior reduction are referred to as *parent training interventions* for maladaptive behaviors. Such approaches aim to minimize undesired or challenging behaviors such as aggression, non-compliance, and task avoidance, as well as problematic behaviors related to feeding, sleeping, and toileting, as these behaviors can be disruptive to learning for children with ASD. The above terms and definitions put forward by Bearss et al. (2015) will be used throughout the remainder of this chapter to organize and discuss various approaches to parent implementation interventions in ASD.

The goal of the current chapter is to provide an overview of parent-mediated and parent training intervention programs designed for use with children with ASD. For each type of parent implementation intervention, we first provide the theoretical rationale for treatment targets and offer a brief historical context. With an eye toward supporting the deployment of parent implementation within clinical practice, we selected several exemplar manualized programs within each parent implementation approach and offer a description and brief overview of the evidence base for these specific interventions. We will then discuss the nascent, but growing, research base for improving access to parent implementation interventions via telehealth and related technology. Finally, we end with a discussion of the clinical implications of this literature and recommendations for continuing to advance research in this area. It is important to reiterate that parents as active participants in ASD intervention have served as a longstanding keystone for the field. While a comprehensive review of all parent implementation interventions is beyond the scope of this chapter, it seeks to offer important context by describing the evolution and current state of the field with respect to actively engaging parents as a way to optimize and maximize ASD intervention outcomes.

16.2 Parent-Mediated Interventions: Improving Social Communication in ASD

As noted above, there is a long history of parent involvement in intervention for children with ASD, particularly those emphasizing supporting the development of core deficits as the treatment targets, such as social communication. Indeed, difficulties with social communication are observed across the entirety of the autism spectrum, regardless of intelligence and co-occurring disorders, making them a critical target for intervention. Social communication skills are composed of verbal (e.g., language, tone) and nonverbal (e.g., eye contact, gestures) abilities, with the goal of enabling clear and effective communication with others (Swineford et al., 2014). The process of successful communication, while innate in typical development, is very complex, involving a unification of multiple neural networks involved in language production, social understanding, language comprehension, and others (Catani & Bambini, 2014; Landa et al., 1992). Early social communication skills, such as the use of a point, or following another person's eye contact to find something of interest, predict social and language development in later childhood, suggesting that early interventions in these core social communication skills can set the foundation for social communication development later in life (Greenslade et al., 2019).

Indeed, given the well-documented and lifelong nature of social communication impairments in ASD, research aimed at identifying evidence-based strategies to improve social communication early in development has been longstanding, with parent-mediated interventions representing a promising approach. Published reports of parents learning and implementing strategies to support their child's social communication functioning date back to the 1970s (Schopler & Reichler, 1971), yet structured and widely available curricula for evidence-based, parent-mediated ASD interventions historically had been lacking. As a result, recent efforts have seen an active shift toward standardized and manualized parent-mediation interventions (Matson et al., 2009), in part driven by the recognition that parents are the *agent of change* in parent-mediated approaches. Given the central role of parent learning in parent-mediated intervention, the majority of research has been on programs that involve parents working closely with a therapist (or "coach") to learn and use the intervention strategies in their everyday lives.

In this regard, the last two decades have seen the emergence of a growing evidence base for parent-mediated interventions falling under the category of *naturalistic developmental behavioral interventions* (NDBIs; Schreibman et al., 2015). NDBI is an umbrella term used to describe intervention approaches that combine best practices from developmental science and the science of applied behavior analysis (ABA). Such approaches emphasize strategies from developmental sciences to promote engagement, social motivation, and synchrony between the parent and child, and utilize operant learning strategies from ABA to teach specific new skills. Individualized and developmentally appropriate treatment goals are guided by developmental sequences, with a strong emphasis on embedding teaching within natural routine and play interactions to enhance generalizability and maintenance of skills. NDBI treatment targets often include early pivotal social communication skills such as joint attention, pointing, imitation, and social routines. Common elements among NDBIs are described in detail by Schriebman and colleagues (2015) and include a three-part contingency (antecedent–response–consequence) fundamental to all ABA therapies, manualized practice, the fidelity of implementation criteria, individualized treatment goals, ongoing measurement of progress, child-initiated teaching episodes (e.g., using the child's focus or interests to teach concepts), environmental arrangement (e.g., placing items in sight but out of reach to prompt requesting and child initiation), natural reinforcement, use of prompting and prompt fading, balanced turns (which allows for some access control to materials, maintains engagement, and teaches social interactions), modeling (demonstrating the desired behavior), adult imitation, and broadening the attentional focus of the child. Naturalistic Interventions, including NDBIs, are considered evidence-based practice categories by the NCAEP, with 75 high-quality efficacy and effectiveness studies showing positive outcomes for children with ASD between 1990 and 2017 (Steinbrenner et al., 2020). While there are many similarities across parent-mediated NDBIs, the methods of intervention development, implementation, and evaluation have varied across these studies. To highlight work being done with different parent-mediated NDBIs, we describe and review the evidence base of three of these programs below.

16.2.1 Pivotal Response Treatment

Pivotal Response Treatment (PRT; Koegel et al., 1989) is one NDBI approach that was developed to address deficits in core "pivotal" skills for children with ASD and has been adapted for a parent-mediated approach. PRT is recognized as a comprehensive teaching model for children with autism (Lord & McGee, 2001). The goals of PRT are to build social and educational skills that will allow children to engage with others and thereby increase opportunities for learning (Koegel et al., 1999). Indeed, the authors define the "pivotal" areas that their interventions address as domains, "that, when changed, generally produce large collateral improvements in other areas" (Koegel et al., 1999, pg. 174), such as responsivity to cues, motivation to initiate (with others), environmental responsivity, and self-regulation. In this way, the intervention targets a few core areas of development, with the understanding that these core areas have cascading influences to improve other domains, or prevent future delays, not directly targeted in the intervention. Additionally, the PRT model addresses an entire domain at a time (e.g., motivation to initiate), rather than focusing on singular behaviors. PRT has emerged as an evidence-based practice in its own right, under the larger category of Naturalistic Interventions, and is considered by the NCAEP to be a Manualized Intervention Meeting Criteria (MIMC) for Evidence-Based Practice (Steinbrenner et al., 2020). This means that PRT is manualized, has a unique "intervention identity," and shares common features with other approaches in the Naturalistic Intervention category, yet also has sufficient data from high-quality studies and replications to be considered its own evidence-based practice.

Parent-mediated PRT has been successfully delivered in both individual and group formats (e.g., Bradshaw et al., 2017; Coolican et al., 2010; Hardan et al., 2015; Randolph et al., 2011). Most research on individual parent-mediated PRT involved weekly (e.g., 45 min to 1 h) parent coaching sessions over the course of 12–24 weeks. A handful of studies have explored "brief" models of parent-mediated PRT (e.g., three 2-h training sessions for parents; Coolican et al., 2010). Some studies of parent-mediated PRT used a general curriculum based on a standard set of PRT-specific technical materials (e.g., handouts and video examples; Hardan et al., 2015), while other studies took a more individualized approach based on the specific needs of the parent and the child (Bradshaw et al., 2017). However, across the majority of studies, active parent coaching (e.g., parents receiving feedback on their use of PRT strategies with their child) was a central component of the intervention. Parent-mediated PRT has also been delivered in a variety of group formats: Minjarez et al. (2011) delivered a 10-week, group-based program consisting of 90 min sessions, while Hardan et al. (2015) delivered eight 90-min group sessions and four 60-min individual parent-child dyad sessions over the course of 12 weeks.

There is empirical support for the efficacy of parent-mediated PRT, with some data even suggesting longer-term social communication improvements (Koegel et al., 1996, 2003, 2010). For example, a 12-week randomized control trial demonstrated that children whose parents participated in group-based PRT demonstrated greater improvements in language and adaptive communication relative to children whose parents were in a psychoeducation group. In addition, 3-month follow-up data from families who completed the parent-mediated PRT program indicated maintenance of these language and adaptive communication gains, as well as additional gains in early cognition after treatment (Hardan et al., 2015). Importantly, the benefits of parent-mediated PRT appear to extend beyond child outcomes. Research suggests that parents trained to use PRT demonstrate significant increases in family empowerment and decreases in parenting stress—most notably reductions in stress related to parent–child interactions—as a result of a group-based parent-mediated PRT program (Minjarez et al., 2011). There has also been an emphasis on determining the best way to integrate parent-mediated PRT into more comprehensive programs and community settings. For example, a 24-week randomized control trial examined a combination of parent-mediated and clinician-delivered PRT with data suggesting that children in the PRT group showed greater improvements in social communication skills and language, as well as improvements on a clinical global impressions rating scale (Gengoux et al., 2019). Preliminary data also indicate that less intensive formats of parent-mediated PRT, with greater potential for dissemination to community settings, may be effective for teaching parents to use PRT and enhancing child language and communication skills (Coolican et al., 2010). Together, the literature supports a parent-mediated model of PRT for teaching parents to use intervention strategies that bolster language and social communication development in young children with ASD.

16.2.2 The Early Start Denver Model

The Early Start Denver Model (ESDM) is an intervention model developed for toddlers with ASD and designed to be implemented in the home setting (Rogers & Dawson, 2010). Specifically, ESDM utilizes the routines built into a child's day for opportunities for social learning and engagement. The ESDM model considers development as a whole, and therefore has a broad focus to improve functioning across all child domains: motor, cognitive, language, play, and self-care skills. It aims to reduce autism symptoms and address delays in development (e.g., social communication). However, considering the developmental level of the intervention and the particular needs of children with ASD, there is a greater focus on improving child outcomes in imitation, nonverbal communication (joint attention), verbal communication, social development, and pretend play (Rogers & Talbott, 2016). Although ESDM itself was not yet considered a MIMC in the NCAEP review as a unique evidence-based practice, it falls under the category of Naturalistic Interventions, and studies examining ESDM are pivotal to the Naturalistic Intervention evidence base.

Initially, ESDM was delivered by providers trained in the model, with parents serving a supporting role by incorporating the model's strategies into their daily interactions (Dawson et al., 2010). More recent adaptations of the intervention have seen parents as the main intervention providers, and research has explored a number of different formats and structures to support parent learning and the use of ESDM (Ryberg, 2015; Zhou et al., 2018). Indeed, research on parent-mediated ESDM has been at the forefront of determining the optimal delivery of the parent-mediated intervention in the United States and globally (Zhou et al., 2018; Rogers et al., 2019). For example, investigators in China trialed a 6-month, high-intensity, parent-mediated ESDM model, consisting of initial self-directed learning via a parent manual, followed by an 8-hr group parent-training course, and then a 90-min individual parent coaching session each week over a period of 26 weeks (Zhou et al., 2018). Researchers in the United States have typically studied parent-mediated ESDM delivered in 90-min, clinic-based individual parent coaching sessions across 12 weeks (Rogers et al., 2019). Efforts have also been made to identify an "enhanced" parent-mediated ESDM model that builds on the traditional format by adding motivational interviewing, multimodal learning tools (e.g., web-based learning), and an additional 90-min home-based individual parent coaching session each week for 12 weeks (Rogers et al., 2019).

The majority of research on ESDM has focused on therapist-implemented ESDM or a combination of parent-mediated and therapist-implemented ESDM. The growing body of high-quality research indicates that such approaches increase a child's spontaneous language use, imitation skills, social initiations, and scores on standardized developmental measures (Dawson et al., 2010, 2012; Estes et al., 2015; Rogers et al., 2019). There is also promising data indicating normalization of brain activity in response to this model of ESDM (Dawson et al., 2012), with additional longitudinal findings supporting improved child outcomes up to the age of 6 years and after 2 years from the end of the intervention (Dawson et al., 2010).

Beyond this, data suggests that parents can effectively learn the ESDM strategies and that children show improvements in social communication and cognition as families engage in these programs (e.g., Rogers et al., 2012, 2019; Waddington et al., 2019; Zhou et al., 2018). Initial single-subject design studies showed that parents increased the number of ESDM strategies used as they progressed through the parent coaching curriculum and that their use of ESDM strategies was associated with improvements in child functioning, including child engagement and expressive language use (Waddington et al., 2019). While the first randomized control trial of parent-mediated ESDM compared to community-treatment as usual failed to find differences on child outcomes after 12 weeks of intervention, children in the community group received significantly more hours of intervention, suggesting that lower intensity (e.g., fewer hours) parent-mediated ESDM may be an efficient alternative to higher intensity community-based treatment approaches (Rogers et al., 2012). A follow-up comparative efficacy trial indicated that relative to the traditional parent-mediated ESDM format, an "enhanced" version (as described above) produced greater improvement in parent skills, although improvements in child social communication, cognition, and adaptive outcomes were comparable across formats (Rogers et al., 2019). Another randomized control trial of Chinese toddlers found that 6 months of high-intensity, parent-mediated ESDM was associated with greater improvement in language, social communication, and play relative to a community comparison condition (Zhou et al., 2018). Taken together, these findings offer strong support for a parent-mediated ESDM intervention for improving cognitive, language, and adaptive skills in young children with ASD.

16.2.3 Project ImPACT

Like the previously discussed interventions, Project ImPACT (Improving Parents as Communication Teachers) is a parent-mediated intervention targeting social communication outcomes for young children with ASD or a high risk of developing ASD (i.e., younger siblings of children with ASD). Specifically, the intervention targets child social engagement, language, imitation, and play by encouraging parents to use strategies during daily routines and play (Stadnick et al., 2015).

Project ImPACT was developed through an iterative process using the insights of parents, teachers, and service providers for use within the community setting (Ingersoll & Dvortcsak, 2010). This close collaboration with stakeholders led to the development of both an individual and group-based Project ImPACT model, which included materials and supports for parents (e.g., PowerPoint slides) and providers (e.g., tutorial videos to assist providers as they train and coach parents). The individual and group models are both delivered over a 12-week period. The individual Project ImPACT format includes 45–60 min parent coaching sessions once or twice per week across the 12 weeks. The Project ImPACT group format alternates between 1 week of group (2 h) and 1 week of individual parent coaching sessions (1 h). Additional academic-community partnerships have adapted the traditional Project ImPACT curriculum for use within specific community settings. For example, Project ImPACT for Toddlers is an adaptation that retained the traditional 12-week structure of Project ImPACT but made enhancements to the intervention and training materials to better align with the Part C Early Intervention systems' values and structures (Stahmer et al., 2019).

Project ImPACT is one of only two interventions within the NCAEP Parent-Implemented Intervention category to be considered its own MIMC as an evidence-based practice (Steinbrenner et al., 2020). There have been a handful of lab-based efficacy studies examining outcomes from Project ImPACT, with results indicating parents can learn the ImPACT strategies successfully and that their children demonstrate improvements in social communication in response to the intervention (Ingersoll & Wainer, 2013; Yoder et al., 2020). For example, a recent randomized control trial (RCT) comparing individual Project ImPACT to treatment as usual in high-risk younger siblings of children with ASD found that parent use of Project ImPACT strategies improved children's imitation and social communication skills, which in turn, improved overall expressive language abilities (Yoder et al., 2020). Although the only lab-based RCT of Project ImPACT, Yoder and colleagues' research meets a high threshold of methodological rigor with a relatively large sample size, multi-method assessment approach, and research staff and outcome evaluators blind to participant status.

Although the research base for Project ImPACT includes relatively less efficacy data, most of its evidence base comes from effectiveness trials which is critical that this program was specifically designed for delivery within the community. Ingersoll and Wainer (2013) worked with 13 teachers representing three intermediated school districts to implement the group-based Project ImPACT curriculum; results from this pilot study indicated children showed improvements in parent and teacher reports of child social communication skills and parents reported decreased stress after participation (Ingersoll & Wainer, 2013). Another community trial of the group format found that children whose parents learned and implemented Project ImPACT strategies from three community providers showed greater improvements in child social communication skills relative to those children in treatment as a usual control condition (Stadnick et al., 2015). Recently, Project ImPACT for toddlers was delivered within the Part C Early Intervention system with preliminary data suggesting that children who received Project ImPACT demonstrated greater improvements in positive parent–child interactions relative to treatment as usual families (Stahmer et al., 2019). While a relatively newer intervention model, Project ImPACT has been shown to be effective for improving child expressive language, imitation skills, and social communication outcomes, including when implemented within community settings where such programs will be most accessible to young children with ASD.

16.2.4 Summary

Research on these three NDBI parent-mediated intervention models demonstrates the breadth and depth of study in this area. For example, research on parent-mediated PRT has focused heavily on understanding outcomes at both the parent and child level; a critical area of further work as parents are truly integral to such intervention approaches. Research on parent-mediated ESDM has focused on high-quality and well-controlled randomized trials, as well as identifying the optimal structure, format, and dose of such intervention approaches. Project ImPACT, on the other hand, has been evaluated in a variety of community settings with an eye toward understanding adaptation, implementation, and sustainability of parent-mediated NDBIs in real-world practice settings. It is critical that researchers continue to approach the study of parent-mediated NDBIs in such complimentary fashions, as together this work provides different, but equally important, types of evidence to support the rationale for engaging parents to use NDBI strategies with children with or at risk for ASD. Important future directions for this work include longitudinal studies to examine longer-term intervention outcomes, a better understanding of family and child-level variables that may influence treatment engagement and outcomes, and continued exploration of strategies to best support parent learning and use of NDBI approaches.

16.3 Parent Training Interventions: Reducing Disruptive Behaviors in ASD

Disruptive behaviors occur in approximately 50–70% of children with ASD and significantly interfere with aspects of daily functioning (Bearss, Lecavalier, et al., 2013; Gadow et al., 2004; Lecavalier, 2006), peer socialization (Koegel, Koegel, Hurley, & Frea, 1992), and learning (Koegel, Koegel, & Surratt, 1992), making the treatment of co-occurring disruptive behaviors of high clinical significance for the family and the child. These behaviors often consist of concerns such as irritability, anger outbursts, tantrums, oppositionality, noncompliance, property destruction, self-injury, and aggression (Burke et al., 2002; Hartley et al., 2008). Importantly, disruptive behaviors may operate through motivating functions by which a child can escape a challenging situation (e.g., learning, sensory overload) or communicate a want or need (Kaat & Lecavalier, 2013; Koegel, Koegel, Hurley, & Frea, 1992; Yang et al., 2017). Despite this, if left untreated, challenging or problematic behaviors have the tendency to persist across settings and impair the child's ability to regulate once the behavior is established (Oliver et al., 2012), which can significantly impact functioning across domains (Bearss et al., 2015).

As with the descriptions of NDBIs above, it has not been until recently that more formalized and manualized parent training interventions have been developed to reduce and improve co-occurring maladaptive and disruptive behaviors (e.g., aggression, tantrum behaviors, noncompliance, self-injury; Burrell et al., 2020; Edwards, 2018; Edwards et al., 2019; Scahill et al., 2016). Historically, parents and clinicians were provided with a series of self-guided resources to target maladaptive behaviors in children with ASD (e.g., *No More Meltdowns;* Baker, 2008) and research on the efficacy or effectiveness of these specific self-guided approaches was limited (Bearss et al., 2015).

Moreover, the earliest research on parent-training programs was limited by inconsistent use of standardized manuals, individualized treatment approaches that lacked generalizability, and small sample sizes (Anderson & McMillan, 2001; Bearss et al., 2015; Ducharme & Drain, 2004; Moes & Frea, 2002; Wahler et al., 2004). Despite these methodological weaknesses, these early studies were important in establishing foundational efficacy for specific parent training techniques in treating disruptive behaviors for children with ASD (Bearss et al., 2015). Fortunately, researchers within the ASD field were able to pull from a longstanding and strong evidence base for parent training interventions that reduce challenging behaviors with children and adolescents with disruptive behaviors without ASD to inform the development of ASD-specific programs and protocols (Brestan & Eyberg, 1998; Briegel, 2016; Costin & Chambers, 2007; Dretzke et al., 2009; Postorino et al., 2017; Urquiza & Timmer, 2012), making it an important and efficacious treatment for disruptive behavior disorders in children with ASD (Kaat & Lecavalier, 2013).

Thus, in the more recent past, a series of parent training programs based on ABA principles have been developed to address disruptive behaviors for children with ASD. These programs provide parents with important behavioral management strategies and emphasize the parent as the primary agent of change for the child (Postorino et al., 2017). Consistent with an ABA approach, functional assessment/analysis is a core component of these interventions, such that clinicians have the opportunity to help parents understand antecedents and consequences that may drive their child's behaviors (Hanley et al., 2003). In this framework, intervention models often consist of psychoeducation, didactic instruction, direct modeling, observation, and interactive coaching techniques.

Below, we highlight a few of the current evidence-based parent training programs designed specifically for children with ASD, recognizing the ongoing need for continued clinical and research investigation in this area.

16.3.1 Functional Communication Training

Functional communication training (FCT) is a well-established behavioral approach designed to reduce problematic behaviors with children, such as aggressive and destructive behaviors, self-harm, and tantrums (Falcomata & Wacker, 2013; Gerow et al., 2018; Tiger et al., 2008). While FCT is thought to be most effective in early childhood and during the elementary years, there is reason to suspect that it is appropriate even for older children (Franzone, 2009). Additionally, FCT can be used with children regardless of their cognitive and/or expressive language abilities

(Franzone, 2009). Importantly, FCT was identified as a broad category evidence-based practice in the most recent NCAEP review, with 31 high-quality efficacy and effectiveness studies demonstrating positive effects on behavior and communication for children with ASD from 1990 to 2017 (Steinbrenner et al., 2020).

The overarching goals of FCT are to (1) identify the functions of challenging behaviors, (2) teach the child replacement behaviors that include more effective, communicative responses, and (3) provide reinforcement for the replacement response (Gerow et al., 2018; Mancil & Boman, 2010; Muharib & Wood, 2018; Tiger et al., 2008). Additionally, reinforcement in the context of challenging behaviors is withheld (Gerow et al., 2018; Mancil & Boman, 2010; Tiger et al., 2008). To accomplish this, functional behavior assessments (FBAs), a key component of FCT, are conducted. Indeed, FBAs are used to identify the variables that maintain or reinforce challenging behaviors (e.g., attention, escape) and help guide the intervention plan (Muharib & Wood, 2018). Following this, replacement behaviors can be taught to the child that produce the same individual end-goal (Muharib & Wood, 2018). Notably, given the significant relationship between impairments in communication and disruptive behaviors (Kaiser et al., 2002; Park et al., 2012), interventions such as FCT are particularly useful in improving communication skills, and subsequent behavioral problems, among children with ASD with severe language deficits. Historically, FCT has been most commonly delivered by clinicians with training in behavioral principles. In the more recent past, however, there has been an attempt to increase parental involvement in FCT interventions, adapting a parent training approach to this intervention.

Reports regarding training models for parents in FCT have varied across research studies, with different methods described for instructional procedures and performance feedback (Barton & Fettig, 2013; Gerow et al., 2018; Ward-Horner & Sturmey, 2012). In a study by Gerow et al. (2018), verbal and written instructions for parents, alongside performative feedback regarding their ability to effectively deliver the FCT strategies, were found to generate an accurate implementation of the FCT intervention during a trained routine. The findings for these methods during novel routines (i.e., generalization of the skill from trained routine to other settings/contexts) were less consistent, although notably the study was limited by a small sample size ($n = 3$; Gerow et al., 2018). Thus, ongoing studies to determine the best training models and/or development of a more standardized, manualized treatment approach to training parents in FCT would be warranted to support these findings.

Concerns that parent-implemented, compared to therapist-implemented, FCT may produce different outcomes in child behavior and have varied implementation fidelity have been expressed (Gerow et al., 2018). For example, there may be increased rates of challenging child behaviors during parent-implemented sessions (English & Anderson, 2004; Hanley et al., 2003; Huete & Kurtz, 2010; Ringdahl & Sellers, 2000). Individual parent differences, such as differences in training approaches, time restrictions, and types of reinforcement (Gerow et al., 2018), may also interfere with parent FCT sessions (Feldman et al., 2004; Moes & Frea, 2000, 2002; Sloman et al., 2005).

Despite these concerns, Gerow et al. (2018) conducted a systematic review of the existing literature on parent training in FCT. Across peer-reviewed studies, FCT conducted by parents was indeed effective in reducing challenging behaviors of children (Gerow et al., 2018). For example, a single-subject design study by Mancil et al. (2006) revealed a clinically significant reduction in challenging behaviors for a young boy following the completion of FCT with his mother. Furthermore, gains in spontaneous communication were also reported. Parent-implemented FCT intervention outcomes have also been shown to, on average, maintain over time and generalize across new environments (Gerow et al., 2018). Parents were described as active participants in the FBA process and often implemented all of the required FCT intervention sessions, which were relative strengths of the current literature in this area and suggest that parent-implemented FCT represents a promising intervention approach

(Gerow et al., 2018). However, this comprehensive review also suggested that parents were inconsistently involved in the development of the FCT intervention planning process (such that this was typically conducted by the therapist), despite the fact that this could help improve parent sustainability of the intervention (Moes & Frea, 2002) and address important individual-level variables (e.g., contextual family variables; culturally and linguistically sensitive intervention plans; Gerow et al., 2018; Koegel, 2000; Moes & Frea, 2000, 2002).

Taken together, there remains an ongoing need for future research to examine ways to more effectively include parents in the development of FCT and examine the impacts of this on both child and parent outcomes. Identifying individual and dyadic-specific variables, environmental factors, and adequate supports that can better support parent learning and implementation to potentially increase overall effectiveness and acceptability of parent-implemented FCT are important next steps. In particular, future work clarifying how, when, and via which methods to include parents as FCT interventionists is warranted to enhance outcomes and support clinical decision-making in the practice settings (Gerow et al., 2018).

16.3.2 Research Units in Behavioral Intervention (RUBI) Autism Network

Similar to FCT, the Research Units in Behavioral Intervention (RUBI) parent training intervention is based on an ABA framework and recognizes that problematic behaviors (e.g., disruptive, noncompliant, aggressive behaviors) serve an important function for the child. Like FCT, the RUBI program aims to address these behaviors in the context of the child's daily activities (e.g., getting dressed, preparing for bed, managing trips to the store), which generally represent a significant source of the daily struggle for families of children with ASD (Bearss et al., 2015).

The RUBI program follows a manualized intervention approach, consisting of 11 core sessions, seven supplemental sessions, a home visit, and follow-up telephone booster sessions as needed (Bearss et al., 2018; Edwards et al., 2019). The program is designed for children aged three to ten and typically spans a six-month intervention period (Bearss et al., 2015). Clinicians are provided with scripts for each session, as well as parent activity sheets and handouts (Bearss et al., 2018). The content of early RUBI sessions focuses on teaching parents the different functions of behavior, such as understanding behavioral antecedents (i.e., the situation or action that precedes problem behavior) and consequences (Bearss et al., 2018). For example, if a parent identifies that problem behaviors predictably occur following times of transition, especially away from preferred activities (i.e., antecedent), yet after the behavior happens the parent does not require the child to transition (the child stays on the preferred activity; i.e., consequence), they are unintentionally or unknowingly reinforcing the problematic behavior that successfully functions as an escape or avoidance mechanism. In this intervention, parents would subsequently learn new strategies for preventing these behaviors and better preparing the child for transitions.

Parents are provided with support from the therapist as they learn to better identify the antecedents of the problem behavior and develop a series of preventative strategies. Early sessions also introduce parents to the use of daily visual schedules that are aimed at decreasing their child's behavior problems. Parents learn the concept of reinforcers as a way to increase compliance and prosocial behaviors. There is also an emphasis on helping parents teach play and social skills through child-directed play, particularly in the context of providing positive reinforcement. Toward the latter half of the intervention, sessions begin to emphasize compliance training (e.g., increasing effective parental requests and commands), functional communication training, task analysis and chaining, prompting procedures, and generalization of skills. Supplemental sessions are also available and may include topics such as token economy systems, imitation skills, time out, sleep and/or feeding problems, toilet training, and crisis management.

Although RUBI itself was not yet considered a MIMC in the NCAEP review as a unique evidence-based practice, it falls under the evidence-based category of Parent-Implemented Interventions, and studies examining RUBI are pivotal to the Parent-Implemented Interventions evidence base (Steinbrenner et al., 2020). Indeed, research examining the effectiveness of the RUBI parent program has found that it reduces problematic behaviors in children based on parent and clinician reports (Bearss, Johnson, et al., 2013). Indeed, initial studies examining the effectiveness of the RUBI model found significant reductions across problematic behaviors, including irritability, hyperactivity, stereotypy, social withdrawal, and inappropriate speech (Bearss, Johnson, et al., 2013). Improvements in aspects of daily functioning were also reported (Bearss, Johnson, et al., 2013). Follow-up studies have continued to support the efficacy of this program, with more recent research indicating significant gains relative to a parent education program (e.g., sessions aimed at providing parents with information about ASD without behavior management strategies; Bearss et al., 2015). When compared to parent education programs, the RUBI model remains effective at increasing activities of daily living, with the most notable gains in daily living skills among children with higher baseline cognition (Scahill et al., 2016). There is also additional benefit when RUBI is paired with pharmacological intervention (Aman et al., 2009; Bearss et al., 2015; Bearss, Lecavalier, et al., 2013; Scahill et al., 2016). Notably, although the RUBI program was designed to be delivered to parents on an individual basis during weekly outpatient sessions, a recent community study adapted the RUBI program to be applied in a group-based format, finding preliminary support for the delivery of RUBI to parent groups (Edwards, 2018; Edwards et al., 2019). While continued studies remain warranted, this preliminary work suggests a potentially cost-effective approach that could maximize the availability of this intervention.

16.3.3 Parent–Child Interaction Therapy (PCIT)

Parent–Child Interaction Therapy (PCIT) is a parent–child intervention originally developed for children aged two to seven with disruptive behaviors without ASD (Funderburk & Eyberg, 2011). In this population, it is highly effective in reducing disruptive and oppositional behaviors and strengthening parent–child relationships (Briegel, 2016; Funderburk et al., 1998; García & Velasco, 2014; Urquiza & Timmer, 2012; Zisser & Eyberg, 2010). While PCIT has not yet been validated for individuals with ASD, there is emerging literature highlighting the potential effectiveness of PCIT for individuals with ASD (Lesack et al., 2014; Masse et al., 2016; Solomon et al., 2008), particularly when adaptations to the intervention are made (Lesack et al., 2014).

Broadly, PCIT for children without ASD consists of two treatment phases: (1) child-directed interaction (CDI) and (2) parent-directed interaction (PDI). The CDI phase is considered relationship enhancement and emphasizes parents engaging in playtime with their child and learning to follow their child's lead. In this phase, the therapist's focus is to help the parent master *positive* skills such as labeled praises, reflections, behavior descriptions, and imitation, while simultaneously avoiding *negative* talk, such as commands, questions, and criticism. The PDI phase extends on CDI by teaching parents how to use effective commands and to implement structured timeout sequences in response to noncompliance. Across both phases, PCIT sessions incorporate 1-h, weekly sessions and include a combination of didactics and live coaching.

Studies have recently started to examine whether PCIT is effective for children with disruptive behaviors with ASD. Masse et al. (2016) found that PCIT was able to increase child compliance, reduce disruptive behavior, and improve parenting skills in a small sample ($n = 3$) of children with ASD. Ginn et al. (2017) similarly found that among a larger group of children with ASD ($n = 30$), eight sessions of the CDI phase of treatment were effective in reducing disruptive behavior and increasing child social awareness. There were also reported reductions in maternal distress, and parents learned new strategies for providing positive attention to appropriate social and play behaviors in their children (Ginn et al., 2017). Other studies have similarly started to replicate findings that PCIT is effective in improving disruptive behaviors of children with ASD and across language and developmental levels (Scudder et al., 2018; Scudder et al., 2019), although specific findings related to changes in parental stress and autism severity have been inconsistent, with some studies reporting improvements in these areas (Agazzi et al., 2017; Ginn et al., 2017) and others suggesting no significant differences (Scudder et al., 2019). While ongoing research remains warranted, early research suggests that PCIT represents a promising and important intervention for children with ASD and co-morbid disruptive behaviors, with a need for continued studies to focus on identifying the effectiveness across samples and the specific types of clinical adaptations needed to best accommodate the unique needs of children with ASD.

16.3.4 Summary of Parent Training Interventions for Disruptive Behaviors in ASD

The programs and data reviewed above offer evidence that parent training interventions targeting co-occurring behavioral difficulties are also highly effective at reducing disruptive behaviors, non-compliance, and aggression. It is promising that even across these different parent training approaches (i.e., FCT, RUBI, PCIT), parents appear able to learn the intervention strategies and their children show corresponding behavioral improvements. There is a continued need for research to understand which programs will fit best in a given service delivery setting and be most effective and for which children and families. For example, PCIT and FCT are transdiagnostic, meaning that they are appropriate for use with children with ASD, as well as children with other clinical presentations. Transdiagnostic interventions allow for efficient training and implementation procedures and may facilitate community providers' deployment of evidence-based approaches across the myriad of patients who walk in their doors, including children with ASD. This is particularly important when considering that many youths with ASD receive services across usual care settings (e.g., community mental and behavioral health clinics) from non-specialist providers with diverse training and educational backgrounds (Christon et al., 2015; Cidav et al., 2013; McLennan et al., 2008). Further, a focus on training and implementation of transdiagnostic behavioral approaches across service settings could help reduce long waitlists for families who are referred to ASD-specialist services due to significant behavioral needs (Kanne & Bishop, 2021). On the other hand, a program like RUBI that includes a formal therapist training protocol and technical supports may offer a structured way for generalist providers to become proficient in the delivery of ASD-specific intervention. Overall, there has been tremendous development in parent training programs over the last two decades; however, this remains a highly relevant area of clinical and research investigation (e.g., determining individual factors that may predict best treatment outcomes and subsequently triage families into these services accordingly).

16.4 Telehealth

As highlighted in the previous sections, there is an already robust and growing body of literature indicating that parents can be successfully trained in strategies to support social communication and behavioral functioning in their children with autism. Unfortunately, long-standing and significant barriers impede on the dissemination of these evidence-based intervention programs, including a shortage of trained professionals, limited financial resources and transportation, lack of childcare, geographic isolation, lengthy waitlists, and extensive time commitments (Stahmer & Gist, 2001; Symon, 2001; Taylor et al., 2008). As a result, autism intervention researchers, informed by innovative health services work and dissemination and implementation sciences, have started to examine non-traditional strategies, such as telehealth, for delivery of parent implementation interventions.

Telehealth, or providing health care remotely through a variety of telecommunication tools (e.g., video conferencing platforms), is a rapidly growing service delivery method for health care workers (Dorsey & Topol, 2016). Telehealth technology has been utilized to provide training and coaching to parents with children diagnosed with ASD and other neurodevelopmental disorders (Benson et al., 2018; Falcomata & Wacker, 2013). The use of telehealth technology has research supporting its effectiveness to help parents teach their children imitation skills, play, and social communication skills, and to support parents as they mitigate problem behavior. Aside from telehealth's promising effectiveness, it further provides benefits to those parents with significant barriers in their environment that limit their ability to access early intervention and behavior support services.

The literature generally describes three different types of telehealth approaches used for parent implementation interventions in ASD. *Self-guided* telehealth programs give parents an online platform, allowing them to access lessons and modules to undertake at their own pace. *Therapist-assisted* telehealth programs provide parents with consultation, feedback, and support from trained clinicians. Finally, *hybrid* telehealth programs often integrate a self-directed component with opportunities for feedback and support from a therapist. Research has utilized all three of these methods to remotely deliver the different types of parent implementation interventions previously discussed in this chapter, although it is important to note that research on the efficacy, effectiveness, and sustainability of these programs is just beginning. Below is a presentation of the evidence supporting the use of telehealth technology to successfully implement parent-mediated interventions for skill-building and parent training interventions for maladaptive behaviors.

16.4.1 Telehealth for Parent-Mediated Interventions

There is a burgeoning body of literature examining the effectiveness of telehealth-delivered parent-mediated NDBIs, including the three specific programs discussed earlier in the chapter, for enhancing core social communication skills in children with ASD.

PRT has been delivered via telehealth using a primarily self-guided program; researchers used DVDs to educate and train parents through self-directed modules focusing on specific PRT strategies (Nefdt et al., 2010). An initial study on this approach found that the majority of parents completed the program and demonstrated the ability to use PRT strategies effectively during interactions with their children. Additional results showed that the children increased their functional communication/utterances, and parents rated the program highly satisfactory (Nefdt et al., 2010).

Vismara et al. (2012) examined the remote delivery of parent-mediated ESDM via a hybrid approach. They provided parents with learning modules on DVD and remote coaching over video conferencing. The parents in this study achieved fidelity in the ESDM intervention skills and maintained these gains across a six-week follow-up period. The children demonstrated corresponding increases in social communication and social engagement with their parents (Vismara et al., 2012). An additional study examined the effectiveness of a hybrid telehealth program, with online modules and therapist coaching, in the ESDM intervention across 12 weeks, and the results suggested that parents were able to learn ESDM strategies and then use them effectively in interactions with their children (Vismara et al., 2013). A larger randomized control trial compared this hybrid telehealth ESDM approach to treatment as usual; social communication improved in both groups, although larger gains were observed for those in the telehealth ESDM condition (Vismara et al., 2018).

Project ImPACT has also been adapted for both a self-guided and hybrid telehealth approach, referred to as ImPACT Online (Ingersoll et al., 2016). An initial randomized control trial of ImPACT Online compared the self-guided to a hybrid (additional parent coaching from a therapist) model and found that while parents in both groups improved in their overall use of Project ImPACT strategies, those in the hybrid condition showed greater improvements in the fidelity of implementation. Furthermore, parents in the hybrid condition reported that support from parent coaching was an essential part of their ability to learn the material (Pickard et al., 2016).

One of the latest updates in telehealth technology is the use of mobile apps to deliver evidence-based practices, which has been applied to interventions for parents of children with ASD. Map4speech, a mobile application based on an adaptation of Project ImPACT, has been piloted with promising results (Law et al., 2018). Parents in this study had the opportunity to access a hybrid model on their personal cell phones. In addition to accessing learning modules, parents had the ability to upload videos of their interactions and receive feedback from trained therapists. Even through the use of mobile apps, parents maintained high fidelity and built up their skills based on the intervention. Furthermore, the children's functional communication increased compared to baseline (Law et al., 2018).

Overall, these smaller-scale studies of telehealth-delivered, parent-mediated NDBIs have provided initial evidence that parents can learn and use intervention strategies in response to telehealth programs and that children demonstrate corresponding increases in key social communication skills as their parents participate in these interventions.

16.4.2 Telehealth for Parent Training Interventions

There is also evidence for the delivery of parent training approaches for ASD via telehealth, including some of those reviewed in this chapter. Indeed, there is a quickly evolving literature examining telehealth delivered FCT to address challenging behaviors of children with ASD. The majority of these studies tend to involve a therapist-assisted approach to supporting parents as they learn and implement functional assessments necessary for the appropriate application of FCT (e.g., understanding the function of the behavior and creating meaningful behavior and communication targets within that context) with their children with autism. Initial single-subject designs found that, with guidance from a therapist, parents were able to learn how to engage in a functional behavior assessment and implement FCT to increase their children's communication and decrease challenging or maladaptive behaviors including self-injury (e.g., Benson et al., 2018; Machalicek et al., 2016; Simacek et al., 2017). A 12-week randomized control trial comparing telehealth-delivered FCT to a waitlist control group for children with ASD and moderate to severe behavior problems found that FCT led to greater overall reductions in challenging behavior (Lindgren et al., 2020). Importantly, comparisons between in-person and remote coaching for functional assessment and FCT found no significant differences between their effectiveness to reduce problem behavior (Lindgren et al., 2016).

The RUBI program has also been adapted to a therapist-assisted telehealth delivery format that closely mirrors the standard, in-person RUBI parent training model (Bearss et al., 2018). In an initial feasibility trial, parents were provided with a RUBI treatment manual and met virtually with a therapist over 16 weeks to learn 11 “core” strategies and up to two “supplemental” strategies depending on the needs of the family and child (Bearss et al., 2018). Session attendance and satisfaction with the telehealth delivery were high, with all parents who completed the program endorsing that they would recommend this approach to others. Further, parents reported increases in confidence to manage their child's current and future challenging behaviors, and children showed decreases in parent-reported noncompliance and irritability over the course of the study (Bearss et al., 2018).

Lastly, while Parent–Child Interaction Therapy (PCIT) has emerging literature to suggest that it is effective in the treatment for children with ASD, there has not been any literature examining the effectiveness of PCIT for children with ASD conducted via telehealth. However, there is promising research to suggest that Internet-delivered PCIT (I-PCIT) can be effectively administered, in a feasible and cost-effective manner (Comer et al., 2015; Elkins & Comer, 2014). In the studies where I-PCIT was being used, parents completed sessions in their homes and received direct coaching from the therapist via a Bluetooth headset (Comer et al., 2015, 2017). There has been one RCT comparing I-PCIT versus the standard PCIT with 40 children with disruptive behavior disorder between the ages of 3 and 5 years. The results demonstrated that I-PCIT was relatively well received and the children showed treatment response; furthermore, the children in the I-PCIT group showed an excellent response posttreatment (Comer et al., 2017), suggesting a future need to assess this model within ASD.

16.4.3 Barriers and Limitations of Telehealth Services

While telehealth has shown immense promise over the past decade or so in terms of its effectiveness and feasibility for families to use, implement, and learn, it is not without limitations. Barriers to accessing telehealth services for families and practitioners often include not having a reliable Internet connection in the home to have consistent conversations and sessions (De Los Rios Perez, 2018; Lerman et al., 2020; Reese et al., 2012). Difficulty finding a reliable Internet connection can lead to audio and video issues, which can limit the quality of service that practitioners are able to provide (Reese et al., 2012).

Additional barriers include the parents' comfort and capability of accessing telehealth services and technology (Salomone & Maurizio Arduino, 2017). Further, when telehealth sessions are provided within the context of the home, there are environmental variables that can impact the sessions, including limited control of the environment, the child having access to toys and reinforcers within the home that would be limited within a clinic setting (Lerman et al., 2020), as well as the lack of privacy and/or the presence of other siblings or family members. If the behaviors that are the target of the intervention are physically dangerous, the practitioner is not able to be physically present to help mitigate the behaviors (Lerman et al., 2020).

Importantly, not all parents may benefit equally from telehealth. For example, initial data have revealed that certain family characteristics such as self-report parental depressive symptoms are negatively correlated with success (Ingersoll & Berger, 2015). Concurrently, it has been suggested that a subgroup of parents may require more support than online video conferencing is able to provide, in which case they may not benefit as greatly from telehealth (Schieltz et al., 2018). Additionally, problem behavior maintained by automatic reinforcement may be difficult to address fully over telehealth, as well as behaviors that change in function over time (Schieltz et al., 2018).

Overall, individual studies, randomized controlled trials, and systematic reviews of telehealth practice for parents of children with ASD suggest that across parent implementation approaches (e.g., parent-mediated NDBIs, FCT, RUBI) and formats (self-guided, therapist-assisted, or a hybrid model), telehealth delivery can be an effective and promising approach for disseminating evidence-based practices (Boisvert et al., 2010; Ferguson et al., 2019; Johnsson et al., 2016; Knutsen et al., 2016; Neely et al., 2017; Parsons et al., 2017; Sutherland et al., 2018; Tomlinson et al., 2018; Unholz-Bowden et al., 2020). Indeed, the use of telehealth has the potential to decrease barriers typically faced by rural and underserved areas by increasing the ability to access evidence-based services (Ashburner et al., 2016; Dorsey & Topol, 2016; Mello et al., 2016; Murphy & Ruble, 2012) at reduced costs (Horn et al., 2016; Jennett et al., 2003; Knutsen et al., 2016) and without placing an undue burden on these families to travel to centers far away from their homes (Heitzman-Powell et al., 2014; Mello et al., 2016). Importantly, the COVID-19 global pandemic has led to the rapid and wide-scale adoption and implementation of telehealth programs, including parent implementation interventions for ASD. It is expected that data collected from both research and practice settings during this time will be critical for increasing the understanding of the effectiveness of these approaches, as well as the larger public health significance of telehealth interventions including, but not limited to, the extent to which these programs address or potentially contribute to disparities in care.

16.5 Conclusions

The delivery of parent implementation interventions is associated with a number of important clinical outcomes for children, both in terms of reducing the severity of core deficits in ASD and improving co-occurring behavioral challenges. Parent-mediated interventions targeting core symptoms of ASD such as PRT, ESDM, and Project ImPACT are associated with increases in child's spontaneous language, imitation, and communication skills (Dawson et al., 2010; Duifhuis et al., 2017; Minjarez et al., 2011). Similarly, parent training programs focusing on behavior reduction such as FCT, RUBI Autism Network, and PCIT report an overall reduction in challenging behaviors, increase in child compliance, and improvements in parent training skills (Bearss, Johnson, et al., 2013; Bearss, Lecavalier, et al., 2013; Gerow et al., 2018; Masse et al., 2016).

16.5.1 Clinical Implications

Given these promising outcomes, it is imperative for caregivers and providers to be able to find and access parent implementation interventions within community settings. Providers and organizations are encouraged to seek out formal training in evidence-based parent implementation approaches and to work with program trainers and developers to consider how best to deploy these programs within their unique practice settings. Fortunately, the formalization and manualization of parent implementation interventions have resulted in the development of prescribed provider training protocols that support the dissemination of parent implementation interventions in practice and community settings.

Notably, as with any clinical decision-making process, it is important for clinicians to carefully weigh the pros and cons of when to deliver such parent implementation models, considering program type and delivery structure in the context of each family and the child's particular needs (Siller & Morgan, 2018). For example, despite the fact that families often indicate an urgent need to start comprehensive intervention programs, including parent-mediated NDBIs, recent evidence suggests that the timing of when a family starts a parent-mediated intervention may impact participation and attrition rates (Pickard et al., 2016). Further, there are data to suggest that previous experiences with services can drive interest in enrolling in these programs and staying engaged throughout (McCurdy & Daro, 2001). As a result, it may be important for clinicians to first establish rapport and trust with a family, prior to offering a parent implementation intervention in order to set up families to be as successful as possible. Finally, while one of the most important strengths of parent-implemented interventions is the role of the parents and their ability to incorporate evidence-based strategies in the context of their child's day-to-day life and routines, this may not always be feasible for parents given other demands in their personal lives (e.g., professional obligations, other caregiving responsibilities; McConnell & Savage, 2015). This may be particularly true for families from underrepresented, lower-income communities who are more likely to face additional challenges with financial stability, transportation, and childcare (Stahmer & Gist, 2001; Symon, 2001; Taylor et al., 2008). Importantly, this does not mean that families with competing priorities should not be offered opportunities to engage in parent implementation interventions; rather, it is critical to consider how best to structure programs so that it is easier for families to participate and be successful considering these barriers (e.g., offering childcare during sessions, offering evening and weekend sessions). In summary, providers must use careful clinical judgment to determine when and what parent implementation intervention is most appropriate on an individual basis, with a need to consider child's unique profile of strengths and weaknesses, family's goals for intervention, and individual family factors (e.g., dynamics of parent home, family stressors, cultural factors that may impact participation or outcomes, etc.).

16.5.2 Limitations & Future Directions

Despite the important promise of parent implementation interventions for ASD, there are limitations worth discussing and important directions for future research. Indeed, while there is clear data that parent implementation approaches work on average for improving functioning for children and families, the field's understanding of how, why, and for whom these interventions work is still limited. There are several future directions that can be explored concurrently to help build a more sophisticated and nuanced understanding of parent implementation approaches for children with ASD.

To date, very few studies have explored individual family/parent/child variables that may best predict family involvement and response to intervention (Gerow et al., 2018; Tarver et al., 2019; Wade et al., 2008). However, identification of such variables could support clinical decision-making processes that can often be challenging for providers given the availability of many parallel therapies. Having more predictive data in terms of which families will respond best to specific intervention types would thus help clinicians maximize limited resources and better support children and their families. Additionally, a better understanding of the optimal sequence of interventions (e.g., which should be first: parent training to address challenging behaviors or parent-mediated intervention to improve communication?) would further enhance the efficiency and effectiveness of service delivery. In addition, it is critical that research continues to expand the understanding of outcomes beyond parent fidelity and child-level functioning (Wainer et al., 2016). Given that parents take on a large responsibility by assuming the role of "therapist" in these interventions, a better understanding of outcomes such as parental stress, parental competence, and family quality of life is necessary (Estes et al., 2015; Ginn et al., 2017; Schwichtenberg & Poehlmann, 2007; Stainbrook et al., 2019).

Relatedly, research has started to examine how certain interventions might work to produce observed changes in child functioning. One line of research has focused on identifying active ingredients and mechanisms of change in parent implementation interventions. For example, initial research found that increases in parent use of Project ImPACT strategies were directly associated with improvements in child language (Ingersoll & Wainer, 2013); later work supported this contention by demonstrating that parent use of Project ImPACT strategies improved children's later language abilities via improvement motor imitation and intentional social communication (Yoder et al., 2020). Another approach to understanding how interventions work has been to examine objective and neurobiological measures in response to treatment (e.g., Dawson et al., 2012; Voos et al., 2013). Research on clinician-administered ESDM demonstrated that, in addition to improvements in social communication, adaptive functioning, and cognition, children in the ESDM group showed increased EEG activation in brain areas associated with social behavior (Dawson et al., 2012). However, research has yet to apply these innovative outcome measurement approaches to parent implementation interventions in ASD. Additional data related to mechanisms of change, as well as neurobiological outcomes, of parent implementation interventions is a critical next step.

Questions about the long-term impact of parent implementation on child developmental trajectories also remain. Additional longitudinal research is necessary to determine the effect of parent implementation interventions on child social communication, behavior, and adaptive functioning in later childhood and adulthood as improvements in pivotal developmental skills, such as those that comprise social communication, have long-term developmental implications (Greenslade et al., 2019). Further research should establish the cost-effectiveness and public health significance of parent implementation approaches over time.

Finally, the majority of research on parent implementation interventions for ASD continues to include families from similar cultural and socio-economic backgrounds. Frequently, families coming from underrepresented communities face challenges that not only impact participation in the intervention but also impact interest and ability to participate in research studies (Carr & Lord, 2016). Active efforts are underway to engage underrepresented populations in research and study parent implementation for ASD intervention in more diverse populations (e.g., Carr & Lord, 2016; Carr et al., 2015; Pickard et al., 2017). Pickard et al. (2017) note that it is critical to engage underrepresented families in the development and adaptation of parent implementation interventions in order to improve the fit and increase the likelihood of sustainability and effectiveness of such programs. Overall, while it is encouraging that current work in this area is underway, there remains a long way to go in the field to develop a more representative and equitable research base for parent implementation interventions in ASD.

16.5.3 Summary

Over the last several decades, parent-mediated and parent training interventions have come to the forefront of intervention research in ASD, particularly for young children and families. These treatment approaches are extremely promising and are gaining a strong evidence base. Indeed, as described in this chapter, studies have consistently documented that the inclusion of parents in the treatment of their child, particularly when provided with appropriate in-person or telehealth support from trained therapists with experience in ASD, has the potential to significantly improve and maximize a child's outcomes across critical developmental and behavioral domains, making parent interventions highly relevant and important to both clinical practice and research in autism spectrum disorders.

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17 Overview of the Early Start Denver Model

Melissa Mello and Sally J. Rogers

17.1 Introduction

The Early Start Denver Model (ESDM) made its appearance in the press just over a decade ago. Yet, its origins in clinical practice and research extend back more than 35 years, and its principles originated in science and theory, in both domains, accumulated over the past 40 years at least. Unlike most of the interventions described in this text, the origins of ESDM began in the 1980s by developing practices and procedures informed by developmental science, applying them to the developmental needs of young children with autism—needs in virtually all domains of development—and monitoring learning rates over time. In the next decade, we sought to integrate the principles of operant learning and positive behavior supports with the developmental principles, content, and practices already established in this naturalistic developmental behavioral intervention (NDBI).

In our third decade of work, we partnered with Geraldine Dawson and her colleagues at the University of Washington to complete the integration of developmental and behavioral principles, treatment techniques, and data collection systems, while maintaining a focus on the use of everyday activities and the importance of sensitive, responsive relationships as well as carrying out the first rigorous efficacy trials. This last decade has focused on the further development of varying applications of ESDM—with infants, with parent implementation, in groups, in low-resource settings, among others—and many research studies using controlled group designs to assess outcomes.

The goal of this chapter is to provide an introduction and theoretical orientation to the ESDM, followed by a clinical description of the practices used, a review of current published work, and a dive into NDBI's and their characteristics. A review of its strengths and weaknesses and the need for further work, both scientific and clinical, will follow.

17.1.1 Origin and Theoretical Bases

The ESDM is a naturalistic developmental behavioral intervention for young children with autism spectrum disorder (ASD) aged 12–48 months. Aiming to target the key early characteristics of autism—delays and differences in social communication and language, social interactions, joint attention, play and imitation skills, problem behaviors, and adaptive behavior—the intervention seeks to enhance the developmental trajectory for chil-

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dren with ASD in all affected domains by embedding needed learning in everyday contexts, activities, and interactions.

The ESDM is a product of the theories, studies, and models that came before it, particularly the Denver Model (Rogers et al., 1986), a developmental, play- and interaction-based model emphasizing both developmental growth and, particularly, the triad of difficulties involving imitation, joint attention, and symbolic play (Rogers & Pennington, 1991); the Social Motivation Hypothesis of autism (Dawson et al., 2004; Mundy, 1995); and the applied behavior intervention Pivotal Response Training (Koegel et al., 1999; Schreibman et al., 1991).

These models each contributed a specific aspect to the intervention techniques and foci that define the ESDM. They share the general premise that early social learning is uniquely impaired in ASD and that, without specific interventions to support the development of social learning, social communication, and social interest and enjoyment, a specific learning profile develops in children with ASD that appears to prioritize non-social experiences over social experiences—one that loses malleability as children move beyond the infant, toddler, and preschool years. Development in the domains of social learning and language tend to happen particularly slowly, creating a gap that hinders most young ASD children's participation in the social-communicative domain. This social communication delay, in turn, hinders other areas of development, especially educational progress, language and literacy progress, peer relationships, and the flow of social information in both formal and informal interactions that teaches most young children how to fully participate in their communities. In order to address this cascading effect of autism symptoms on children's developmental and behavioral trajectories, the ESDM maximizes coordinated, interactive social communication, social play, and interactive daily living activities throughout the child's waking hours, to fill in for past "missed" opportunities through intensive learning opportunities.

17.2 Clinical Description of ESDM Practices

17.2.1 The ESDM Curriculum

The ESDM curriculum targets ten developmental domains, follows developmental sequences in each, and aims to accelerate development in those domains in which children show delays. Embedded in the curriculum are communicative tools for expressing needs, emotions, desires, and interests. Developmental skills on the ESDM curriculum checklist are grouped into the following domains: social skills, cognitive skills, play skills, gross motor skills, fine motor skills, imitation, self-care skills, joint attention, expressive communication, and receptive communication. The ESDM curriculum checklist allows for the development of individually customed treatment objectives by evaluating the child's current skill-set and knowledge via play-based activities and interactions during everyday routines. Once written, objectives are broken down into 5–6 small steps, beginning with the child's current level of performance and ending with the objective at its mastery level. New learning goals are written at 12-week intervals based on family priorities and developmental needs based on the ESDM curriculum.

These steps focus the therapist on practicing the child's current level of performance and the next levels of mature performance, arranged hierarchically in small steps that lead to the mastery of the learning objective, with mastery defined as a high level of performance generalized to adults, locations, and materials maintained via natural reinforcers—those embedded in the situation and similar to those that support the skill in young children without ASD. Thus, teaching consistently occurs in what Vygotsky (1978) identified as the *zone of proximal development*, the next small steps in the development of a skill that builds from the child's present level of mastery. Several studies examining quite different domains of development have supported this concept, demonstrating the most rapid learning occurs at the edge of the child's current skills (Lifter et al., 1993; Taumoepeau & Ruffman, 2008).

17.2.2 Developmental Framework

In the ESDM, ASD is considered a developmental difference/disorder (i.e., a brain-based disorder that affects early childhood development in virtually all domains but particularly in social communication and in repetitive action patterns). The ESDM is based on a developmental framework, with principles and concepts, including adult–child relationships and the approach to language, all coming from research in developmental psychology focused both on conditions that enhance learning in young children and on key developmental skills that influence the development of social communication, language, imitation, play, and joint attention. For example, infant/toddler learning and participation are affected by the quality of relationship that exists with the adult partner, enhanced by those who are sensitive and responsive to child cues and who follow the child's lead to objects and activities of interest (Tomasello, 1992). While typically developing toddlers easily engage in back-and-forth activities with adults, allowing for practice and imitation of the partner's actions, children with autism often need scaffolding to learn the back and forth of dyadic exchange, hence the need for partners to take active turns rather than only follow child leads. This adult scaffolding of more mature performance as a critical learning tool is part and parcel of Vygotsky's (1978) theory of early learning (and well supported by the studies mentioned above).

17.2.3 Child Initiative and Learning

ESDM teaching capitalizes on the exploratory nature of toddlers and the number of novel learning opportunities that result. The "joint activity" framework of ESDM activities fosters and reinforces child initiation and exploration within the interactive dyad in order to maximize the number of novel learning opportunities occurring during activities. This framework involves four phases: (1) set-up, in which the child activity emerges from the child's initial interest and engagement with materials or social games; (2), theme, in which the child and partner are engaged in a goal-directed activity with several repetitions; (3) variations, in which either partner adds variations to the original actions that both partners engage in; and (4) closing, in which the activity is losing its learning value and the adult and child close down the activity and transition to another. The multiple repetitions embedded in both the theme and the variations phases can help consolidate immediate learning into long-term memory (Horst, 2013; Zhan et al., 2018).

Child initiation of novel acts and exploration of novel stimuli and novel acts on objects, supported by the child's interest and desire to continue the activities, are key tools for self-directed learning that most young children use but are less prevalent in ASD (Jarrold et al., 1996; Pierce & Courchesne, 2001) and provide many learning opportunities across each activity of the child's day. Thus, the use of four-step joint activities addresses two fundamentals of toddler learning that are affected in ASD: (1) initiative and variety in play and (2) social scaffolding of child learning within interactive exchanges (Rogers, 2016).

The ESDM is constructed to address the fact that autism limits early childhood learning via decreased social interest and social initiative (Dawson et al., 2004), immature imitation skills (Rogers et al., 2003), and delayed and infrequent joint attention acts (Carpenter et al., 2002), resulting in delayed verbal and non-verbal communication and immature play skills (Sigman & Ungerer, 1984). Since most toddlers rely on these skills to learn from others, especially in the period before new learning is accessible through language, these aspects of ASD limit social learning opportunities in the child's earliest years with cascading effects over time. The relative lack of attention that 2-year-old's with ASD pay to markers of social communication in interactions (Chawarska et al., 2012) results in far fewer novel social learning opportunities than typically developing children experience (Rogers, 2016). ESDM teaching techniques optimize the frequency of social learning opportunities by their careful planning of developmentally and age-appropriate motivating learning materials and activities embedded in an interactive social framework, with the goal and result that children with ASD in ESDM treatment demonstrate much less preference for object stimuli over social stimuli than those in other interventions (Dawson et al., 2012; Gale et al., 2019; Sasson & Touchstone, 2014).

17.2.4 Integrated Approach to Intervention

One of the most important characteristics of the ESDM is its focus on merging developmental domains, varying evidence-based foundations for teaching, and different areas of professional intervention practice into an integrated whole. It merges learning in various developmental domains by using whole activities rather than discrete trials as the basis for teaching. Young children's activities with others typically involve visual motor skills, fine motor skills, gross motor skills, cognitive skills, attention and interest, information processing, and communicative/language exchanges, carried out within a positive emotional valence. By using a whole activity as the teaching frame, and by inserting learning objectives in all developmental domains, the adult has the opportunity to scaffold and reinforce new learning in many domains within a single activity.

Second, it integrates several foundations for teaching. It follows principles of constructivist development in early childhood by the use of evidence-based hierarchies of skill development characterizing typical development in its development of learning goals, in its use of Vygotsky's (1978) zone of proximal development and Bruner (1975) in terms of skill teaching and social scaffolding in a specific activity, and its use of Piagetian levels of teaching imitation and symbolic play (Piaget, 1952). It follows the developmental sciences of social communication and language development in its curriculum and embeds its language-learning techniques in all activities (Bates et al., 1988). The ESDM also follows the principles of applied behavior analysis in the use of ongoing assessment, task analysis, skilled use of reinforcement strategies, data-informed instruction, and skilled prompting and prompt reduction strategies (scaffolding) to accelerate new learning that is also quickly generalized and maintained. Thus, ESDM embraces both developmental and behavioral approaches and incorporates them seamlessly into learning supports for children.

Third, it integrates early childhood professionals from several different disciplines into an interdisciplinary team that follows each child and has input into the child's intervention plan. Speech pathology, behavior analysis, occupational therapy, psychology, early childhood or infant special education, social work, and pediatrics play prominent roles, with input from any other professional needed to help with a child's particular difficulties also included. This is carried out in one of two main ways. In some settings, ESDM is delivered as part of a larger pediatric or early intervention setting where these disciplines are all part of a general clinic team. In this case, various disciplines conduct an interdisciplinary team assessment, determine and discuss critical aspects of the child's intervention needs in terms of the domains (e.g., motor, communication, cognitive, behavior, family challenges), ending with a set of short-term intervention goals that comprehensively address the child's needs.

The person who will be the team lead for this child (see Rogers & Dawson, 2010, for a complete description of how an intervention is organized and delivered in ESDM) then constructs a set of intervention goals, broken down into small steps, for the interventionists (parents, paraprofessionals, other professionals) to implement. This is signed off on by the interdisciplinary team members and carried out by every team member delivering services to the child, regardless of their professional training. Progress data are reviewed by the various members, and every 12 weeks, after the child's recurring curriculum evaluation, the team lead drafts a set of new objectives and holds a progress meeting with the team to review progress and assure that the new plan represents the child's needs across all domains.

In other settings, the intervention team consists solely of one or two professionals, and the other disciplines are represented by professionals at other agencies who are also involved with the child. The team lead assembles assessment data from other professionals who have been involved with the child, conducts the curriculum assessment, drafts the learning goals and steps incorporating recommendations made by other professionals in their reports, shares them with the other professionals and asks for their input, and delivers the intervention for 12 weeks, after which the curriculum re-assessment occurs, progress data are shared with the other professionals along with new learning goals and steps, and intervention continues.

17.2.5 Interdisciplinary Team

In settings in which various disciplines are all on staff, the ESDM uses a generalist, transdisciplinary team approach (Rogers, 2016). All intervention staff, regardless of professional discipline, are trained to fidelity in ESDM and address the child's comprehensive learning goals in their sessions. Thus, both child and family are experiencing consistency across professionals in their treatment style as well as their content. Given that the model uses an entire learning activity as the medium for teaching, and that any activity involves communication, motor performance, cognitive performance, and behavioral skills, the individual professional can support all developmental domains involved in the activity while paying particular attention to the child's needs in the area of specific expertise. This model protects parents from experiencing differences of opinion or differing advice from the various members of the child's team since any differences have already been worked through by the team at various team meetings. The team lead role for a specific child may be assigned to the professional with the greatest expertise in the child's greatest areas of need, to guide the team of interventionists more closely.

17.3 Multiple Methods of Delivery

The ESDM was constructed as an intervention that could be delivered in any setting or any activity with any available materials in order to maximize the amount of learning available for a child. It has also produced evidence to demonstrate the fidelity of implementation and positive outcomes in varied delivery settings. Many different delivery methods have demonstrated positive results; these include one-to-one intervention in clinics, natural community settings, and homes, parent-implemented intervention at home and in other community activities and settings, group intervention in daycare and both specialized and inclusive or typical preschools, delivery by public service programs in remote and low-resource areas guided by ESDM-credentialed staff through telehealth, 12-week models, 1-year models, and 2-year models (Fuller & Kaiser, 2020). The ESDM delivery approach thus fits flexibly into the various environments, care, and educational situations that serve young children across many different cultures and countries including those with resources and systems of care that differ greatly from the higher-income countries. Its emphasis on everyday activities and materials and naturalistic interactions allows for flexible delivery that can be adapted to many different contexts and frameworks with fidelity (Rogers, 2016).

17.4 ESDM Teaching Strategies

By combining techniques from the aforementioned models and theories, ESDM teaching strategies aim to create learning opportunities and experiences similar in kind and frequency to those of typically developing toddlers and to fill in for previously "missed" social and communicative learning opportunities. Scaffolding these typical toddler/preschool experiences allows for reinforcing social learning and interaction patterns via introducing social stimuli, teaching the appropriate responses to these stimuli and making the learning experience highly rewarding, ensuring positive emotional experiences during interactions with others, and supporting child initiative and motivation to initiate and continue such activities. Various teaching strategies to accomplish these are outlined below.

17.4.1 Creating Positive Emotion Inside the Learning Experience

Creating positive emotional states allows children to experience pleasure in social interaction. Pleasurable social games ("sensory social routines [SSRs]" in ESDM terminology) are typically accompanied by reciprocal eye contact, vocal exchanges, and nonverbal communication. Routines involving preferred objects and activities reinforce communicative and social learning targets embedded in the interactions. Repeating pleasurable, interactive social exchanges allows time for children to process the social-communicative learning involved. The emphasis on positive affect goes beyond behavioral reinforcement. It involves emotional engagement in pleasurable social learning activities with a trusted partner, which activates the social brain structures including the neurotransmitters, synapses, and gene activation that accompanies such experiences (Kandel, 2006; Santamaria et al., 2019; Siegel, 2020).

The social reward system is stimulated in two unique ways: (1) to like and (2) to want to continue it. Some children with ASD may respond positively to social engagement but they will not necessarily initiate actions to pursue it. Some children may respond in neither way. Some children will respond in both ways. The ESDM targets both facets by boosting the social engagement reward value and by carefully using pauses, anticipation, and prompting as needed to encourage child responses that request repetition. Operant learning helps establish these connections by ensuring that children have to work toward the reward—it is not simply provided to them. This makes them actively learn and use communicative and social acts and reinforces the behavior further.

17.4.2 Play and Everyday Activities as the Frame for Learning and Teaching

The ESDM method emphasizes joint activity routines, one of the most important vehicles of early childhood learning (Bruner, 1975; Siegel, 2020)—a type of play in which both participants are attending to each other and interactively engaged in shared play activities, with the more mature partner scaffolding the participation of the less mature partner. These activities involve those that would have taken place naturally in different circumstances.

In ESDM, the child has considerable control within joint activity routines. Carried out with and without objects, these activities establish children as key players in the routine. Children's choices are taken into consideration; while the adult provides a specific range of objects available as guided by the child's learning objectives and decides the actions to be reinforced and some aspects of the sequence of the activities, it is the children's choices of or responses to objects and materials used and to some extent the sequence of activities carried out.

Joint activities are routines-based activities, meaning they can occur inside all daily routines a child engages in. This can be various play activities, both object-based and social, self-care routines involving meals, dressing, toileting, learning to carry out simple chores, and a wide range of activities based on parental and societal expectations for children of the same age.

Thus, the range and style of activities used in ESDM treatment allow the interventionist to address a child's full range of learning objectives, a variety of developmental and adaptive skills, including constructive and symbolic play, imitation, communication (expressive and receptive), social skills, cognitive skills, and even fine and gross motor development. This style of teaching also allows the parent to integrate teaching into their daily lives, as they do not have to make monumental changes to their family structure in order to incorporate teaching.

17.4.3 Intensive Teaching

The social orienting/social motivation hypothesis suggests that one of the main reasons for delayed development in early autism is due to the number of learning opportunities that young children with autism miss due to the differences in social orienting and social attention, and due to their low rates of social initiation and responses to others; efforts to engage-characteristic of most young children with ASD (Dawson et al., 2004; Mundy, 1995). To fill in these "missed" experiences, naturalistic teaching is embedded in every social exchange. When this is carried out at fidelity, children are receiving scaffolding learning opportunities every 10–30 seconds—a rate of teaching intensity that rivals discrete trial teaching. In ESDM, intensive teaching refers to this frequency of 1:1 scaffolding learning opportunities, whether delivered in a group, by a parent, or by a therapist of any discipline, and it is measured with the fidelity tool. Activities, materials, and interactions are based on "age-appropriate" experiences so that children we are treating are as ready as possible to interact with peers and adults in typical settings with young children without developmental differences.

Research in developmental psychology has shown that children with caregivers who are responsive and sensitive to their children's signals and needs, use rich language, and follow children's leads rather than directing most activities stimulate their children's learning. These characteristics have multiple impacts on development. Sensitive, responsive caregiving promotes secure attachment relations, which positively affect social relations with peers (Bohlin et al., 2000), learning (De Ruiter & Van Ijzendoorn, 1993), and behavior (Greenberg et al., 1991). Parents' use of rich and varied language spoken in response to children rather than primarily directing children has large effects on children's language learning (Ramirez et al., 2020). Parents who tend to follow their children's lead by imitating and expanding rather than directing have positive effects on language development (Girolametto et al., 1999), including secure social relations, better language development, and positive social interactions. Since the first 5 years of children's lives are especially sensitive periods for language learning (Friedman & Rusou, 2015; Kuhl, 2000), it stands to reason that those with autism require at least the same level of interactions and experiences as children without developmental delays in order to develop language, social communication, and other skills that are dependent on social interaction for learning.

17.4.4 Positive Approaches for Unwanted Behavior

Inside ESDM, positive behavior supports for unwanted behavior are implemented and the process for this will be discussed here. It is important to note, however, that often by following the ESDM teaching principles described, children tend to make progress with their unwanted behavior. Many behavior issues are addressed simply through the process of teaching the child's objectives using the full range of ESDM techniques including following children's leads, reinforcing their communication attempts, ensuring they enjoy the teaching materials and co-constructing the activities with their interests, giving choices, using related reinforcers, and teaching within the child's zone of proximal development. If we do not see changes in problem behaviors, or if the behaviors prevent learning activities from occurring, we conduct a functional analysis in multiple environments to determine function and guide intervention strategies. Based on the results of the functional analysis, positive behavior supports are developed.

For very young children, these tend to include the use of reinforcement to teach adaptive, conventional behaviors that functionally meet the needs of the child. Once the new target, or replacement behavior, has been identified, the child is taught to use the behavior in the situations that elicit the problem behavior and to use the replacement behavior with prompting as needed prior to the problem behavior. The new behavior is reinforced, while the unwanted behavior is placed on extinction and no longer receives reinforcement.

If a behavior plan is developed, these changes are conveyed to parents, and parents are taught to use the strategies at home. The behavior plan is not "taught" separately from teaching within activities during sessions. We teach in every environment and the behavior plan is embedded in the teaching activities carried out by staff and everyday activities that parents carry out with their children. Both the replacement behavior and the unwanted behavior are tracked and monitored closely to ensure progress. Instead of focusing on suppression of unwanted behavior like aggressive, disruptive, and repetitive behavior via punishment techniques or time out, we use behavior substitution or replacement, prompting children to use a behavior that is as easy, as fast, and as efficient as was the unwanted behavior for attaining their goals. We select replacement behaviors already in the child's repertoire in some nascent form, behaviors that are age-appropriate for the child, culturally acceptable, and readily understood by others. We prompt the child to use the replacement behavior to attain their goals (we assure that they do!), especially intentional communication, and increase the use of age-appropriate behaviors for expressing wants, needs, and negative emotions. We also prompt the replacement behavior earlier in the identified chain than the problem behavior would occur which constitutes a proactive, antecedent approach.

17.4.5 Family Involvement

Autism interventions for young children often incorporate family involvement and consider this to be an important focus of intervention given the large amount of time young children are with their families in the early years, as well as the privileged position that parents have in terms of young children's attention and responsivity. Studies have demonstrated that secure attachment relations with parents are present in young children with autism in early childhood (Capps et al., 1994; Oppenhein et al., 2009; Rogers et al., 1991), as well as in older children with ASD, for whom attachment security affects friendship patterns (Bauminger et al., 2010). Family participation in the planning and implementation of the child's intervention plan in their natural environment throughout the course of a normal day is an inherent aspect of ESDM. According to Brookman-Frazee (2004), active parental involvement in ASD intervention provides parents with feelings of empowerment, motivates parents to use intervention strategies to aid their children's development, and decreases depression; thus, facilitating early action is imperative for children with ASD. Finally, a randomized controlled trial (Rogers et al., 2012) demonstrated that parent coaching using ESDM significantly enhanced parental alliances with their team leads.

In ESDM, parents share leadership roles with the team lead and also share intervention roles with others, because their provision of high-quality learning activities during the times that interventionists are not present is crucial for the goal of engaging children in learning opportunities throughout their waking hours. Parents have separate ongoing parent coaching sessions with their team lead and learn to deliver ESDM with fidelity and manage child behavior according to behavior plans within their everyday activities at home and in community locations with their child. Although parents of children with ASD tend to interact with their children in the same way that those with typically developing or children with other types of delays do, the response of children with ASD differs by initiating interactions with less frequency (Chiang et al., 2008; Kasari et al., 1988; Kasari & Sigman, 1997).

Therefore, despite parents interacting with their children in typical ways, children tend to not sustain these interactions or initiate them at the level of frequency seen in other developmentally matched groups of children (Kasari & Sigman, 1997), resulting in fewer interactions, less communication, and fewer opportunities for children to learn. In addition to reducing child learning opportunities, this reduces opportunities for parents to respond sensitively to their children's cues as well as reducing the reinforcement to parents that come from successful parent–child exchanges.

As described throughout this chapter, the ESDM addresses these characteristics of early ASD by providing many supported opportunities for child initiations and contingent responses, and by supporting and shaping natural gestures and sounds into conventional communications recognizable by parents that, in turn, allow them to respond contingently and sensitively, building and reinforcing all child communicative efforts. Parents experience the success of their interactions and gain confidence in themselves and in their children as a result.

17.4.6 When Children Receiving ESDM Are Not Making Rapid Progress

Even when ESDM is delivered intensively and with appropriate fidelity, some children do not progress quickly. Individual variability in autism has been seen in all aspects: cognitive, language, temperament, attention, and activity level (Wozniak et al., 2017). Just as individuals with autism experience the world in different ways, they learn in different ways as well. Thus, teaching strategies need to consider individual differences. A child who is not progressing is not one who cannot progress, but one who is not being taught in their learning style (Vivanti et al., 2017), and his or her learning program must be reorganized to fit the child's needs.

During ESDM delivery, data are taken at 15-minute intervals based on behaviors and objectives that have occurred within specific activities. Data sheets are designed to reflect progress on objectives involving all areas of development, with a separate data sheet for specific behavior plans. If a child is making consistent progress, seen within 1 week of data, the approach continues as per the basic model (Rogers & Dawson, 2010).

Should the data show a child not making progress on one or more objectives quickly, the supervisor consults a decision tree to guide how to optimize the basic teaching approach of the objective in question for a particular child. Using a flowchart involving yes/no questions, the decision tree walks sequentially through several steps: (1) adding reinforcer strength, (2) adding more structure, and finally (3) use of visual communication systems. While many may question this placement of visuals as the last adaptation to make, ESDM prioritizes spoken language and natural gestures over pictorial representations of language for two reasons. First, developmental research has clearly demonstrated that it takes typically developing young children a long time to grasp the representational value of pictures—well into age 3 (DeLoache, 1991; DeLoache & Burns, 1994). Second, the benefit of the choices we have made to prioritize children's use of and understanding of speech is clearly represented in our replicated outcome data, in which language is the area of a greatest positive effect of ESDM (Dawson et al., 2010; Rogers et al., 2019a, b).

17.4.6.1 Increasing Reinforcer Strength

The ESDM typically relies on reinforcers that are intrinsic to the preferred activity or materials and in the careful arrangement of tasks that surround a preferred activity. When an activity does not have an intrinsic reinforcer, for example, self-help skills, external reinforcers are added and used to motivate and support learning. We often begin with Premack's principle—placing the activity to be carried out just before a highly preferred activity so that the flow of activities contains the reinforcers. As changes are made, data is monitored to assess progress and if the data do not show rapid progress, additional changes to reinforcer strength are made by moving up a hierarchy and continuing to make adjustments to reinforcer value, moving next to unrelated toys, tokens, and social reinforcers, then to non-social toys (electronics) and perhaps to edibles. Social reinforcers are always included to assist with the eventual fading of the extrinsic reinforcers. If new reinforcers are put in place, the data are followed for the next 2 weeks to assess progress. If there was no problem with reinforcer strength, or if the new reinforcers are not leading to the desired progress, the next step is to add additional structure to learning approaches for the objective under examination.

17.4.6.2 Increasing Structure and Repetitions

When modifying teaching structure and repetitions, the ESDM therapist continues to maintain ESDM fidelity, even with the changes made. Child choice, child preferred materials and activities, and social communication objectives in every activity are all maintained even while structure and repetitions are added. Increasing structure and repetitions generally begins with having the child seated at a table, rather than on the floor or in various places of the child's choosing, in order to add some physical boundaries and support for attention. The next step would involve additional teaching trials, first distributed within the activity, but if needed, also carried out with more tasks that require massed practice. This structuring process may also include a reduction in the play variations that typically occur within the joint activity.

17.4.6.3 Visual Supports

The final level of change made to the program is to add visual supports. In this phase, visual antecedents, visual schedules, timers, picture schedules, and Picture Exchange Communication System (PECS) can all be implemented to support the child's learning. There is no hierarchy, and any mode of evidence-based visual communications that could support the child's learning can be chosen, including video modeling, play scripts, tactile or kinesthetic information, work baskets, picture or word symbols, work schedules, and more.

To summarize, in each of these three domains, the decision tree moves from the least amount of support through to significantly more support with the expectation to see progress begin to occur quickly, within a week. Whatever alterations are made for teaching as a result of this process are maintained throughout the 12-week teaching period, until the next curriculum evaluation occurs, and a new teaching plan is generated.

17.5 Evidence Base

The ESDM is an evidence-based intervention and has been studied in detail. While early behavioral intervention for children with autism is widely agreed upon by experts, establishing an intervention's efficacy requires strong evidence that an intervention demonstrates greater benefit than standard care. While intervention studies are plentiful, many do not demonstrate this level of methodological rigor. All the papers chosen for review here involve well-controlled trials, either by matched groups or in randomized controlled trials. Dawson et al. (2010) conducted the first randomized controlled trial of ESDM using a randomized design that compared the intervention against community treatment. Additional methodological strengths included high retention rates, the use of naive examiners, and measures of fidelity of implementation. Participants received either community intervention or ESDM delivered 1:1 for a planned 20 hours per week and were regularly assessed to measure progress. The results from this study demonstrated ESDM-specific benefits in the areas of language, cognition, and adaptive behavior in relation to the comparison group.

A follow-up study published by Estes and colleagues in 2015 where the children were a mean age of 6 years demonstrated continued ESDM advantages in core autism symptoms and adaptive skills in communication, daily living skills, and social skills compared to the community treatment group. In addition, both groups maintained the rates of development they had achieved during the intervention period, even though the ESDM group received significantly less treatment than the community group in the 2 years following the end of the intervention study, resulting in an overall benefit per cost advantage of the ESDM intervention over community intervention (Cidav et al., 2017). One outcome measure involved an examination of brain response to social and non-social preferences to photos of women's faces or toys (Dawson et al., 2012). Two comparison groups were used, the community treatment sample and an additional sample of typically developing agemates. Findings demonstrated that both the typically developing group and the ESDM-treated group responded more strongly and more rapidly to the social versus the non-social photos, while the community sample demonstrated the opposite response. This was interpreted as demonstrating preferential orientation to people versus objects in the ESDM group, and it addresses the social orienting/motivational hypothesis underlying the rationale for many aspects of the ESDM that address social motivation directly, described earlier.

A multisite, randomized, intent-to-treat replication of the Dawson et al. (2010) was published in 2020. The ESDM study involved 118 children and replicated the finding of the significant benefit of ESDM for young children in the language domain, though the performance was not consistent across sites for the ESDM group (Rogers et al., 2020).

17.5.1 Parent-Implemented ESDM

Given that parents have the most expertise on their children and spend the greatest amount of time with them, they are well-positioned to take advantage of everyday activities and turn those activities into learning opportunities for their young children with autism. Furthermore, if parents understand how to manage difficult behaviors and teach new skills, family life can be less stressful and more rewarding. In many situations, parent-implemented intervention may be the only source available to the child, given parent schedules, intervention costs, and lack of available intervention resources in some communities (Vismara et al., 2009).

Research on parent-implemented ESDM (P-ESDM) has shown some significant gains in both parents' acquisition of ESDM technique and children's social-communicative behavior (Vismara et al., 2009). In the initial single-subject study of P-ESDM involving 1 hour per week of 1:1 parent coaching with their child for 12 weeks, all but one parent mastered the ESDM techniques measured via the ESDM fidelity tool (Rogers & Dawson, 2010) at a minimum of 85% criterion by the completion of 5–6 sessions (Vismara et al., 2009), which were maintained over time both during and after the ending of intervention. Children in both groups increased their scores in verbal production and imitation markedly by the end of the study (Vismara et al., 2009). These skills continued to show gains during the 3-month follow-up following the end of intervention sessions. Thus, both parents showed gains during the intervention that were well-maintained for 3 months following the end of the intervention (Vismara et al., 2009).

A randomized, intent-to-treat study of 115 children developed from the original 2009 P-ESDM study did not demonstrate significant effects of P-ESDM coaching over community intervention on 1-year-olds with ASD (Rogers et al., 2012). Both groups of children made marked gains in developmental quotient (DQ) and language abilities and decreased autism symptoms involving social affect over the 3-month period. The children in the community group averaged more than double the intervention hours of the P-ESDM group, who averaged only 1.5 hours of intervention per week. While there were no significant differences in child progress, there was a significant effect on parent stress in this brief study. By the end of the study, parents in the P-ESDM group reported significantly lower levels of parental stress than did those in the community group, and the difference remained significant even when controlled for the number of negative life events occurring in that 3-month period.

Why were there no significant group differences, either in parent fidelity scores or child progress, in this study? We hypothesized three reasons: (1) the intensity was just too low for effects to show up, (2) the fact that the parents were just learning the intervention during the time that we were measuring child and parent change demonstrates that the P-ESDM children were not getting a "full dose" of the intervention, and (3) standard measures being used were not sensitive enough to detect small changes occurring over such a short period.

A similar randomized study involving 32 young children directed by Vismara et al. (2018) examined the use of the Internet as a delivery method for P-ESDM for learning materials (e.g., videos, lesson synopses, learning modules, and a variety of relevant information and aids). In this study, significantly more parents receiving P-ESDM reached criteria for the fidelity of implementation than did the community group, demonstrated significantly greater fidelity of implementation skills than did the control group. P-ESDM parents also reported significantly greater satisfaction with their intervention than did the community group. Children in the P-ESDM group showed significantly higher rates of imitation than did controls.

Rogers et al. (2019b) and a multi-site team conducted a randomized, intent-to-treat trial of P-ESDM, with a sample of 45 children to test two hypotheses from the Rogers et al. 2012 study. The hypotheses concerned (1) enhancing the intensity and parent coaching approaches within the P-ESDM intervention and (2) testing the sensitivity of proximal versus distal measures for detecting child change. Instead of using a treatment-as-usual comparison group, both groups were assigned to a P-ESDM treatment, with one receiving an enhanced version of the training (Rogers et al., 2019b) and the other receiving the standard version. Enhancements included, first, an extra weekly session conducted at home to help generalize techniques to the children's everyday environment (Rogers et al., 2019b). Additionally, parents were provided with different materials to target their specific learning styles (e.g., visual, audio; Rogers et al., 2019b). Lastly, parent coaching was implemented using Motivational Interviewing techniques (Miller & Rollnick, 2002), to improve parental motivation and engagement through identifying the parent goals and aligning treatment with them (Rogers et al., 2019b).

The second methodological addition was the use of a proximal measure involving a developmental checklist administered at several points in the 6-month trial (i.e., 3 months of intervention, 3 months of follow-up) in addition to the standardized, distal measures of child skills administered at three timepoints (i.e., pretest, end of active treatment, and end of the follow-up period). In terms of parent change, the parents in the enhanced group demonstrated significantly greater gains in parent fidelity of implementation skills than did parents in the non-enhanced group. In terms of child progress, both interventions were associated with significant developmental acceleration; although, child outcomes did not differ by group on either proximal or distal measures. However, individual child rate of progress was significantly related to parent fidelity scores, demonstrating that the key practices of ESDM intervention predicted the amount of child progress as measured by the proximal measure. Parents in both groups reported satisfaction with the intervention.

17.5.2 ESDM in Group Settings (G-ESDM)

While the most rigorous studies of ESDM have involved 1:1 intervention conducted by interventionists or parents, in some cultures and contexts 1:1 intervention is not available or preferred. ESDM grew out of a group model for young children with autism developed by Rogers and colleagues at the University of Colorado Health Sciences Center. Group ESDM, or G-ESDM, is a current ESDM adaptation, described by Rogers and Dawson (2010) and Vivanti et al. (2017), intended for specialized, inclusive, or community childcare and early educational group settings. The intervention design process follows the basic ESDM process of assessment using the ESDM curriculum checklist completed for each child every 12-weeks and the development of individualized learning goals on all the developmental domains. An interventionist targets several of each child's objectives in each group activity using brief 1:1 exchanges that involve several learning opportunities delivered every 30 seconds or so while other children carry out their own play or wait for a turn. Staff to child ratio was 1:3 and all staff were trained to fidelity. Data are taken on each objective taught in each activity and drive decisions about how to best deliver the intervention to accomplish objectives, using the decision tree as described previously.

Parents receive coaching at regular intervals. Vivanti et al.' (2014) outcome study compared two groups of children, those receiving the specialized ASD group services made available through the public health system and those receiving group-delivered ESDM carried out in a university-based community childcare service with a specialized autism wing. Children in the ESDM group attended at least 15 hours per week while children in the community settings typically attended all day, 5 days a week. At the end of 1 year of intervention, the ESDM group displayed greater improvement than the comparison group on gains in their developmental quotients, receptive language, and adaptive behavior using standardized measures and naive raters (Vivanti et al., 2014). The performance had increased in the domains of visual perception, receptive language, and expressive language. Communication skills and gross motor skills had also improved, and parents' questionnaire responses indicated reduced autism-specific features. Although the results were not as drastic as those found by Dawson et al., 2010, this was not surprising since earlier intervention is more beneficial for children with ASD, and Dawson et al.'s was conducted significantly with younger children.

17.5.3 Other Research

The strength and consistency of the ESDM findings were recently documented in a careful meta-analysis published by Fuller et al. in 2020. The study included data from 12 ESDM studies, included data from 640 children, and involved 44 unique effect sizes. The studies included data from all three delivery types: one-to-one intervention, parent-implemented intervention, and group intervention. Data were obtained from measures of IQ/DQ, language, adaptive behavior, joint attention, repetitive behaviors, and autism severity scores. Most measures involved assessor-implemented measures, though parent-report measures were also used. Children who received ESDM made greater progress than controls in the areas of receptive and expressive language, and cognition; and the overall aggregated effect size across all 44 unique effect sizes was moderate and statistically significant, indicating an overall advantage for children receiving ESDM compared to those in comparison interventions.

Finally, a recent multisite intent-to-treat RCT (Rogers et al., 2020) conducted a direct comparison of ESDM intervention outcomes compared to Early Intensive Behavioral Intervention (EIBI) outcomes following the treatment manual, *A Work in Progress*, written by Leaf and McEachin (1999) with the EIBI delivery trained and overseen by McEachin. The study also tested two different levels of treatment intensity. Planned delivery of 15 and 25 hours per week of 1:1 intervention resulted in the actual delivery of 12 and 22 hours per week. Eighty-seven children from three sites were randomized into one of four cells: (1) ESDM 15 hours, (2) ESDM 25 hours, (3) EIBI 15 hours, and (4) EIBI 25 hours. All cells received 12 months of intervention at home or other care setting from highly trained interventionists working under the supervision of a professional supervisor. All families received monthly coaching twice from their team lead. We predicted that the severity of children's developmental and autism symptoms would moderate the effects of intensity and treatment style in four domains: autism symptom severity, expressive communication, receptive language, and nonverbal ability. Examiners and coders were naive to group assignments. Data analysis revealed that neither treatment style nor treatment intensity had overall effects on outcomes in any of the four areas. Furthermore, children's initial severity of symptoms did not predict a better response to one intervention compared to the other. And there was very little evidence that severity predicted a better response to one intensity level compared to the other. All four groups of children made similar and marked levels of progress on all four variables with effect sizes ranging from 0.5 to 2.2.

17.6 Naturalistic Developmental Behavioral Interventions

The Early Start Denver Model falls into a category of autism treatment known as Naturalistic Developmental Behavioral Interventions. Naturalistic Developmental Behavioral Interventions, or NDBI's, are the product of merging the sciences of applied behavior analysis and child development (Schreibman et al., 2015). Prior to the development of NDBI's, these two fields existed separately; however, the increasing emphasis on treating autism early in childhood has led to the blending of these two fields (Schreibman et al., 2015). NDBI's represent the integration of ABA and developmental sciences, which ideally allows for accelerated child learning and more substantial gains while being particularly well-suited for the infant and toddler population (Schreibman et al., 2015). The focus of NDBI's is to address the core symptoms in autism including delays in face-to-face reciprocal interactions, imitation, play, social communication, and joint attention (Schreibman et al., 2015).

17.6.1 Pre-NDBI

Before the 1960s, interventions for autism were minimal, since it was believed that those with ASD could not be treated. The early 1960s saw this belief fade with proof of children with ASD learning new skills through an operant learning paradigm (Lovaas, 1987). The operant learning paradigm was adapted to teach autistic children various skills such as language, social, and academic skills (Schreibman et al., 2015). This also proved to be effective in reducing unwanted behavior and was taught to parents so that they could integrate it at home.

In 1987, Lovaas' work on autism treatment demonstrated the benefits of early intervention using applied behavior analysis. Lovaas' methods resulted in higher IQ scores and adjustments to mainstream schooling (Lovaas, 1987). This led parents to favor early intensive behavioral intervention, advocate for it, and popularized discrete trial teaching (DTT). DTT involves breaking skills down into different components and using discrete trials to teach components one at a time (Schreibman et al., 2015). This was done until behavioral changes were seen. While DTT has been incredibly successful in leading to powerful behavioral changes for children with autism, critiques of the model are that DTT did not allow children to generalize skills to different environments and promoted unwanted changes such as avoidance challenging behavior (Schreibman et al., 2015). Other critiques are that DTT reduced spontaneity and made children with autism dependent on prompts, which decreased their spontaneous behaviors (Schreibman et al., 2015). The inclusion of new developmental theories in learning aimed to target these criticisms and offer an alternative teaching approach for children with autism and their families (Schreibman et al., 2015).

17.6.2 Developmental Perspectives and Autism

Research on infant and child development in the 1980s and 1990s contributed to advanced models of development which, in turn, contributed to research on autism. Developmental research was especially useful since the development of communication, social learning, and language are some of the key domains targeted when treating those with ASD. As autism diagnosis and autism intervention moved downward chronologically from 1980 to 2000, autism interventionists were beginning to be faced with children as young as 15–18 months old, children too immature to participate in standard DTT interventions. These children are very close to the age at which the skills so affected by autism—reciprocal interaction, joint attention, imitation, use of gestures, receptive communication, and preverbal communication—are just emerging in typical development. Developmental studies of ASD demonstrated that many skills thought to be completely atypical in ASD were better characterized as immature and that progress of children with autism tended to follow similar patterns like those with typical or delayed development—hence the concept that a developmental approach to their intervention might be helpful as characterized by studies of the Denver Model as early as 1986.

Because of this, autism treatment began to focus on skills like joint attention (Mundy et al., 1990), which would then aid in the development of other skills like social engagement, language, and imitation (Rogers & Lewis, 1989). Research also showed that children being active participants during learning led to better results than the respondent learner approaches, since infants are hypothesis-testers who learn from testing predictions on their environments (Saffran et al., 1996). Communication and imitation were also found to be dependent on social relationships and learning on affective exchange (Charman et al., 2001). Since those affected by ASD have deficits in social motivation and affective sharing, these were incorporated into new and improved interventions (Prizant et al., 2003). Lifter et al. (1993) concluded that atypical and typical children followed similar developmental paths in many domains and that those with ASD simply developed at different rates, leading to an investigation of this blended form of teaching individuals with ASD.

17.6.3 Developmental Perspectives and NDBI

Early developmental psychologists such as Piaget, Vygotsky, and Gibson (among others) concluded that children flourish when they are engaged as active participants in a developmentally appropriate learning context, and in contexts that are meaningful and relevant to the child (Schreibman et al., 2015). Vygotsky (1978) found that children most readily learn skills that are scaffolded by caregivers and just beyond their current knowledge, therefore assessing the child's current abilities as well as finding skills that represent the "zone of proximal development" in every developmental domain enables success (Lifter et al., 1993).

NDBIs implement a constructivist approach, meaning that children's learning experiences are intentionally developed to (1) actively engage children's attention; (2) foster child initiation and maintenance of both interactions and goal-directed activities; (3) foster flexible, varied play, to help them connect new experiences with what they know now; (4) teach children guided by developmental sequences by systematically increasing the complexity of their learning experiences; (5) allow them to construct their own knowledge, learn language from their own topics of engagement with partners; and (6) learn the routines and regularities of their life experiences (Schreibman et al., 2015). Children are encouraged to initiate interactions and engage in spontaneous behaviors, both of which are rewarded, leading to the promotion of the child's own learning (Schreibman et al., 2015).

Research in developmental psychology also examined environmental factors that promoted learning, social cognition, and play, which has been applied to the development of interventions for individuals with autism (Schreibman et al., 2015). One such example is that of a child learning in the context of affectively rich social interactions that involve play with both objects and people. The same information taught in another context, without the rich affect, lacks the same quality of learning (Kuhl, 2007). Ratner and Bruner (1978) found that the daily routines that children participate in offer rich learning contexts for young children. Not only does this ensure learning takes place in everyday life but it also helps with adaptive functioning. Teaching children inside their daily routines showed increased generalizability of their skills, addressing one of the critiques of DTT (McGee et al., 1983).

Further efforts to improve the effectiveness of autism treatment led to the development and incorporation of strategies to help improve the child's motivation for engaging in an activity (Schreibman et al., 2015). Some of the strategies implemented that vary from previous forms of treatment based on ABA include the use of reinforcement that is embedded in the goal-directed activity rather than external to it, child-led interactions, and treatment occurring in natural contexts. Bates et al. (1988) showed that skills such as gestures, shared affect, and joint attention led typically developing children into language acquisition (see also Charman et al., 2001), and Mundy et al. (1990) demonstrated that this was also true for children with autism. This led to a change in how language was taught to children with autism. Ingersoll and Schreibman (2006) used a treatment study to demonstrate the interrelated effects of changes in imitation, joint attention, language, and pretend play in early ASD.

17.6.4 NDBIs and Autism

NDBIs have been shown to be successful in children with autism when children are extremely young and have less established patterns of disruptive behavior. Not only does this help with generalization but it also reduces children's dependence on prompts, results in more natural language, teaches language along with the meaning, and results in habituation to the distractions that are there in daily life (Schreibman et al., 2015).

NDBIs are also inherently social since they involve interactions with peers and adults, making them likely to promote social development (Morrier et al., 2009). Additionally, they are family-friendly and can be carried out by parents in the context of daily routines, increasing the quantity and quality of interactions and learning experiences (Schreibman et al., 2015).

The surge in popularity for NDBIs took place just as researchers studying autism were understanding the importance and the benefits of early intervention in autism (Schreibman et al., 2015). Learning goals and plans were chosen based on developmental readiness, which included both developmental and chronological age. Children with autism, therefore, were taught skills in accordance with their developmental age, which resulted in better generalization, maintenance, and acquisition (Lifter et al., 1993).

NDBIs also reduced unwanted and disruptive behavior in autism by focusing on development as a whole and considering challenging behavior a normal part of development in both autistic and typically developing children (Schreibman et al., 2015). This was done by teaching children how to regulate their own behavior. These interventions also focused on grabbing a child's attention, which was done by making use of items and events that are preferred by the child. Because of this, escape- and avoidance-motivated behavior is reduced (Koegel et al., 1987).

17.7 NDBI Components

There are a variety of components that make up the NDBI strategies. These will be discussed below.

17.7.1 Nature of Intervention Targets

Targets include a variety of developmental domains, including social, language, cognition, play, and motor systems (Dawson et al., 2010). NDBIs also ensure that there is an integration of skills across the various domains and prioritization of generalization. This developmental system's approach makes sure that skills are not taught in isolation or chosen without regard to the child's current developmental accomplishments but that new skills fall within Vygotsky's zone of proximal development and are taught within everyday activities by a variety of people rather than in artificial teaching situations with artificial materials and instructions. Skills that form the foundation for learning other skills include sharing emotions, attending to others, imitating others, and understanding that meanings are communicated via sounds, expressions, gestures, and words. With core components established, additional skills can be learned (Schreibman et al., 2015).

Examples of skills that aid in the acquisition of other skills include joint attention and imitation. Joint attention refers to gestures, gaze, and language that is used to aid in sharing information with others. Joint attention has proven to be linked to greater language skills in both autistic and typically developing children (Mundy et al., 1990). Imitation is crucial when it comes to social acceptance and learning since it allows children to engage with others and learn from others before they develop the ability to speak. Not only does it facilitate social interaction, but it also allows children to experience others' states by synchronizing their experience with others, and thus, helps in the development of the theory of mind (Gopnik & Meltzoff, 1993). Imitation is especially important since it allows children to learn by observing others instead of experiencing things themselves, and helps them to grasp concepts such as games, language, and symbols. Interventions designed for children with ASD have proven to be effective in teaching them to imitate in a socially engaged manner (Ingersoll, 2010).

17.7.2 Nature of Learning Contexts

Research has indicated that children's neurobiological development is affected by their experiences and that these experiences affect development as a whole (Dawson et al., 2012). Meaningful social interactions aid learning (Topál et al., 2008) and allow children to learn about their environment and the social landscape surrounding them (Spelke et al., 2013). NDBIs focus on this by placing learning and engagement within daily routines and play, which helps with contingency-based skill-building. These contexts are characterized by the activities used, the relationship between the adult and child, and the emotional valence of the interaction and activity (Schreibman et al., 2015).

17.7.3 Nature of Instructional Strategies

Strategies used in NDBIs are both successful and ecologically valid and use simple action sequences along with rewarding experiences to create motivating activities. A variety of strategies are used, including modeling, chaining, shaping, prompting, and differential reinforcement. With these, the child learns to expand language and action sequences, and the adult gradually increases the complexity of the activities to further this learning. Children's communication and social, reciprocity, and play skills are expanded while motor, cognitive, and adaptive skills are scaffolded. Because the activities are child-centered and increase their motivation, unwanted and disruptive behaviors are reduced and replaced with more acceptable alternatives (Schreibman et al., 2015). Incidental Teaching, Pivotal Response Treatment, and Reciprocal Imitation Training are all examples of NDBIs, as is the ESDM (Schreibman et al., 2015). While the different interventions vary in their individual treatments, they have a host of common features.

17.7.4 Three-Part Contingency

NDBI's focus on a high rate of teaching, ideally with learning opportunities occurring multiple times per minute. Learning occurs inside the three-part contingency (i.e., antecedent-response-consequence). This creates clarity for the child around when and how to respond and comes from the field of applied behavior analysis. However, unlike discrete trial teaching, this triad is not necessarily separate from the next triad, and one often sees that the consequence of one round is also the antecedent for the next.

17.7.5 Manualized Practice

While not specific to NDBIs, treatment manuals are expected parts of treatment research, and maintaining fidelity to a specific model generally includes following the treatment manual. Having a manual that clearly details the practices of intervention allows for more accurate implementation (Durlak & DuPre, 2008). A manualized practice also assists with training and consistency of implementation among providers (Schreibman et al., 2015).

17.7.6 Fidelity of Implementation

Fidelity of implementation documents that the intervention is being delivered as intended and this is essential in order to achieve the effects of an evidence-based intervention. Fidelity of implementation refers to how well a treatment is implemented as intended. Fidelity measures may also serve to determine therapist competence (Durlak & DuPre, 2008; Gresham et al., 2000).

17.7.7 Child-Initiated Teaching

A critical difference between NDBI and DTT interventions is the principle of following the child's lead, which is the process of allowing the child to have a choice in which activity or materials they will engage in, as well as choices throughout the interaction. When a child initiates an activity, they are more likely to engage in the particular activity, allowing for increased learning opportunities (Schreibman et al., 2015). Not only does this increase the child's motivation, but it also uses achievement of the goal as a positive consequence for the skill being targeted (Schreibman et al., 2015). Furthermore, language development studies have clearly demonstrated the positive role of parent speech that follows up on child initiations compared to parental directive speech for language development (Hirsh-Pacek et al., 2015).

17.7.8 Environmental Arrangement

The environmental arrangement plays an important role in supporting interactions between adults and children. In NDBI's, the natural environmental setting is typically arranged to support the child's attention and interaction. This usually involves clearing out spaces, using furniture, rugs, and other cues and natural boundaries to support the child staying with the therapist, organizing materials so that the child is not distracted by multiple objects lying around in a chaotic fashion, and reducing distractions in the environment. Often, the arrangement can be such that preferred items are in sight, but some are out of reach to encourage the child to interact in order to gain access to the preferred object or activity. Controlling access to preferred materials or blocking child access encourages the child to initiate interactions to obtain the materials and allows for the presentation of multiple communication learning opportunities.

17.7.9 Natural Reinforcement and Related Methods for Enhancing Motivation

Natural reinforcement contrasts with external reinforcement and refers to reinforcement that is related to the child's goal. Instead of having a child complete a task and receive an unrelated reward, this procedure uses natural reinforcement/intrinsic rewards. For example, instead of telling a child to stack the blocks and then providing a token, a break, or an edible when complete, the NDBI interventionist may place a box of blocks near the child, and when the child approaches and begins to handle the blocks, the therapist may stack one block on one of the child's and offer one to the child. The two go back and forth co-constructing the tower for the pleasure of seeing how high it will build before it falls over. The child's enjoyment in the process is the natural reinforcer for engaging reciprocally with the therapist in this activity as well as for the fine motor and cognitive skills involved. No other reward is needed. If a child is having trouble completing the task at the level the objective requires, an NDBI therapist will simplify the task so that the child has a sense of goal achievement. Also known as reinforcing attempts and loose shaping, this maintains the child's motivation and encourages them to keep trying (Koegel et al., 1988).

Rather than discrete trial drilling of acquisition tasks after failures, NDBI therapists alternate one or two acquisition tasks with maintenance tasks. This results in increased motivation, generalization, decreased frustration (when a failure occurs), practicing already learned skills, and ultimately in the acquisition of new skills (Schreibman et al., 2015). Since varying degrees of complexity also occur in learning with typically developing children, this keeps interactions as close to natural as possible (Koegel et al., 1988).

17.7.10 Balanced Turns Within Object or Social Play Routines

Known as reciprocal interactions, shared control, and turn-taking, this serves to reinforce social reciprocity, develop nonverbal communication, and give adults opportunities to control access to the materials used and opportunities to model a target skill. The back-and-forth structure used is commonplace in early learning which is why it is often incorporated in NDBI's (Harrist & Waugh, 2002). The idea of balanced interactions has to do with who is initiating and who is responding. This idea that the "leader" of an interactive round should be the child as often as the adult leads to balanced interactions and supports child learning.

17.7.11 Adult Imitation of Child and Modeling

Known as reciprocal imitation, mirroring, and contingent imitation, this strategy aims to increase the child's responsivity to the adult and to continue the interaction. Children with ASD have been shown to pay more attention to adults when being imitated (Dawson & Adams, 1984). Domains such as imitation, language; cognitive, motor skills; social, play, and self-care skills can all be taught using modeling. Modeling, as it is used here, refers to children learning via imitation from the adult demonstration of behavior, and is an essential component of learning in early childhood. Skills targeted during modeling are chosen carefully with the child's developmental progress in mind.

17.7.12 Broadening Attentional Focus

Children with autism have been known to have deficits in attention and are prone to the stimulus over selectivity (Lovaas et al., 1971). Stimulus over selectivity is when a child's behavior is either under a limited range of stimuli or irrelevant stimuli. Overly restricted attention hinders learning and is affected by over selectivity (Ploog, 2010; Reed et al., 2013). Research by Reed et al. (2013) demonstrated that typically developing children with a mental age of under 36 months also have difficulty with over selectivity and that it is likely a developmental delay rather than an autism-specific impairment. It is not unique to ASD, and attentional flexibility can be supported and addressed in an intervention (Koegel & Schreibman, 1977). NDBIs target this by using multiple stimuli that are varied, which helps with generalization and thus broadens attentional focus. This is also taught in natural environments for easier adaptation (Dawson et al., 2012).

17.8 Limitations and Future Directions of the ESDM

The ESDM is in use around the world, and the number of certified therapists and trainers grows daily. It has been examined in upwards of 30 or more studies, authored by a wide range of scientists, and carried out in many nations using simple and complex designs. We have reviewed the findings from the controlled, methodologically rigorous studies here and the intervention is continuously being shaped and tweaked to address new findings both from our own studies and from other developmental, behavioral, and treatment findings.

While the ESDM has been implemented in different countries and community settings, there remains much to learn. Future research should also include subsets of autistic children so as to determine whether some treatments are more effective than others for different children and families (Zwaigenbaum et al., 2015). Further research is required to learn how to adapt the model to best meet the needs of different cultures worldwide. For example, research should examine sociocultural beliefs, cultural factors, and economic capability since this can greatly affect intervention outcomes. Lack of access is often a factor of race, low SES (Liptak et al., 2008), insurance (Wang et al., 2013), living in non-metropolitan areas (Thomas et al., 2007), parental advocacy, and limited resources, such as shortage of professionals (Murphy & Ruble, 2012).

Not only are lower SES families less likely to have access to interventions but they may also have different cultural views that hinder development. Families with children with ASD experience more barriers to interventions than do families involved with other disabilities (Vohra et al., 2014). This can be due to misunderstandings, translation errors in case of poor language abilities, or insufficient training for at-home interventions (Zwaigenbaum et al., 2015). Culturally appropriate program materials are needed for all families, as are trained local service providers. We need to continue our studies investigating how to adapt autism treatment to best meet the needs of ethnically and culturally diverse families and how to best educate and guide providers who do not fit the Western-culture professional mold (Zwaigenbaum et al., 2015).

Additionally, we need to be extremely sensitive to the number of burdens and stressors shouldered by underrepresented families, economically stressed families, families stressed by physical and mental illnesses and multiple adverse life events. Assuring that we are listening deeply to family needs and requests and ensuring we are doing our best to meet them rather than imposing our own agenda is a necessary aspect of working with families. It is critical to assure that providing "help" for families does not add yet another layer of burden, another experience of failure, or another experience at the hands of insensitive professionals. The best intervention for a child is one that works for the child's family needs. Future ESDM research needs to focus much more on adaptations that make the intervention feasible for a very wide range of families. The outcomes research that we have published has involved a mid-SES American group. Our international colleagues will help us understand the effects of ESDM in differing cultures and the adaptations needed. Since parental involvement is key in the ESDM and other early interventions, research should take into account factors or characteristics of the family that affect treatment fidelity, intensity, and results. This includes family stressors, parental involvement, cultural differences, and the quality of intervention, among others.

All of these directions will help us to understand the effects of ESDM on a wide range of children and families, and will also help us improve the intervention's efficacy, lower its cost, simplify it, reduce needed training time, and increase our competence as therapists and scientists as we continue to provide children with the widest and best developing array of early childhood knowledge and skills possible.

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PEAK Relational Training System

18

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18.1 PEAK Relational Training System

Since the landmark study by Sidman (1971), the phenomenon of stimulus equivalence has been known to behavior analysts for many decades. In short, stimulus equivalence can be captured via three main processes. Reflexivity, or generalized identify matching, describes the learner's ability to match a stimulus to its identical copy without a direct history of reinforcement. Symmetry describes the ability to engage in a conditional discrimination without a history of direct reinforcement due to existing learning history of the stimulus-stimulus relationships, where the role of sample stimuli and comparison stimuli switches place. For example, when shown an array of an apple, an orange, and a peach (Stimulus B) and presented with a flashcard with the word "Apple" (Stimulus A) and the instruction, "put with same," the learner will select the apple and contact a reinforcer. Here, the flashcard (Stimulus A) is the sample stimulus, and the array of fruit (Stimulus B) is the comparison stimulus. What symmetry describes is that once the learner can reliably complete the task described above, without specific programing, the learner is now able to select the flashcard with the word "Apple" (Stimulus A) from an array (i.e., an array with three flashcards, "Apple," "Orange," and "Peach") when shown an apple (Stimulus B) and asked to put with same. In the second task, the fruit becomes the sample stimulus, and the flashcard becomes the comparison stimulus. In other words, once the learner is taught A = B, the learner is able to derive B = A. Transitivity describes the derived relation between two stimuli due to their existing relations to other stimuli. In the example described above, we would now present a flashcard with the word "Apple" (Stimulus A) and an array of three flashcards with the Mandarin characters of these three fruits, "苹果," "橙子," and "桃子" (Stimulus C) and ask the learner to "put with same." Once reaching the mastery criteria, we would see that now the learner can select the fruit apple (Stimulus B) from an array when shown the flashcard with the Mandarin character "苹果" (Stimulus C) on it. In this example, the learner learned that A = B and A = C. Without a direct history of reinforcement, the learner is now able to demonstrate C = B. Instructional procedures that leverage on stimulus equivalence is termed equivalence-based instruction (EBI), and its benefits are clear. By arranging teaching in specific ways, the learner will be able to derive new knowledge. With a three-member equivalence class, teaching two conditional discrimination tasks can lead to the emergence of seven new stimulus-stimulus relations. With a four-member equivalence class, teaching three conditional

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discrimination tasks can lead to the emergence of 13 new stimulus-stimulus relations. As more and more class members are introduced into an existing relational network, the growth is exponential. Fast forward 30 years, the development in relational frame theory (Hayes, Barnes-Holmes, & Roche, 2001) expands the benefit of such instructional paradigm, as the relation is no longer restricted by equalness. Comparison, opposition, hierarchical, etc., all come together and form a complex relational network. The procedure through which to produce such networks is often coined as relational training. Topographically the relational training procedure may resemble that of EBI, but it can also take other forms such as requiring the learner to complete a memory matching game after teaching and deriving coordination between two arbitrary stimuli stimuli (i.e., after teaching ♋ is the same is ♌, and ♌ is the same as ♍, asking the learning to play a matching game, where ♋ and ♍ are considered as a pair). At the same time, instead of the relationship of sameness, other nonequivalent relationships are utilized. However, despite such a phenomenon demonstrated in behavior research for many years, there are limited attempts in incorporating this scientific development in clinical practices. In this chapter, we will discuss a comprehensive treatment model and its assessment tools that are specifically designed to leverage on this form of learning, synthesizing existing evidence, evaluating its clinical utilities, and providing a brief review of the discourse around this curriculum since its introduction.

The *Promoting the Emergence of Advanced Knowledge,* or PEAK Relational Training System, was released into the applied behavior analytic community in a series of four installments between the years of 2014 and 2016. Approximately every 6 months, a new "module" appeared which contained a brief assessment tool, data sheets, and 184 curriculum items that focused on a specific learning modality. In 2019, a standardized evaluation tool entitled the PEAK Comprehensive Assessment (PCA; Dixon, 2019) was added to the system, which, to date, remains the only standardized assessment of language and cognition in the field of applied behavior analysis (ABA). In addition to the PEAK modules and assessment, a variety of supplemental resources have been available to users of the program for the past 8 years. A PEAK YouTube channel has hundreds of demonstrations on conducting the assessments, running curriculum programs, and constructing materials. There is also a voluntary PEAK Certification program that contains three levels of distinction, ranging from exposure to a set training curriculum (Level 1), demonstrated mastery of targeted competencies (Level 2), and the ability to deliver and train others on PEAK (Level 3). Supplemental assets exist on Facebook, Instagram, and other social media outlets which allow for peer-to-peer community support.

The Direct Training Module (Dixon, 2014a) was the first available PEAK module and emphasized a direct contingency teaching approach heavily rooted in B. F. Skinner's 1957 text *Verbal Behavior*. In the Direct Training Module, the skills which were targeted ranged from basic vocal imitation, picture and word discriminations, object selecting, and conversation skills. These sorts of skills fall within the Skinnerian vernacular of "verbal operants," yet such technical vocabulary is only lightly used within PEAK to expand accessibility to non-behavior analytic users. More complex forms of such operants, along with a wide variety of listener skills, are contained within the Direct Training Module, and prior research has suggested that in contrast to the *Verbal Behavior Milestone and Placement Program* (VB-MAPP; Sundberg, 2008), or the *Assessment of Basic Language and Learning Skills – Revised* (ABLLS-R; Partington, 2010), which are criterion referenced to neurotypical ages 4 and 5 years, respectively, this first PEAK module approximates a total score around neurotypical age 8 years (Dixon et al., 2015; Malkin, Dixon, Speelman, & Luke, 2017). A wider range of skills that rely on contingency learning are included in the Direct Training Module, such as basic perspective taking skills, social skills (e.g., telling jokes), and more advanced verbal operants, such as metonymical tacts.

The Generalization Module (Dixon, 2014b) expanded upon the prior installment through the utilization of a training-testing approach to intervention whereby certain stimulus targets were designed to be trained with prompting and error correction, while other similar, yet nonidentical, targets were to be concurrently probed in hopes of establishing generalization across stimuli, responses, or contexts. The Generalization Module of PEAK included an additional 184 curriculum items which ranged from more complex forms of verbal operants, basic problem-solving, mental and visual rotation tasks, short-term memory challenges, and advanced mathematics. Technical language was again kept to a minimum to encourage usage beyond behavior analysts. Research on the Generalization Module has demonstrated both effectiveness of the train-test teaching approach to produce both new skills and the generalization of those same skills (Dixon, Peach, Daar, & Penrod, 2017; Dunkel-Jackson & Dixon, 2018), and there is also research suggesting that the module contains skills advancing to around neurotypical age 11 years (Dixon, Rowsey, et al., 2017).

The Equivalence Module (Dixon, 2015) served as a radical departure from the first two PEAK modules in its exclusive reliance on equivalence-based instruction (Sidman, 1971) as the sole means of teaching new skills. Included in the Equivalence Module is an expanded assessment, entitled a "Pre-assessment" which utilized a series of mostly arbitrary tasks to determine the degree of derived relational responding that a client would be capable of doing. Such evaluation items range across basic identity matching, symbolic symmetric recall, and higher-level deductive tasks. An interesting characteristic of this assessment process was that it incorporates all five sensory modalities, requiring the client to taste, smell, and touch a variety of items, as an attempt to capture derived relational responding abilities across all sensory modalities, catering to the learner's preference. The 184 curriculum items move from an easy-to-hard hierarchy in which early items focus on simple matching to sample, while later items take the form of complex problem-solving, often times involving multiple sensory modalities and abstract stimuli. Research on the Equivalence Module of PEAK has shown a range of correlations between pre-assessment scores and other indexes such as intelligence (Dixon, Belisle, & Stanley, 2018), challenging behavior (Belisle et al., 2017), and other established assessment tools (Belisle, Dixon et al., 2021). A variety of outcome studies have documented gains for individual curriculum skills (Dixon, Belisle, Stanley, Speelman, et al., 2017; McKeel & Matas, 2017) and the comprehensiveness of the entire module as proof of derived relational responding as a generalized operant (Dixon et al., 2021).

The Transformation Module (Dixon, 2016) was the first and remains the only tool for the assessment of and intervention for deficits in relational framing (Hayes et al., 2001). This PEAK module also contains a pre-assessment which is separated into two subsections for expressive and receptive skills. Within each, there are questions pertaining to six different relational frame families: coordination, opposition, distinction, comparison, hierarchy, and deictic. Beginning with intervention programming that attempts to establish nonarbitrary relationships among stimuli that are based on formal characteristics and advancing to higher-order transformations of arbitrary stimulus functions, the PEAK Transformation Module contains a comprehensive path to building what is termed "arbitrary applicable relational responding" (AARR; Hayes et al., 2001). Research has shown that programming within this module can teach perspective taking skills (Belisle, Dixon, et al., 2016), recognizing emotions in others (Schmick, et al., 2018), establishing temporal relationships (Barron et al., 2019), and comparative relations (Belisle, Stanley et al., 2020). Furthermore, assessment scores appear to be correlated with measures of intelligence and adaptive behavior (May & Flake, 2019).

The PCA (Dixon, 2019) serves as an alternative and likely eventual replacement to the in-module assessment tools that were used up until this time. This standardized tool contains a verbatim script, all necessary stimulus materials, scoring guide, administration integrity checklist, and evaluation of challenging behaviors and of autism symptomology. Therefore, such enhancements make the PCA a much more comprehensive and easier to use apparatus for assessment of language and cognition skills than prior installments in the PEAK modules. Although an extremely significant correlation exists between the PCA and the prior assessments of PEAK (Moore et al., 2020), approximately 67% of the items have been modified to improve clarity, global adoptability, and reduce false positives. Additional research on the PCA has also shown correlations between IQ test scores, adaptive behavior, and autism symptomology (Sutton et al., 2021). A higher score on the PCA is statistically correlated with higher IQ test scores, better performance during adaptative behavior assessments, and decreased autism symptom severity (Table 18.1).

To date there has been considerable empirical support for the PEAK system; however, future additions to this body of work will strengthen knowledge of the relative strengths and weaknesses of the existing studies. What follows is an exhaustive review of the current scientific literature that pertain to PEAK. The methods used to source content for this task were the same from Dixon, Belisle, McKeel, et al. (2017), with the addition of all articles and book chapters published between April 2017 and April 2021. A total of 61 articles were included in our analysis. The following section summarizes evidence supporting the utilization of PEAK as a structured curriculum and as an assessment tool for language and cognitive skills.

18.1.1 Clinical Outcomes of the PEAK Curriculum among Children and Adolescents

To date, four studies (see Table 18.2) have evaluated the effectiveness of using PEAK as a structured curriculum using group-based designs, with three conducting randomized controlled trials and one using a quasi-experimental design. Overall, their results suggest that PEAK can produce changes in specific behavior skills more effectively (Dixon, Belisle, Stanley et al., 2018; May & St. Cyr, 2021; McKeel, Dixon et al., 2015) than traditional evidence-based methods, such as standard special educational practices, interventions that are primarily based on contingency learning, and those that do not incorporate EBI or relational training procedures. McKeel, Dixon et al. (2015) compared the effectiveness between traditional special education practices and ABA interventions based on the PEAK curriculum. Their study found that those who received interventions based on the PEAK curriculum made more gains in their language skills than those in the control group ($p = 0.005$). Dixon, Belisle, Stanley et al. (2018) compared 34 students' outcomes from three different schools, two of which were implementing PEAK-based interventions. The results showed that students from these two schools made more gains during the PEAK-DT assessment after one academic year ($p < 0.05$). May and St. Cyr (2021) also compared the effectiveness between interventions based on the PEAK curriculum and standard special education practices. Their results showed that, after one semester, those who received interventions based on the PEAK curriculum made more gains during the PEAK-PA ($p = 0.04$).

These studies also suggest that instructions based on PEAK can produce changes in participants' global level of functioning, as measured by their performance during intelligence tests, while traditional interventions focusing on contingency learning and programing for generalization fail to produce such results. In the study by May and St. Cyr (2021), participants receiving PEAK interventions showed greater improvements in their raw score on the vocal ($p = 0.02$) and the information ($p = 0.04$) sub-scale of the *Wechsler Intelligence Scale for Children – Fifth Edition* (WISC-V), as well as their full-scale IQ ($p = 0.04$). The results of Dixon, Paliliunas, et al. (2019) further highlight the importance of incorporating instructions that promote relational responding. In their study, 17 children with autism were randomly placed in the traditional ABA group (T-ABA) or the comprehension ABA group (C-ABA). Additionally, Dixon, Paliliunas, et al. included 11 children with autism to serve as a convenient waitlist control. Participants in the T-ABA group received interventions focusing on

Table 18.1 Comparison between PEAK Pre-assessment and the PCA

DT	G		E	Tr			Te	
FLS 12*	LLS 3	CPM 1	REF 1	COR 1	OPP 1*	HIR 1*	COR 10	HIR 2
FLS 13*	LLS 5	CPM 2	REF 2	COR 2	OPP 2*	HIR 2*	COR 13	HIR 3*
FLS 14	LLS 6	CPM 4*	REF 3	COR 3	OPP 3*	HIR 3*	COR 15	HIR 4*
FLS 15	LLS 8	CPM 8*	REF 4	COR 4	OPP 4	HIR 4*	COR 16	HIR 5*
FLS 16	LLS 11*	CPM 11*	REF 5	COR 5	OPP 5	HIR 5*	COM 1	HIR 6*
PLS 1	LLS 12	CPM 12	REF 6	COR 6	OPP 6	HIR 6*	COM 2	HIR 7
VCS 10	LLS 14	CPM 13*	SYM 1	COR 7	OPP 7	HIR 7*	COM 7	HIR 8*
VMS 3	CMS 2	CPM 14*	SYM 2	COR 8	OPP 8	HIR 8*	COM 9	HIR 9*
VMS 11*	CMS 3*	CPM 15	SYM 3	COR 9	OPP 9	HIR 9*	COM 11	HIR 10*
VMS 12	CMS 6*	CPM 16	SYM 4	COR 10	OPP 10	HIR 10*	COM 12	HIR 11*
VMS 14	CMS 7	RPR 1	SYM 5	COR 11	OPP 11*	HIR 11*	COM 14*	HIR 12*
VMS 16*	CMS 8	RPR 2	SYM 6	COR 12	OPP 12*	HIR 12*	COM 15*	HIR 13*
	CMS 9	RPR 3	TRS 1	COR 13	OPP 13*	HIR 13*	COM 16	HIR 14
	CMS 10	RPR 5*	TRS 2	COR 14	OPP 14*	HIR 14*	OPP 1*	HIR 15*
	CMS 11	RPR 7	TRS 3	COR 15	OPP 15*	HIR 15*	OPP 4*	HIR 16*
	CMS 12*	RPR 9	TRS 4	COR 16	OPP 16	HIR 16*	OPP 5	DTC 1*
	CMS 14*	RPR 10*	TRS 5	COM 1	DIS 1	DTC 1*	OPP 10	DTC 2*
	CMS 16	RPR 12*	TRS 6	COM 2*	DIS 2	DTC 2*	OPP 12*	DTC 3
		RPR 13	EQU 1	COM 3*	DIS 3	DTC 3*	OPP 15	DTC 4
			EQU 2	COM 4*	DIS 4	DTC 4*	OPP 16	DTC 5*
			EQU 3	COM 5*	DIS 5*	DTC 5*	DIS 1*	DTC 6*
			EQU 4	COM 6*	DIS 6*	DTC 6*	DIS 2*	DTC 7*
			EQU 5	COM 7	DIS 7*	DTC 7*	DIS 6*	DTC 8*
			EQU 6	COM 8	DIS 8*	DTC 8*	DIS 7*	DTC 9*
				COM 9	DIS 9*	DTC 9*	DIS 8*	DTC 10*
				COM 10	DIS 10	DTC 10*	DIS 10*	DTC 11*
				COM 11*	DIS 11	DTC 11*	DIS 14	DTC 12*
				COM 12*	DIS 12	DTC 12*	DIS 15	DTC 13*
				COM 13*	DIS 13*	DTC 15		DTC 14*
				COM 14	DIS 14*			DTC 15*
				COM 15*	DIS 15*			DTC 16*
				COM 16*	DIS 16			

Note*:* Replaced items are noted with *All other items are revised (increase the number of distractions in comparison stimuli, change the phrasing or include additional instructions in S^D to improve clarify, and correcting grammatical errors)

contingency learning and generalization, while those in the C-ABA group received interventions focusing on developing their skills in relational responding. The results showed that, although participants in both groups mastered similar number of programs during the 12-week period ($p = 0.45$), participants were able to make more gains during the intelligence test ($p = 0.001$) by including components of relational training found in the PEAK curriculum (i.e., PEAK-E and PEAK-T), compared with those who only received contingency-based instructions from the PEAK curriculum (i.e., PEAK-DT and PEAK-G).

Together, these studies represent some of the recent attempts of using group-based randomized controlled trials in evaluating the overall effectiveness of an ABA-based curriculum, which is somewhat scarce within the field of behavior analysis. These results show that interventions based on the PEAK curriculum can not only successfully teach specific skills but also produce large-scale changes in areas that are not directly targeted, such as performance in intelligence tests, which is commonly used in both educational and clinical settings for predicting long-term outcomes and as a

Table 18.2 Clinical outcomes of the PEAK curriculum among children and adolescents

Authors	Title	Participants/design	Results
McKeel, Dixon et al. (2015)	Evaluating the efficacy of the PEAK relational training system using a randomized controlled trial of children with autism	27 children with pervasive developmental disorders (aged 5–10, 25 males and 2 females) Randomized controlled trial design, 13 in control group (treatment as usual per participants' IEP), 14 in treatment group (instructions based on PEAK-DT)	Participants in the treatment group made statistically more significant gains in language skills than those in the control group as measured by the PEAK-DT assessment
Dixon, Belisle, Stanley et al. (2018)	Student outcomes after 1 year of frontline staff implementation of the PEAK curriculum	34 children with autism (aged 5–15, 30 males and 4 females) Quasi group design, 19 in PEAK group (instructions based on PEAK-DT), 15 in control group (treatment as usual per participants' IEP)	Participants in the PEAK group made statistically more gains during the PEAK-DT assessment
Dixon, Paliliunas et al. (2019)	Randomized controlled trial evaluation of ABA content on IQ gains in children with autism	28 children with autism and language delay (aged 3–13, 24 males and 4 females) Randomized controlled trial design, 8 in comprehensive ABA (C-ABA; interventions based on all 4 PEAK modules), 9 in traditional ABA (T-ABA; interventions based on PEAK-DT and PRAK-G), 11 in waitlist control	No statistically significant differences between the number of programs mastered between those in C-ABA and T-ABA Participants in the C-ABA group made statistically more significant gains in their performance during intelligence tests than those in the T-ABA group and the waitlist control
May and St. Cyr (2021)	The impact of the PEAK curriculum on standardized measures of intelligence: A systems level randomized control trial	52 participants with autism (aged 5–20, 38 males and 14 females) Randomized controlled trial design, 26 in PEAK group (interventions based on all 4 PEAK modules), 26 in control group (treatment as usual per participants' IEP)	Compared with the control group, PEAK group produced statistically more significant improvements in participants' performance in PEAK-PA Participants in the PEAK group made more gains on the vocal and information sub-scales of the WISC-V test Only participants in the PEAK group showed statistically significant improvements in their IQ after removing those demonstrating a floor effect

proxy for overall problem-solving skills and executive functioning. Rooted in the relational frame theory, the structure of the PEAK curriculum focuses on promoting the development of relational framing, or AARR, as a high-order operant via targeting specific behavior skills that are of social significance to the learner. The reason why interventions based on the PEAK curriculum were more effective in producing these changes exceeds the scope of this chapter, but interested readers are suggested to explore the relational frame theory and its implication on human language and intelligence (e.g., Cassidy et al., 2010), as well as procedures such as multiple exemplar training (Hayes et al., 2001).

Table 18.3 Psychometric properties of PEAK-based assessments

Authors	Title	Sample size	Results
Dixon, Whiting et al., (2014)	Assessing the relationship between intelligence and the PEAK relational training system	50 participants receiving special education services (aged 5–22, 46 males and 4 females)	Statistically significant correlation between participants' IQ score and PEAK-DT score
Dixon, Belisle et al.,(2014)	Normative sample of the PEAK relational training system: Direct training module and subsequent comparisons to individuals with autism	206 neurotypical participants (aged 1–21, 93 males and 113 females) 70 participants with autism (aged 5–22, 58 males and 12 females)	Established the normative data of the PEAK-DT assessment Positive correlations between age and PEAK-DT score among nonclinical sample Participants with autism obtained a statistically lower score than their neurotypical peers
Dixon, Carman et al. (2014)	PEAK relational training system for children with autism and developmental disabilities: Correlations with *Peabody picture vocabulary test* and assessment reliability	13 children with developmental disability (aged 3–8, 10 males and 3 females)	Positive correlation between PEAK-DT assessment score and *Peabody picture vocabulary test* and the Illinois early learning standards test
Rowsey, et al., (2015)	Principal component analysis of the PEAK relational training system	98 participants with developmental or intellectual disability (aged 5–22, 81 males and 17 females)	Established a four-factor model for the PEAK-DT assessment Excellent internal consistency within each factor and among all items in the PEAK-DT assessment High interrater reliability
Dixon et al. (2015)	Toward a behavior analysis of complex language for children with autism: Evaluating the relationship between PEAK and the VB-MAPP	40 participants with autism (aged 5–21, 35 males and 5 females)	A strong correlation between PEAK total scores (DT and G) and the VB-MAPP and that a logarithmic regression model provided a good fit for the data Celling for VB-MAPP was observed with a PEAK total score of 138
McKeel, Rowsey, Dixon et al. (2015)	Correlation between PEAK relational training system and one-word picture vocabulary tests	27 participants with developmental disability (aged 5–22, 23 males and 4 females)	A strong correlation between the PEAK-DT assessment and the *receptive one-word picture vocabulary test – Fourth edition* (ROWPVT-4) and the *expressive one-word picture vocabulary test – Fourth edition* (EOWPVT-4)
Dixon, Stanley, et al., (2016)	The test-retest and interrater reliability of the promoting the emergence of advanced knowledge-direct training assessment for use with individuals with autism and related disabilities	39 participants with developmental disabilities (aged 6–22, 32 males and 7 females)	High test-retest reliability for both the PEAK-DT raw score and the equivalent developmental age (age-referenced score) High interrater reliability for PEAK-DT assessment
Malkin et al. (2017)	Evaluating the relationships between the PEAK relational training system-direct training module, assessment of basic language and Learning skills – Revised, and the Vineland adaptive behavior scales II	21 children with autism (aged 4–8, 18 males and 3 females)	A significant correlation between scores on the PEAK-DT assessment and ABLLS-R, PEAK-DT assessment, and VABS-II, as well as the ABLLS-R and VABS-II

Dixon, Rowsey et al. (2017)	Normative sample of the PEAK relational training system: Generalization module with comparison to individuals with autism	183 neurotypical participants (aged 1–21, 98 males and 85 females) 84 participants with autism (aged 5–21, 75 males and 9 females)	Established the normative data for the PEAK-G assessment Positive correlations between age and PEAK-G score among nonclinical sample Participants with autism obtained a statistically lower score than their neurotypical peers
Belisle et al. (2017)	The relationship between derived mutually entailed relations and the function of challenging behavior in children with autism: Comparing the PEAK-E-PA and the QABF	47 participants with developmental disability (aged 5–19, 41 males and 6 females)	Participants with the ability to engage in DRR, as measured by PEAK-E-PA, obtained a significantly lower score on QABF. QABF was significantly less likely to identify a single behavior function for this group The ability to engage in DRR did not predict specific challenging behavior topography
Dixon, Belisle, and Stanley (2018)	Derived relational responding and intelligence: Assessing the relationship between the PEAK-E pre-assessment and IQ with individuals with autism and related disabilities	64 children with developmental or intellectual disability (aged 4–16, 54 males and 10 females)	Significant positive correlation between PEAK-E pre-assessment scores with raw IQ and full-scale IQ Significant positive correlation between all subtests of the PEAK-E pre-assessment and raw-IQ scores
Belisle et al.,(2018)	The mediating effects of derived relational responding on the relationship between verbal operant development and IQ	64 children with disability (59 with autism, aged 5–16, 55 males and 9 females)	Significant positive correlations among PEAK-DT assessment, PEAK-E pre-assessment, and WISC-IV PEAK-E pre-assessment score has stronger predictive power on IQ than PEAK-DT assessment
Ackley et al. (2019)	A review of language development protocols for individuals with autism	N/A, literature review	Among the 18 protocols reviewed, PEAK is one of the few protocols that had data supporting its psychometric properties and effectiveness
May and Flake (2019)	PEAK pre-assessments: Preliminary evidence establishing internal consistency and construct validity	18 participants (16 with autism and 2 with AHDH, aged 3–18, 12 males and 6 females)	Statistically significant correlations between PEAK-PAs with measures of intelligence and adaptive behavior No significant correlations were found between PEAK-PA and age, autism diagnostic instruments, and aggressive scales
Moore et al. (2019)	An initial evaluation of an assessment method for the PEAK relational system direct training module	16 children with autism (aged 2–8, 12 males and 4 females)	For PEAK-DT module, indirect assessment showed moderate correlation with the pre-assessment result PEAK-DT pre-assessment offers the strongest predictor in terms of participants' PEAK-DT assessment scores

Barron et al., (2020)	Evaluation of the PEAK-DT and PEAK-G pre-assessments: Comparing directly implemented and indirect assessments of verbal abilities	31 children (26 with autism, aged 3–13, 26 males and 5 females)	Parental reports of PEAK-DT and PEAK-G are both significantly correlated with PEAK-DT and PEAK-G pre-assessment score Indirect assessment by parents can more reliably report deficits in advanced skills than more basic skills
Moore et al. (2020)	Examining the convergent validity between the PEAK relational training System's semi-standardized and standardized skill assessments	22 children (18 with autism, aged 3–13, 12 males and 10 females)	Strong correlation between PCA and PEAK-PA on all levels The PCA might assess a wider range of skills compared with the PEAK-PA
Belisle, Dixon et al. (2021)	The convergent validity of the PEAK-E-PA and two common assessments of language development: The ABLLS-R and the TOLD 1: 4	23 participants with autism (aged 3–22, 24 males and 9 females)	Significant correlation between PEAK-E-PA and ABLLS-R and TOLD 1:4

18.1.2 Psychometric Properties of PEAK-Based Assessments

To date, 18 studies (see Table 18.3) have examined the psychometric properties of various PEAK-based assessments, including the PEAK Directing Training Module Assessment (PEAK-DT assessment), the PEAK Generalization Module Assessment (PEAK-G assessment), PEAK Pre-assessments (PEAK-PAs) that accompany each PEAK modules, and the PCA. As reported by Ackley et al. (2019), very few instruments developed by the field of behavior analysis have data supporting their utility as a clinical assessment tool, which, to some extent, limits their external validity. The different PEAK-based assessment tools are some of the most heavily researched instruments within the field of behavior analysis. Studies have reported favorable outcomes in areas such as the convergent validity (Dixon et al., 2015; Dixon, Whiting, et al., 2014), factorial structure (Rowsey et al., 2015; Rowsey et al., 2017), internal consistency (Rowsey et al., 2015), and test-retest and interrater reliability (Dixon, Stanley, et al., 2016).

As a series of semi-standardized, or in the PCA's case a standardized assessment, multiple studies have reported robust psychometric properties. Dixon, Stanley, et al. (2016) evaluated the test-retest reliability and the interrater reliability of the PEAK-DT assessment and reported high test-retest reliability for both the PEAK-DT raw score ($p < 0.001$) and the equivalent developmental age (age-referenced score; $p < 0.001$). May and Flake (2019) also reported excellent internal consistency between all subtests of the PEAK-PA. In two separate studies by Rowsey et al. (2015) and Rowsey et al. (2017), researchers conducted two principle component analyses for the PEAK-DT and PEAK-G assessment and established two four-factor models. The normative samples of the Direct Training and the Generalization modules were also reported by Dixon, Belisle, et al. (2014) and Dixon, Rowsey et al. (2017), which provide additional references for clinicians when deciding intervention goals. At the same time, these assessments have shown excellent convergent validity with established measures of adaptive behavior (e.g., the *Vineland Adaptive Behavior Scale II*; Malkin et al., 2017), language assessments based on Skinner's account (e.g., VB-MAPP; Dixon et al., 2015), and common standardized language assessments in clinical and educational settings (e.g., the P*eabody Picture Vocabulary Test*; Dixon, Carman, et al., 2014). Moreover, studies have found the obtained results from PEAK-based assessments to be significantly correlated with measures of IQ, which provide additional evidence that supports RFT's account of human language and intelligence (Belisle et al., 2018; Dixon, Belisle, & Stanley, 2018; Dixon, Whiting, et al., 2014).

Besides the many evidence supporting these assessments as valid clinical tools, multiple studies have compared the validity of assessment results obtained from different assessment formats, such as the indirect assessment completed by caregivers (Barron et al., 2020) and comparison between PEAK-PA and indirect assessments (Moore et al., 2019). The overall positive outcomes indicate that clinicians can choose the assessment modality that best fits their unique clinical settings and still expecting reliable outcome. Recently, the PCA was introduced as the newest addition to PEAK-based assessments. As a standardized assessment, the PCA offers many unique benefits over existing indirect assessments and semi-standardized PEAK-PAs, as it ensures consistent administration across settings and providers, eliminates the ambiguity in terms of queries, provides uniformed manipulatives, specifies the termination criterion, and allows comparison across age group. Moore et al. (2020) compared the results obtained from the PCA and the PEAK-PA and found that they were highly correlated. Their analysis also showed that 67% of the items on the PCA involved some levels of revision compared with corresponding items on the PEAK-PA. Among the test items that were replaced, around half of the items yielded the same score, while 33% of the items received a higher score on the PEAK-PA. Together these results showed a high degree of agreement between the PEAK-PA and the PCA, indicating that existing findings on PEAK-PAs were likely to be able to be generalized into the PCA. At the same time, the PCA seems to be able to assess a boarder range of skills that are not captured by the PEAK-PA. Practitioners should take these findings into consideration when choosing the optimal assessment modality.

18.1.3 Skill Specific Gains Produced by PEAK-based Instructions

Twenty-six different studies (see Table 18.4) have examined the effectiveness of PEAK-based interventions in producing skill-specific gains among children, teenagers, and adults with intellectual and developmental disabilities. These interventions targeted a variety of skills in different contexts, such as basic and complex language skills (Daar et al., 2015; McKeel, Rowsey, Belisle, et al., 2015), social skills in group settings (Dixon, Blevins, et al., 2019), academic skills (Dixon, Belisle, et al., 2016; Dixon, Stanley, et al., 2017; Stanley et al., 2018), leisure skills (Dixon, Speelman, et al., 2016), creativity (Dixon, Belisle, Rowsey et al., 2017), perspective-taking skills (Belisle, Dixon, et al., 2016), and advanced skills that require inductive and deductive reasoning (Belisle et al., 2019). Together, these studies supplement the result of group-based studies investigating the effectiveness of PEAK as a curriculum and show that the instructional design found within PEAK can reliably produce significant behavior change in multiple domains.

Many of the studies also highlight the importance of incorporating relational training procedures in skill development. For example, Belisle, Paliliunas et al. (2021) taught four children with a diagnosis of autism how to correctly engage in a selection-based response when presented with a 2 x 2 matrix. In the top two cells of the matrix, the researcher presented one colored picture in each cell. The two cells were either filled with the same color, the opposing color (i.e., black and white), or different colors (i.e., black and blue). In the lower two cells, the researcher would place one picture in one cell and ask the participant to select the correct picture that should go into the other cell. For example, if the two cells in the top row were filled by the same color, and the researcher placed a picture of a boy in the second row, the participant should select another picture of a boy, since the relation indicated by the first row is "same." However, if the two cells in the top row were filled by the opposing color, the correct response would be selecting a picture of a

Table 18.4 Skill-specific gains produced by PEAK-based instructions

Authors	Title	Participants/design	Results
Daar et al. (2015)	Derived emergence of WH question-answers in children with autism	3 children with autism (aged 10–11, 1 male and 2 females) Multiple baseline across participants	Instructions based on PEAK-E 12R successfully taught intraverbal skills of answering wh-questions among all three participants For two of the three participants, mastery of these relations was functionally related to the emergence of accurate responding to untrained intraverbal wh-questions
McKeel, Rowsey, Belisle, et al. (2015)	Teaching complex verbal operants with the PEAK relational training system	3 children with autism (aged 9–11, 2 males and 1 female) Multiple probe across skills and participants	PEAK-DT-based curriculum was effective in training complex verbal operants (autoclitics, metonymical tact) among all participants
Dixon, Belisle, et al. (2016)	Derived equivalence relations of geometry skills in students with autism: An application of the PEAK-E curriculum	2 males with autism (aged 13 and 15) Concurrent multiple probe across participants	Instructions based on PEAK-E 5E successfully taught geometry skills between both participants Derivation of untrailed relations occurred after mastery of one trained relation
Belisle, Dixon, et al. (2016)	Teaching foundational perspective-taking skills to children with autism using the PEAK-T curriculum: Single-reversal "I–you" deictic frames	3 males with autism (aged 12–18) Multiple baseline across participants with embedded multiple probes	Instructions based on PEAK-T 11 J successfully promoted basic perspective taking skills among all participants All three participants demonstrated transfer of stimulus functions to untrailed stimuli Two participants showed transfer of stimulus functions to untrained single-reversal "you" relationships
Dixon, Speelman, et al. (2016)	Derived rule-following and transformations of stimulus function in a children's game: An application of PEAK-E with children with developmental disabilities	3 male children with developmental disability (aged 7–9) Multiple baseline across participants	Instructions based on PEAK-E 12 M successfully promoted the derivation among unfamiliar synonymous anatomical terms during the game twister
Dixon, Belisle, Stanley, Speelman, et al. (2017)	Establishing derived categorical responding in children with disabilities using the PEAK-E curriculum	3 male children with intellectual or developmental disability (aged 8–9) Multiple probe across participants	Instructions based on PEAK-E 14B successfully promoted the emergence of categorical responding Two of the three participants demonstrated the emergence of additional intraverbal responding without prior training
McKeel and Matas (2017)	Utilizing PEAK relational training system to teach visual, gustatory, and auditory relations to adults with developmental disabilities	3 male participants with autism (aged 23, 24, and 69) Multiple probe across participants	Instructions based on PEAK-E 10 K successfully promoted the emergence of derived relational responding across visual, gustatory, and auditory stimuli among all participants

Dixon, Belisle, Rowsey et al. (2017)	Evaluating emergent naming relations through representational drawing in individuals with developmental disabilities using the PEAK-E curriculum	3 male children with developmental disability (aged 7–10) Multiple baseline with embedded multiple probe across participants	Instructions based on PEAK-E 8F successfully promoted the derivation of reflexive responding of representational drawing following the training of tacting unfamiliar animal blends
Dixon, Belisle, Stanley et al. (2017)	Establishing derived coordinated symmetrical and transitive gustatory-visual-auditory relations in children with autism and related intellectual disabilities using the PEAK-E curriculum	3 male children (aged 10–11, 2 with autism, 1 with cognitive delay) Multiple baseline across stimulus class with embedded multiple probe	Instructions based on PEAK-E 10 K promoted the derivation of reflexive and transitive stimulus-stimulus relationships across different modalities
Dixon, Peach, et al. (2017)	Teaching complex verbal operants to children with autism and establishing generalization using the PEAK curriculum	3 children with autism (aged 4–5, 2 males and 1 female) Concurrent multiple baseline across behavior replicated across 3 participants	Instructions based on PEAK-G curriculum successfully taught and established generalization of distorted tacts, autoclitic tacts, and creative path finding among all three participants
Dixon, Stanley, et al. (2017)	Establishing derived equivalence relations of basic geography skills in children with autism	2 children with autism (one 12-year-old male and one 9-year-old female) Multiple probe across participants	Instructions based on PEAK-E 7E promoted the derivation of untrained geography skills on both participants Generalization between paper-map and computer-map was observed
Mullen et al. (2017)	Establishing auditory-tactile-visual equivalence classes in children with autism and developmental delays	2 male children with autism (aged 4 and 5) Nonconcurrent multiple baseline across participants	Instructions based on PEAK-E 9C and 9 K promoted the cross-modal derivation of untrailed stimulus-stimulus relationships
Stanley et al. (2018)	Equivalence-based instruction of academic skills: Application to adolescents with autism	3 male participants with autism (aged 13–18) Nonconcurrent multiple baseline across participants with embedded probe	Three different PEAK-E programs were successful in promoting academic skills among three teenagers with autism in a school setting
Dunkel-Jackson and Dixon (2018)	Promoting generalized advanced language skills of children in intensive behavioral intervention with promoting the emergence of advanced knowledge generalization (PEAK-G) module	4 male children with autism (aged 6–7) Concurrent multiple baseline across behavior replicated among all participants	Instructions based on multiple PEAK-G programs successfully increased advanced language skills that were directly taught among all participants Different degrees of generalization were observed among three of the four participants
Schmick et al. (2018)	Teaching children with autism to identify private events of others in context	3 male participants with disabilities (aged 13–17) Concurrent multiple baseline across participants	Instructions based on PEAK-T 11H successfully taught two participants to recognize other's emotions under different context The remaining participant reached the mastery criteria after a multiple exemplar training procedure

Dixon, Wiggins, et al. (2018)	The effectiveness of the PEAK relational training System and corresponding changes on the VB-MAPP for young adults with autism	3 male participants with autism (aged 19–21) Multiple baseline across participants with embedded assessment probe	PEAK-DT-based training was effective on improving and maintaining an improved VB-MAPP score
Dixon, McCord, et al. (2018)	A demonstration of higher-order response class development in children	1 neurotypical female (8 years old) and 1 male with autism (13 years old) Concurrent multiple baseline across contexts	Instructions based on PEAK-G 10 M successfully established a higher-order operant of descrambling the work when presented in isolation or when presented within a sentence
Belisle et al. (2019)	Abstraction of tactile properties by individuals with autism and down syndrome using a picture-based communication system	2 male participants with autism (aged 14 and 16) Multiple baseline across response	Instructions based on PEAK-G 6F successfully established stimulus control of abstract tactile properties Participants also demonstrated generalization using novel untrained stimuli
Barron et al. (2019)	Teaching “then-later” and “here-there” relations to children with autism: An evaluation of single reversals and transformation of stimulus function	2 6-year-old children with autism Multiple baseline across behavior	Instructions based on PEAK-T 9P and 10A successfully establish the here-there and then-later deictic relations Participants demonstrated mutually entailed single-reversal responding using novel stimuli
Dixon, Blevins, et al. (2019)	Teaching children with autism extended verbal utterances under audience control in the context of show-and-tell	3 10-year-old boys with autism Multiple baseline across participants	Instructions based on PEAK-DT 14Q successfully brought extended verbal utterances under appropriate stimulus control within the context of show-and-tell
O’Connor et al. (2020)	Establishing multiple control responding of children with autism to people and emotions in context by utilizing derived stimulus relations	3 participants with autism (aged 12–17, 2 males and 1 female) Multiple baseline across participants with embedded multiple probe	The configuration of PEAK-E was able to identify and establish derived relational responding among two participants in their ability to identify someone’s emotion under a context using a multiple exemplar training procedure The multiple exemplar training procedure was able to facilitate the emergence of untrained relations in the third participant
Belisle, Huggins, et al. (2020)	Generalized reflexive responding and cross-modal tactile transfer of stimulus function in children with autism	Study 1: 2 children with autism (aged 4, 1 male, 1 female), multiple baseline across participants Study 2: 2 boys with autism (aged 6 and 7), multiple baseline across participants with embedded probes	Match-to-sample was able to establish identity reflexive responding as a generalize operant Among the two participants with moderate ASD intensity, such operant was able to be generalized across modal (tactile)

Belisle, Dixon, et al. (2020)	Teaching children with autism to tact the private events of others	3 boys with autism (aged 5–10) Multiple baseline across participants	Instructions based on PEAK-DT 14R using a most-to-least prompting procedure produced the correct independent responding among three ASD children to tact private events of other when shown a picture
Belisle, Stanley, et al. (2020)	Establishing arbitrary comparative relations and referential transformations of stimulus function in individuals with autism	Study 1and 2: 2 male participants with autism (aged 14 and 19), multiple baseline across behavior with embedded multiple probe	Instructions based on PEAK-T 12C promoted the emerged combinatorial relation between stimuli and the transformation of stimulus function to novel stimuli on both participants
Dixon et al. (2021)	Evidence from children with autism that derived relational responding is a generalized operant	Study 1: 11 children with autism (aged 4–15, 8 males, 3 females), mixed design Study 2: 3 boys with autism (aged 10–11), multiple baseline across participants with embedded multiple probe	Instructions based one PEAK-E promoted the development of DRR as a generalized operant Acquisition rate of PEAK-DT and PEAK-G programs is different from that of PEAK-E programs
Belisle, Paliliunas, et al. (2021)	Emergent entailed analogical reasoning of “same,” “different,” and “opposite” in children with disabilities	4 boys (aged 5–7, 3 with autism) Multiple baseline across participants with embedded multiple probe	Instructions based on PEAK-T 7 L successfully promoted the emergence of analogical reasoning, while contingency-based training failed to produce changes in untrained analogical reasoning tasks

girl, since the relation indicated by the first row was “opposite.” If the two cells in the top row were filled by different colors, the correct response would be selecting a picture of a computer, since the relation indicated by the first row was “different.” After completing this phase of teaching, two of the four participants went through additional relational trainings targeting derived relational responding along the frame of distinction and opposition. Their results showed that contingency-based instruction successfully improved all four participants’ response score. However, when the researcher replaced the picture used in the matrix task, only those who received relational training procedures maintained their performance. This is only one of the many examples that highlight the importance of incorporating relational training procedures in skill acquisition, as it moves beyond learning via direct contingency and memorization, but rather promoting the development of a high-order operant that allows relational and behavior flexibility.

Among the 26 studies identified above, some of them also demonstrated the effectiveness of remediation strategies provided within the PEAK curriculum, such as multiple exemplar trainings (Schmick et al., 2018) and different prompting strategies (Belisle, Dixon, et al., 2020). For example, in the study by Schmick et al. (2018), the researcher used a multiple baseline across participants design to investigate the effectiveness of instructions based on PEAK-T: 11H in teaching children with autism how to identify emotions of others. After relational training, two of the three participants successfully reached the mastery criteria for the directly trained relations, demonstrating derivation of untrained stimulus-stimulus relationships, as well as transformation of stimulus-stimulus relationships toward novel

Table 18.5 Referencing PEAK in other areas

Authors	Title	Context/findings
Barnes-Holmes et al. (2016)	Relational frame theory: Implications for education and developmental disabilities	Referenced the PEAK relational training system as one of the commercially available products to promote relational learning
Belisle, Rowsey, et al. (2016)	The use of in situ behavioral skills training to improve staff implementation of the PEAK relational training system	Behavioral skills training improved staff implementation of PEAK and resulted in a corresponding improvement in selected language skills across two of the three learners with autism
Hahs and Jarynowski (2019)	Targeting staff treatment integrity of the PEAK relational training system using behavioral skills training	A 2-hour behavioral skill training session on PEAK successfully improved staff's treatment fidelity and improved the clinical outcome of six staff-client pairs
Belisle, Paliliunas, et al. (2020)	Derived relational responding and transformations of function in children: A review of applied behavior-analytic journals	A comprehensive review of existed evidence from behavior analytic journals demonstrating the phenomenon of derived relational responding and transformation of stimulus functions which referenced multiple studies utilizing PEAK-based procedures
Dixon and Stanley (2020)	PEAK relational training system	A book chapter within the *encyclopedia of autism Spectrum disorders*, which provides an overview of the PEAK relational training system
Padilla (2020)	Global assessment use and practices in applied behavior analysis: Surveying the field	A survey on the use of different assessment instruments used in applied behavior analytic settings, where 14% of the respondents indicated the use of PEAK-based assessments in clinical practices
Belisle, Clark, et al. (2021)	Synthesizing the multiple-probe experimental design with the PEAK relational training System in applied settings	A technical guide on embedding a multiple-probe design within the programing of PEAK

stimulus class. However, one participant failed to show such derivation. The researcher then implemented a multiple exemplar training procedure, which successfully prompted the emergence of untrained stimulus-stimulus relations.

18.1.4 Referencing PEAK in Other Areas

Six articles and one book chapter have been published since 2014 that referenced the PEAK Relational Training System to various degrees (see Table 18.5). Overall, these articles focus on the conceptualization behind PEAK (Barnes-Holmes et al., 2016; Dixon & Stanley, 2020), staff training procedures of implementing the PEAK curriculum (Belisle, Rowsey, et al., 2016; Hahs & Jarynowski, 2019), the use of PEAK-based assessments (Padilla, 2020), and conducting applied research during the implementation of PEAK (Belisle, Clark, et al., 2021; Belisle, Paliliunas, et al., 2020). These articles extend beyond applied research on PEAK's clinical out-

Table 18.6 Reviews and critiques of the PEAK Relational Training System

Authors	Title	Context/findings
Reed and Luiselli (2016)	Promoting the emergence of advanced knowledge: A review of peak relational training system: Direct training module by Mark R. Dixon	A book review of the PEAK-DT module and emerging evidence on its clinical outcome, supporting its underlying principles of behavior science, acknowledging its effort of translating relational training methodologies into applied practices, and recognizing the potential impact of PEAK in advancing existing clinical approaches to verbal behavior
Dixon, Belisle, et al. (2017)	An internal and critical review of the PEAK relational training system for children with autism and related intellectual disabilities: 2014–2017	A comprehensive literature review of available evidence published on peer-reviewed journals about PEAK between 2014 and 2017
Witts (2018)	An external review of the conclusions regarding the peak direct training module	A critique on the Reed and Luiselli (2016) article and on existing research on the PEAK-DT, listing conceptual and methodological issues with existing evidence on PEAK-DT, calling for a more rigorous examining of previous research findings
Belisle and Dixon (2020)	Rational skepticism: A scientific review of Witts' (2018) criticisms of the PEAK relational training system	A response to Witts's (2018) critique that examined the 30 major criticisms in the original article, which concluded that the majority of the criticisms were not valid and that many of Witts's suggestions would potentially hinder the field from moving toward large-scale research
Beaujean and Farmer (2020)	Conceptual and methodological concerns: A commentary on "randomized controlled trial evaluation of ABA content on IQ gains in children with autism"	A critique of the Dixon, Paliliunas, et al. (2019) research on the impact of relational training on IQ gains, listing seven major methodological concerns that undermined the reported effect in the original paper
Yi et al. (2021)	$P < 0.05$ is in the eye of the beholder: A response to Beaujean and Farmer (2020)	A response to Beaujean and Farmer (2020) that examined the seven concerns voiced by the author, which concluded that the outcome reported by the authors served a cautionary tale of categorical interpretation of p-values, restrictive pre-analytic assumptions, and invalid arguments favoring certain statistical methods

come and provide an overview of many conceptualizations behind PEAK and its implementation from an organizational behavior management perspective. Overall, studies have shown that clinicians can significantly improve treatment fidelity following behavioral skill training procedures (Belisle, Rowsey, & Dixon, 2016; Hahs & Jarynowski, 2019). At the same time, the PEAK curriculum could potentially provide a context for applied researchers to explore many empirical questions regarding clinical applications of the relational frame theory among individuals with intellectual and developmental disability. As shown by Belisle, Clark, et al. (2021), the configuration of PEAK's training and testing paradigm across trial blocks allows the researcher to embed a multiple probe design into daily clinical practices. Given the overall scarcity of empirical evidence demonstrating complex transform of nonequivalent stimulus-stimulus relations, it is of both scientific and applied value for practitioners to utilize this opportunity to further advance the science of human behavior.

18.1.5 Reviews and Critiques of the PEAK Relational Training System

Since the publication of the first module of PEAK in 2014, the content of PEAK has sparked many healthy discourses within the scientific community. Six reviews, critiques, and responses have been published, synthesizing existing evidence on research related to the PEAK Relational Training System (see Table 18.6). Although PEAK has acquired many supporters and positive reviews (e.g., Reed & Luiselli, 2016), a few have taken the position that the data on PEAK are not sufficient (e.g., Witts, 2018). When placing a careful eye on the debates around specific findings, it is clear that the majority of comments extend beyond the curriculum itself, to the broader scientific enterprise of ABA. With PEAK being by far the most empirically documented ABA curriculum, skeptics of relational framing, ABA interventions, and alternatives to Skinnerian approaches to autism treatment have sometimes taken a critical eye. However, such questioners have failed to produce any significant data which supports their own position on ABA content efficacy.

In conclusion, the PEAK Relational Training System has made an impact on behavioral assessment and treatment for persons with autism and related disorders. PEAKs adoption of post-Skinnerian philosophy and techniques has resulted in a fair amount of research and implications for best practices in intervention. Existing research to date has overwhelmingly supported its effectiveness and user-friendliness as a comprehensive treatment model derived from evidence-based scientific discoveries. As one of the curricula and assessments with the largest body of research and its utilization of methodologies beyond traditional approaches in the field of ABA, PEAK has the potential to impact services beyond traditional ABA interventions and promote dialog outside this field. Furthermore, PEAK's embracing of randomized trials, convergent validity with other nonbehavioral measures, and normative referencing positions itself within broad arenas of autism research that have often excluded more traditional behavior analytic contributions. The content of PEAK, the inclusion of a wide range of ages and ability levels, and a set of easy-to-follow directions have combined to move this program to the forefront of attention in ABA language interventions. Continued curriculum research such as dosages, outcome impact across disability level, global functioning changes, and parent implementation adherence all are in need of empirical-based answers. Larger randomized trials, neurological markers of treatment success, and large group treatments will answer even more questions about the potential robustness of PEAK on improving the deficits and enhancing the strengths of a person with disabilities.

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19 The Picture Exchange Communication System

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19.1 The Picture Exchange Communication System

The Picture Exchange Communication System (PECS; Bondy & Frost, 2001) was derived from Skinner's (1957) analysis of verbal behavior and developed to teach learners with autism spectrum disorder (ASD), a form of functional communication (Bondy & Frost, 1994). Since its development in the early 1990s, outcomes of PECS implementation have been evaluated in numerous research studies that demonstrate its effectiveness in teaching communication skills to children with ASD, along with other ancillary benefits. To date, over 200 peer-reviewed articles have been published on PECS (Pyramid Education Consultants, n.d.), and several well-recognized organizations have deemed PECS an evidence-based practice including the National Professional Development Center (NPDC) on ASD (Sam et al., 2020) and the National Clearinghouse on Autism Evidence and Practice (NCAEP; Steinbrenner et al., 2020).

The NPDC and NCAEP specify criteria for an intervention to be deemed evidence based. This includes meeting one of three minimum standards: (1) two high-quality experimental or quasi-experimental group designs conducted by two (or more) different researchers; (2) five single-subject design studies conducted by three (or more) different researchers with at least twenty participants across studies; (3) one high-quality randomized or quasi-experimental group design study *and* three high-quality single-subject design studies conducted by three (or more) different researchers or research groups (Sam et al., 2020; Steinbrenner et al., 2020). PECS is classified as a *focused intervention* and a *manualized intervention*. Focused interventions are defined as individual instructional practices that are used to teach specific skills or concepts to children with ASD (Odom et al., 2010). Communication goals have been successfully addressed using PECS including increased initiations from the learner (e.g., Carr & Felce, 2007), increased requests (e.g., Ali et al., 2011; Angermeier et al., 2008; Dogoe et al., 2010), increased speech and spontaneous vocalizations (e.g., Charlop-Christy et al., 2002; Greenberg et al., 2013; Jurgens et al., 2009), and increased social interactions with peers (e.g., Paden et al., 2012). PECS has been demonstrated to be an effective intervention for preschoolers (3–5 years) to middle school learners (12–14 years) with ASD.

PECS comprises six phases that are designed to be taught in sequence (Frost & Bondy, 2002). Briefly, the goal in Phase 1 is to teach the initial steps of communication by teaching a learner to

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independently pick up and deliver a single picture or icon to a communicative partner (e.g., teacher, parent, or another caregiver). The developers of PECS recommend that two adults be available for this initial training phase (Frost & Bondy, 2002). One adult serves as the communicative partner (i.e., the person who receives the picture/icon and gives access to the indicated item), and the second adult serves as a prompter to assist the learner in picking up and exchanging the picture. In Phase 2, the learner demonstrates this same communicative behavior (exchange of single-picture card) but learns to travel to the communication book and then to a communicative partner across various settings. Phase 2 is named "distance and persistence" because the learner gains important skills in using the communication binder as their voice. In Phase 3, the learner begins to discriminate between pictures/icons via a four-step error correction procedure and correspondence checks. During Phase 3A, the learner discriminates between a preferred and a non-preferred item, while in Phase 3B the learner discriminates between two preferred items. In Phase 4, the learner constructs simple sentences using an "I want" sentence strip. In Phase 5, the learner responds to the question "What do you want?" Finally, in Phase 6 the learner begins to expand their communication by commenting with various expressions (e.g., "I see," "I hear," and "I feel") and use of attributes (e.g., adjectives, verbs, and prepositions; Frost & Bondy, 2002).

PECS has benefitted from a robust line of research showing its efficacy in teaching functional communication skills (Ganz et al., 2012). The remainder of this chapter will provide an overview of key research areas that have been evaluated over the years including direct learner outcomes (e.g., acquisition of the various phases of PECS, development of speech, reduction of unwanted behavior), interactions with peers as communicative partners, training caregivers to implement PECS with high levels of treatment integrity, and adaptations for bilingual learners and learners with multiple disabilities. The chapter will conclude with an overview of recommendations for clinical and future research.

19.1.1 Learner Outcomes

The primary benefit for learners who successfully use PECS is the development of core communication skills (e.g., joint attention, initiation, requesting; Charlop-Christy et al., 2002). Additional collateral benefits have been reported, namely, in the form of the development of speech and reduction of unwanted behaviors (e.g., tantrums, aggressive, self-harming behavior; Bondy, 2001; Ganz et al., 2012). Learners who begin using PECS before 6 years of age and continue using this communication system for at least 1 year are more likely to develop speech as their sole communicative modality following mastery of 80–120 icons (Bondy, 2001). Other learners may need a much larger icon representation before vocalizations begin to emerge, if they emerge at all.

In an early demonstration of the PECS for three boys (ages 3–12) with ASD, Charlop-Christy et al. (2002) demonstrated systematic implementation of all six phases of PECS. Results of this study showed participants acquired a range of functional communicative skills following proficiency in PECS including spontaneous speech during Phase 4, imitation in play and academic settings, social-communicative behaviors (i.e., joint attention), and reduction of unwanted behaviors.

Other researchers have reported similar outcomes in speech development following proficiency in Phase 4 of PECS (Bondy & Frost, 1994; Ganz & Simpson, 2004; Tincani et al., 2006; Whitby et al., 2019). For example, Tincani et al. (2006) examined the effects of PECS on requesting behaviors and speech development in two school-aged children with ASD. The researchers varied the training by delivering verbal feedback when the child emitted a vocalization in one condition and no verbal feedback for vocalizations emitted by the child in a second condition. The verbal feedback condition resulted in differentiated outcomes for speech production (following proficiency in Phase 4). These results suggest that the outcome was a function of explicit prompting and reinforcement provided by the researchers, indicating this is a necessary component of PECS implementation.

A larger outcome study by Carr and Felce (2007) evaluated the impact on learner outcomes for 41 children with ASD (ages 3–7 years) who received 15 hours of PECS instruction (Phases 1–3) compared to a group of children who did not receive instruction. Results showed an increase in persistence, spontaneity, and generality of communicative initiations for children who received the PECS training. The generalizability of PECS outcomes (e.g., across objects, activities, environmental settings, and people) was a particularly noteworthy outcome of this study. An essential component of a functional communication system is its generality to situations that differ from the original training context. The goal of PECS is to create a functional communication system that learners can effectively use in a variety of contexts and with a variety of communicative partners, including peers in natural settings.

Generality of PECS A smaller number of studies have evaluated the generality of PECS outside of the training context (e.g., in other settings and maintained use following initial training). Carré et al. (2009) taught 5- and 6-year-old children with ASD to use PECS (Phases 1–3) in their classroom and then evaluated the use of PECS in each child's home. The training was modified to program for generalization. Specifically, teachers and paraprofessionals were briefed at regular intervals throughout the study to promote high levels of treatment integrity among communicative partners. Despite these efforts, child participants showed minimal communicative acts using PECS at home even though they were consistent in their use of PECS in the classroom. These results indicate the need for intervention that incorporates features of a new communicative environment (e.g., typical communication partners and contexts) to systematically program for generalization.

Other studies have reported successful generalization outcomes in various forms including learners using PECS to communicate access to items that were not directly trained (Marckel et al., 2006), using PECS in novel settings (Greenberg et al., 2012), and with novel communication partners (Tincani et al., 2006). For example, Greenberg et al. (2012) evaluated the effectiveness of a train and probe generalization assessment technique following each of the first four phases of PECS. Generality of PECS use was measured across various settings (i.e., a center playroom area, a convenience store found in the nearby community, and the living room and other central in-home areas for each participant). The train and probe procedure was deemed effective for three of four participants. Some procedural details of the probes may have contributed to these positive outcomes. First, access to the highly preferred items was limited to the duration of the study. Second, the preferred items were visible to the participants on a timed-interval schedule to evoke a response. Future research should evaluate how these contextual variables may contribute to positive generalization outcomes. Although limiting access to highly preferred items to increase motivation for learner use of PECS is recommended, it is not clear how often this practice is implemented.

Peers as communicative partners An important learner outcome that has received more attention in recent years is how PECS can be used to promote *peer* interaction. This is an essential skill for learners with ASD who may often experience difficulties in communication with peers. Teaching functional communication skills with peers may lead to more complex social interactions and eventually the development of friendships. To maximize opportunities and generality of training outcomes, peers can be involved in PECS training. For example, Kodak et al. (2012) paired peers with access to learner-preferred items to increase the reinforcing value of peer interactions. Peers were directly instructed to deliver preferred items to target participants contingent on a picture exchange (following the Phase 1 protocol). This training established peer interactions as conditioned reinforcers.

In a similar study, Paden et al. (2012) increased peer-directed requests for preferred items using PECS by teaching two boys with ASD to exchange picture icons with one another following direct training with an adult as the communicative partner. Following proficiency in picture exchange with adults, these communicative acts were placed on extinction, while picture exchange to peers was directly prompted and reinforced. This training resulted in an increase in peer-directed requests and brief social interactions in the form of playing with the same toy. The results of this study were replicated by Doherty et al. (2018) who used a systematic fading procedure to increase rates of independent requests to peers using PECS. Participants were six boys with ASD (ages 3–5). Results of this study showed some participants initiated communication with a peer and responded appropriately to communication bids by a trained peer. Importantly, the results generalized and maintained for up to 1 month following the end of formal training sessions.

Thiemann-Bourque et al. (2016) also recruited peers as communicative partners in a formal peer-mediated intervention that incorporated PECS. Participants in this study were nonverbal or minimally verbal preschool children with ASD and typically developing peers (ages 3–5 years). Participants with ASD had experience using PECS in Phases 3–5 at the start of the study. Typically developing peers were trained to emit responsive social skills such as turning toward a peer who initiates communication, showing preferred items to entice communication, and giving access to preferred items contingent on a picture exchange. Each trained peer was paired with one child with ASD during 10- to 15-min activities 1–2 times per day for 2 days per week. During all sessions the PECS binder was placed between the child with ASD and the typically developing peer. If no interaction occurred following 30 seconds, the child with ASD was prompted to initiate a picture exchange with their peer. Results of this study showed an increase in communicative behaviors including gaining attention, commenting, requesting, and sharing toys. In addition, engagement in dyadic play increased, which was defined as staying within 2 feet of one another and participating in the same activity for at least 45 consecutive seconds.

Beside direct learner outcomes, numerous studies have evaluated training systems to teach implementation of PECS with high levels of treatment integrity. Given the established relationship between treatment integrity and learner outcomes in behavior analytic interventions more generally (Brand et al., 2019), this area of research is critical for the continued effective use of PECS. The next section of the chapter will provide a summary of studies that have evaluated systems to train parents, staff, and other caregivers how to implement PECS with a variety of learners.

19.1.2 Teaching Implementation of PECS

Although initial training in PECS via workshops is widely available (Pyramid Educational Consultants, n.d.) and is recommended as a first step for parents and professionals who will implement PECS with children under their care, didactic training alone is insufficient to promote long-term and consistent use of behavioral interventions (Parsons et al., 2012), and this includes implementation of PECS in various settings (Ganz et al., 2013). A study conducted by Jurgens et al. (2012) exemplified the need to explicitly train correct implementation of PECS to teachers and other caregivers. Jurgens et al. recruited families who were using PECS and asked them to upload a series of videos on YouTube showing their implementation at home with their child with ASD. Results of treatment integrity scores showed high levels of errors in implementation. Specifically, 61% of all observed exchanges included one or more errors such as the use of a vocal or gestural prompt by the communicative partner (no prompts should be delivered by this individual during training), lack of timely reinforcement (reinforcement should be immediately following a picture exchange), and/or incorrect implementation of the recommended four-step error correction procedure during Phase 3. Fortunately, several studies have evaluated systematic training approaches to teach implementation of PECS to education professionals (Ganz et al., 2013; Hill et al., 2014; McCoy & McNaughton, 2018), student trainees (Martocchio & Rosales, 2016, 2017; Rosales et al., 2009), and parents of children with ASD (Alsayedhassan et al., 2020; Park et al., 2011).

Teacher and university student training Teachers and other school paraprofessionals interact with children with ASD on a regular basis. Similarly, university students in undergraduate and graduate training programs work in various training settings to gain experience working with this population. Training accurate implementation of PECS with these groups is essential but may be challenging to implement in a systematic fashion due to the time constraints school and other professionals experience daily.

Rosales et al. (2009) used behavioral skills training (BST) consisting of written and verbal instructions, modeling, rehearsal, and feedback to teach implementation of PECS Phases 1–3 to university students. The training was conducted with a confederate learner followed by generalization probes with an adult with developmental disabilities. Results of this study showed the BST package led to high levels of accurate implementation across all participants and the skills acquired during training generalized to a new setting. The results of this study were also replicated by Homlitas et al. (2014) with three teachers who worked directly with young children with ASD.

In a similar study with pre-service teachers, Hill et al. (2014) taught PECS data collection and implementation for Phases 1–4 in the context of an extended school year setting. Training consisted of modeling the procedures to be used during six 3-hr sessions with opportunities to practice and receive feedback from the researchers. Two teachers were paired to work with one child participant (one teacher served as the communicative partner and the second as the physical prompter during Phase 1). Teachers showed successful implementation of PECS and communicated student progress to parents using graphs at the conclusion of the summer program. Student participants also showed generalized use of PECS. These results show promise for training programs that incorporate aspects of BST for teacher training.

In a related study, Ganz et al. (2013) evaluated the effects of self-monitoring and instructional coaching on the frequency of PECS opportunities provided by three practitioners who worked with children with ASD (ages 3–4 years). Training was focused on Phase 3 and included a review of the steps for this phase, review of the treatment integrity checklist created for the purpose of the study, practice implementing Phase 3 with the researcher until a criterion was met with the researcher acting as the child confederate, defining "PECS opportunities" for the participant, and demonstrating how to collect data on these opportunities throughout the day. Participants set a goal for the number of opportunities they would provide to target students each day. They were then taught to graph and review data on the number of opportunities provided each week. Results of this study showed an increase in the number of opportunities provided to child participants, and child participants showed a corresponding increase in the use of PECS. However, the results did not generalize in a novel context due to the lack of opportunities provided by the school professionals and/or access to the communication book.

Parent training Teaching parents to use PECS with their children is vital to the maintenance of this functional communication system. Some studies have recruited parent participants to demonstrate the effects of various training approaches. For example, Park et al. (2011) evaluated the effects of teaching mothers to implement Phases 1–3B on the number of independent picture exchanges for their children with ASD (2–3 years old). The training consisted of a 40- to 60-min session that included written instructions, video modeling, rehearsal, and feedback. Once parents met the established criteria for PECS implementation (90% accuracy across three consecutive trials), they were asked to implement

PECS with their child. Results showed that the child participants increased their use of independent picture exchanges, generalized this skill with a different communicative partner, and the skills were maintained at 1-month follow-up. Importantly, mother participants reported high levels of satisfaction with the training, but the primary dependent measure for this study was the child's use of PECS.

In a more recent study, Alsayedhassan et al. (2020) demonstrated the effects of a systematically implemented BST package on PECS implementation by parents with their children (3 and 8 years old). The training package consisted of written and verbal instructions, modeling, role play, and feedback. Parents received formal training in a university setting with a graduate student playing the role of a child. Following this initial training, parents implemented PECS with their own child in the same setting. Researchers used a bug-in-ear device to provide immediate feedback to parents during PECS implementation with their children. Results showed quick acquisition of PECS implementation by parents (Phases 1–3) and increased use of PECS by child participants. These results generalized to effective use of PECS in the home setting and maintained 1 month following the end of training.

Although the use of BST to teach implementation of PECS is effective, the time commitment may not be feasible for practitioners and school professionals. To address this limitation, follow-up studies have evaluated the use of pyramidal training (Martocchio & Rosales, 2016), voice-over video modules (Martocchio & Rosales, 2017), and computer-based training (Rosales et al., 2018). The use of asynchronous training helps to address the challenge associated with methods that require the presence of an expert trainer and may help increase accessibility to systematic training on the implementation of PECS and other behavioral intervention procedures (Gerencser et al., 2020), but additional research is needed to evaluate the effectiveness of this approach to training.

19.1.3 Caregiver and Learner Preference

An important aspect of any behavioral intervention program is the consumers' perception of the intervention. Consumers' perception of services is correlated with recommendations for the use of behavioral analytic strategies and follow-through with implementation of such strategies. Social validity has been at the heart of behavior analytic interventions since its inception (Wolf, 1978), and this topic has continued to receive attention in the field over the years (Hanley, 2010). In the context of PECS implementation and training, some studies have systematically evaluated preference for PECS by both caregivers and learners (Lorah, 2016; van der Meer et al., 2012). Systematic evaluation of preference for communication modalities is an objective measurement of social validity (Hanley, 2010).

Collectively, studies that have systematically evaluated preference for a communication modality including PECS have result in idiosyncratic outcomes (e.g., Couper et al., 2014; Hill et al., 2014; LaRue et al., 2016). This indicates that a choice evaluation may be important to integrate into functional communication programs. There are advantages to starting with a traditional tangible icon-based system, namely, the systematic implementation that promotes development of critical communication skills (e.g., joint attention and initiation). Disadvantages of exclusively using a communication book is that learners may acquire hundreds of pictures/icons in their binder in a short period of time, and this makes storing the binder and traveling with the binder impractical. At this point in the training, the learner may benefit from a careful and gradual transition to an electronic device to avoid skill degradation or loss (Bondy, 2001).

Although some formal evaluations of preferred communication modalities show a preference for technology-enhanced communication systems (e.g., use of Proloqu2Go on an iPad or tablet), this may be due in part to a general preference for the device *itself* and not how it is used as a tool for functional communication. For example, the auditory stimulus generated by electronic devices may serve as a reinforcer for selecting an icon on a device by the learner. Teachers' preference for technology-based communication in lieu of traditional PECS systems is important given their position as the stakeholders of this technology. The nature of these devices with appealing voice-output features and applications that serve functions other than communication needs to be considered as potential confounds in studies that evaluate preference for one communication modality over another (Couper et al., 2014). On the other hand, there are advantages of adopting the use of electronic devices for functional communication. For example, there is a decrease in the social stigma attached to carrying a communication binder since much of the general population always carries at least one electronic device.

In general, PECS is considered an accessible option because of its portability and low cost. If low-tech intervention can be as effective as high-tech intervention during the first stages of communication development, more research is needed to evaluate whether a transition from low-tech to high-tech is effective, and if so, when it should be implemented. Bondy (2012) suggested this transition may be ideal during Phase 4 of PECS, since this is usually also when vocal verbal behavior is achieved. Alternatively, users may benefit from a combination of the two modes of communication.

19.1.4 Adaptations of PECS

One of the major advantages of PECS is that this is a low-tech form of functional communication is also generally low-cost. That is, caregivers and practitioners working with families need not purchase items from the official developers of PECS to create a communication binder so long as the implementation of PECS follows the protocol outlined by Frost and Bondy (2002). For example, a communication binder can be created using digital photos taken with a camera or phone, printed, and laminated, and a hook-and-loop tape can be purchased to add to a three-ring binder to create a basic communication binder. Another unique feature of PECS is its flexibility and adaptability for a variety of learners (Frost & Bondy, 2002). The developers of PECS outline many ways this communication system can be changed to meet the needs of learners with a variety of disabilities, but demonstrations of these adaptations have not been widely published. The next section of the chapter will outline various adaptations that have been reported for learners with multiple disabilities and learners from bilingual or multilingual backgrounds.

Adaptations for learners with multiple disabilities Adaptations to the PECS protocol have been demonstrated for learners who have hearing impairments (Malandraki & Okalidou, 2007) and visual impairments (Bracken & Rohrer, 2014; Ivy et al., 2014; Lund & Troha, 2008), and at least one study has demonstrated that a visually impaired therapist was successful with PECS implementation with a learner with ASD (Charlop et al., 2008). To accommodate the therapist's blindness, PECS cards were slightly modified by adding Braille labels to the cards and having another therapist accompany her when she interacted with the children.

Malandraki and Okalidou (2007) adapted PECS for a 10-year-old boy with ASD and bilateral sensorineural profound hearing loss (i.e., deafness). The participant was taught to use PECS up to Phase 4 in an intensive training program, followed by continued training for an additional 4-month period and a 6-month follow-up. Modifications accounted for the participant's hearing loss and potential writing abilities. For example, because he emitted spontaneous writing and fingerspelling during an informal assessment, PECS picture cards were replaced with written cards. The participant emitted spontaneous vocalizations during the generalization of Phases 4 and 5, and these behaviors maintained at follow-up in both written English and Greek sign language.

Lund and Troha (2008) used tactile symbols (i.e., three-dimensional objects) to teach Phases 1–3A of PECS to three blind adolescents with ASD (12–17 years old). Referents included computers, rain sticks, and crash pillows represented with a combination of craft supplies (e.g., plastic, fabric, and masking tape) and household items (e.g., grains of rice and marbles) and placed on 3 × 3 in. squares of cardboard. The items were attached to a 4 × 8 in. Plexiglas board to create a modified PECS communication board. One participant successfully completed all three phases of the modified PECS instructional program in under a month, while the other two showed notable improvement from baseline. All participants' rates of progress resembled those of sighted children using PECS. This demonstration shows that tactile symbols can be successfully incorporated into a PECS protocol for children with ASD who are also blind.

In a similar demonstration, Bracken and Rohrer (2014) assessed the effectiveness of an adapted form of PECS to increase independent requesting in deafblind adults with intellectual disabilities. PECS cards consisted of enlarged photographs and swelled images on raised line drawing paper. Participants learned to communicate with PECS up to Phase 3 with these modifications and their responding generalized to novel settings and with multiple communicative partners.

Adaptation for bilingual learners A recent area of increased interest in the field is how approaches used by behavior analysts can be adapted for learners from culturally and linguistically diverse backgrounds (Lim et al., 2018; Wang et al., 2019). These adaptations necessarily apply to the use of PECS. The flexibility of PECS allows for incorporation of multiple languages, and the communication system has been implemented across the globe since its development (Al-dawaideh & Al-Amayreh, 2013; Hu & Lee, 2019; Odluyurt et al., 2016; Sulzer-Azaroff et al., 2009). Surprisingly, there are no empirical studies on the adaptation of PECS for families from diverse cultures (Medina & Salamon, 2012). Although the assumption may be that implementation of PECS may be the same across languages and cultures, current research on this topic shows that this assumption is risky.

For example, despite the flexibility of picture communication systems, there are features that require special attention and consideration. Nakamura et al. (1998) discussed the difficulties of picture-based systems for Japanese speakers because these systems tend to be based on English sentence formation. Chompoobutr et al. (2013) also described the importance of evaluating the choice of graphic icon symbols as these may have different meanings depending on the learner's cultural background. These researchers emphasized the cultural factors that decide the efficacy of graphic symbols in picture communication systems. For instance, apples are not traditionally consumed in Thailand; therefore, using an image of an apple to stand for a food concept can create unnecessary confusion to the learner. Similarly, Dukhovny and Kelly (2015) outlined basic guidelines for effectively designing and implementing functional communication systems such as PECS to multilingual and multicultural users with limited functional speech (e.g., age-appropriate picture symbols, gender- and language-appropriate voice options, and multilinguistic keyboards).

19.2 Limitations and Future Directions

As noted throughout earlier sections of this chapter, there is ample empirical support showing the benefits of PECS for learners with ASD. The research to date has focused on the first three phases of PECS with few exceptions (e.g., Charlop-Christy et al., 2002). This paucity of research on implementation and outcomes for Phases 4–6 may be due in part to learners transitioning to electronic devices (e.g., tablets and iPads). Another factor that may contribute to this lack of research is that when vocalizations begin to emerge in learners following PECS implementation, there tends to be a shift of focus to shaping vocalizations (speech) and pause the use of PECS. This interruption is not recommended as it may lead to slowed progress in the development of increased length of utterances and complex verbal repertoires (Bondy, 2001, 2019).

Although collective results for direct learner outcomes are promising, more research is needed on the generalization and maintenance of these outcomes for participants who learn to communicate effectively with both peers and adults. Future research should incorporate more learner outcomes (e.g., measures of emerging vocalizations, spontaneous initiations, and reduction of unwanted behaviors). As noted in a section above, this line of research is important given the social validity and direct potential benefits of increased social interactions for both the learner and the peers learning to communicate with children with ASD. Future research on this topic should replicate and extend the procedures outlined in previous studies. For example, demonstrations for peer-directed mands that expand into later phases of PECS (e.g., beyond Phase 4) are needed, as well as evaluation of the components necessary to support these skills in the absence of adult mediation. Future studies should also evaluate other forms of requests with peers (e.g., if another child is playing with a preferred item, the child with ASD could be taught a socially acceptable response to request access to said item).

Additional research is also needed on optimal training strategies to implement PECS with learners from diverse backgrounds. Findings from the literature to date suggest that ethical practice demands practitioners be informed and capable of understanding, respecting, and collaborating with the wants and needs of their clients' families in developing more linguistically fluid and culturally relevant interventions. There is surprisingly limited research to date on this topic given the popularity of PECs worldwide.

Finally, in comparison to the evidence base of PECS with children with ASD, there is little research on adult learner outcomes. Hughes-Lika and Chiesa (2020) reviewed the literature of PECS implementation for adult learners and found only five empirical studies with a total of 18 participants (ages 19–52 years old). The review included only one participant with ASD (other participants had a wide range of disabilities including intellectual disability, Down syndrome, and deaf-blindness). Results of the review provide initial support for the use of PECS with adult learners, but additional research is needed with this population. Future research should not be restricted to ASD/ID in children and adolescents and instead evaluate the collateral effects and other unique aspects of PECS implementation in adults with various disabilities. It is important to note that this paucity of research for adult learners is not unique to PECS.

Although the use of speech-generating devices and other forms of technology may be preferred for this age group, there is limited research to show its efficacy, and the transition to exclusive use of an electronic device should be done in a systematic manner. Future studies may evaluate rates of acquisition when PECS is implemented using electronic devices compared to the traditional communication binder. Bondy (2001) cautions that the transition to an electronic device may result in the loss of current communication skills. To avoid this ethical dilemma, the first two phases of PECS that teach the learner to *initiate* communication should be followed regardless of communication modality (e.g., learner approaches a communicative partner, gets their attention, and then proceeds to use the device to make a request or statement).

19.3 Clinical Recommendations

Many variables must be considered in selecting a communication modality including the response effort required of the learner, learning histories correlated with presence of a specific communication modality, the likelihood that communicative acts will be reinforced in the learner's natural environment, and prerequisite skills and learner preference (Valentino et al., 2019). To date there is little experimental research to guide modality selection by practitioners. Although more research is needed in this area, there is a large body of evidence to support the widespread use of PECS for learners with ASD. The following are recommendations to prepare for and implement PECS in practice.

First, implementers of PECS should receive formal training from other professionals with expertise in this area. As mentioned above, workshops that provide novice PECS implementors with the necessary foundational training needed are widely available. If this training is completed, it should be followed up with additional booster sessions and frequent check-ins to increase the likelihood of adequate levels of treatment integrity.

Second, implementers of PECS should conduct a brief assessment to determine if PECS is the most appropriate communication modality for the learner. Valentino et al. (2019) evaluated the use of a brief prerequisite assessment to predict the effectiveness and rate of acquisition of requesting using three modalities (i.e., sign, picture exchange, and vocalizations) in 13 young children with ASD. A brief assessment such as that described by this group of researchers can save training time and result in optimal outcomes for the learner.

Third, implementers of PECS should identify preferred items that will be used during PECS training using a formal procedure. Preferred items that will function as reinforcers are an essential ingredient for effective PECS training. A stimulus preference assessment or reinforcer sampling can be used to help implementers identify reinforcers for individual learners. If a learner stops showing interest in an item that is used during training, new items should be evaluated for use.

Fourth, once PECS is selected as the modality for functional communication, implementers of PECS should identify two adults to participate in the initial phases of training. One adult is the prompter and the other is the "communicative partner." During Phase 1, these roles should be consistent, but once the learner demonstrates the selected mastery criterion, the roles can be reversed, and additional communicative partners (both adults and peers) should be recruited to assist with the training to program for generalization. Parents should also be integrated into the training as early as possible to promote further generalized use of PECS in various settings.

Fifth, implementers of PECS should prepare the communication book or binder. Only a few pictures or icons are needed during the first few phases of PECS and no specific pictures or symbols are required, although these are available for purchase on various websites (e.g., Mayer Johnson Co. Boardmaker®). Selection of the picture or symbols that require the least amount of response effort is recommended. As learners progress through the training phases, a designated communication book will be needed to store all commonly used pictures/icons. A communication book can be a small three-ring binder with hook-and-loop tape placed on the cover and inside of the book. Pictures/icons should be organized by theme to make the book user-friendly and to ease transition to an electronic device or system. Images should be saved in a digital folder for easy access (e.g., if icons need to be replaced or duplicated).

Sixth, during PECS implementation model vocalizations, implementers of PECS should differentially reinforce vocal approximations by the learner and create learning opportunities to increase the likelihood of initiations. Seventh, data should be collected on learner use and progress with changes made as needed. If the learner gets stuck in any phase, the implementer of PECS should reevaluate steps 1–3 to determine if refresher training may be needed or if the criterion to move to the next phase of training was met before advancing to the next phase or before switching to a different form of communication. Implemters should also evaluate learner preference, and use multiple modalities if the learner indicates preference for more than one form of communication.

Finally, implemeters of PECS should view the communication book/binder as the learners' voice. That is, the communication book should always be with the learner, and multiple opportunities should be created to practice using the communication system early in training. Consider adding a strap for easier transport during transition periods. Finally, if PECS is the preferred form of communication, implementers should consider a gradual transition to an electronic device to promote long-term use.

19.4 Conclusion

This chapter reviewed evidence for the Picture Exchange Communication System. This mode of functional communication boasts a large body of empirical support when implemented with learners with ASD. Although it is considered an evidence-based practice for children with ASD, the research to date is insufficient to make the same recommendation for adult learners with ASD. Best practice suggests that an initial assessment be conducted during the intake process to help identify the ideal mode of communication for all learners (Valentino et al., 2019). While there is a large body of support for PECS for learners with ASD, limitations of the existing research include a lack of systematic applications for all six phases of PECS, inadequate demonstrations of PECS with adult learners, limited evaluation of the protocol with bilingual learners with ASD, and systematic evaluation of approaches to use or transition to using an electronic device for communication. Despite these limitations, PECS should continue to be considered when learners with ASD do not have an established form of functional communication.

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20 Augmentative and Alternative Communication (AAC) Systems

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20.1 Augmentative and Alternative Communication (AAC) Systems

Autism spectrum disorder (ASD) is a complex, neurodevelopmental disorder characterized by specific behavioral deficits and excesses, including significant limitations in communication skills, as a whole, and vocal speech, in particular (Diagnostic and Statistical Manual of Mental Disorders, DSM-5; American Psychiatric Association, 2013). The rate of ASD diagnoses has increased over the past three decades, from approximately 1 in 2500 individuals in 1990 to, currently, 1 in 59 (United States) and 1 in 66 (Canada) (Center for Disease Control and Prevention, 2014). Research suggests that approximately 50% of all individuals diagnosed with ASD cannot engage in fluent spoken communication; 25–61% have limited functional communication skills (Aydin & Diken, 2020; Hart & Banda, 2010; Nam et al., 2018; National Research Council, 2001; Schlosser & Wendt, 2008). These profound difficulties in communicating contribute to the etiology of other corresponding characteristics of ASD, specifically increased rates and severities of inappropriate behaviors (e.g., aggression, self-injury, disruption, and destructive behaviors). These behaviors, while often highly socially unacceptable, *are* adaptive for these individuals in that they serve socially communicative purposes, such as obtaining specific wants and needs, in the absence of more socially acceptable communication skills (Nam et al., 2018). These severe communication challenges, paired with problematic behavior, often serve as significant barriers to successful participation and inclusion in a variety of naturalistic settings, including home, school, work, and other community-based environments (Beukelman & Mirenda, 2013; Holyfield et al., 2017).

Interventions targeting various symptoms associated with ASD, grounded in the principles of applied behavior analysis (ABA), have produced efficacious outcomes over nearly 50 years (Baer et al., 1968; Reichow, 2012; Virués-Ortega, 2010). These behavior-analytic interventions ubiquitously focus on incorporating empirically supported methods for improving a wide variety of skills, including functional communication skills (Carr & Durand, 1985; Durand, 1999). However, despite advances in comprehensive, early intensive behavioral interventions (EIBI), as many as 35% of children with ASD still enter school unable to speak in multiword utterances or communicate basic wants and needs via speech or other methods (Light et al., 2003; Sievers

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et al., 2018). Therefore, it is critical that researchers and practitioners refocus their efforts on targeted interventions and strategies to promote strong communication repertoires that maintain over time and generalize across environments, throughout the life span.

The use of AAC has become a therapeutic response to address the unique communicative goals of individuals with complex communication needs (CCNs), many of whom present with an ASD diagnosis (Light et al., 1998; Light & McNaughton, 2012). Seventy years of publications document and describe the use of AAC interventions with diverse populations of children and adults, across a variety of disciplines (e.g., speech and language therapy, special education, and ABA-based therapy). Specifically, AAC interventions have been applied with typically developing toddlers and children; neurodiverse children, adolescents, and adults, including those diagnosed with ASD, developmental disabilities (DDs), intellectual delays (IDs), and Down syndrome; individuals with physical disabilities, such as cerebral palsy (CP); individuals who have sustained traumatic brain injury (TBI); and geriatric populations, including those diagnosed with dementia and aphasia (Creer et al., 2016; Harris & Reichle, 2004; Light & Drager, 2011). For the purposes of the present chapter, discussion will focus primarily on the application of evidence-based AAC interventions with individuals with ASD.

20.2 Overview of AAC

20.2.1 What Is AAC?

As a field of clinical practice, AAC focuses on meeting the needs of those with significant communication disorders, characterized by impairments in speech-language production and/or comprehension (ASHA, 2005). AAC interventions incorporate the use of a wide variety of symbols (e.g., objects, images, and text) to represent language. Individuals may be taught to communicate using one or more techniques, including gestures and/or manual signs, pointing to or selecting items, or activating speech-generating technology.

For individuals with severe speech and/or physical impairments, AAC may serve as an *alternative* to vocal speech. For those with developmental disabilities, including ASD, AAC may serve as an *alternative* to vocal speech, or it may *augment* an individual's spoken communication skills. For some, AAC may be used temporarily, while speech develops, or long-term, if necessary. Some individuals may require AAC for all communication, while others may require AAC at specific times or under specific conditions (ASHA, 1989, 2005; Mirenda & Fossett, 2011). It is important to emphasize that the use of AAC interventions does not interfere with the development of spoken language skills (Millar et al., 2006; Schlosser & Wendt, 2008), and, as such, these interventions should not be withheld while targeting the development of speech. For individuals with ASD, specifically, rather than waiting for a young child with ASD to "fail" in developing functional communication skills via speech before considering and implementing AAC, early AAC intervention will help to (a) prevent the development of communication-based problem behavior, (b) facilitate the development of functional and social communication skills, and (c) support the development of conceptual and learning skills that will further enhance successful outcomes in a variety of environmental settings (Beukelman & Mirenda, 2013; Mirenda, 1997).

There are two primary elements that comprise any individual's AAC system: (a) the symbols that represent words or messages and (b) the techniques used to communicate words or messages (Mirenda, 2017). Various instructional strategies, many derived from ABA, are used to teach individuals to use these elements to engage in functional, independent communication (Mirenda, 2017). To better understand these two primary elements and, ultimately, make therapeutic decisions, it is necessary to explore a number of individual AAC components.

20.3 AAC Systems

AAC systems are comprised of multiple, integrated components, including (a) symbols, (b) strategies or techniques, and (c) aids or equipment.

20.3.1 Types of Symbols

Generally speaking, symbols are used to represent something else; in the context of AAC, they represent words and/or messages. Symbols are further classified as either *unaided* or *aided* (Mirenda, 2003; Mueller, 2014; Sennott & Mason, 2016). It is important to note that both unaided and aided symbols can be used to enhance communication *input* (i.e., understanding or "receptive" skills) and *output* (i.e., "expressive" skills). As well, an individual's AAC system may incorporate the use of one or more types of symbols. For example, individuals may use both unaided (e.g., gestures and/or manual signs) and aided (e.g., tangible, graphic, and/or text-based) symbols as part of their overall AAC system. The following section will provide a description of each category of symbols in general, as well as specific informAtion regarding commonly used symbol sets.

20.3.1.1 Unaided Symbols

Unaided symbols do not require any external or ancillary materials or equipment; they are produced by the individual's body (Aydin & Diken, 2020; Mirenda, 2003; Mirenda & Fossett, 2011; Sennott & Mason, 2016). Forms of unaided symbols include (a) vocalizations, (b) gestures, body language, and facial expression, (c) manual signs, and (d) eye gaze. A key advantage to unaided symbols, in general, relates to this lack of external equipment. As unaided symbols utilize a person's body, cost and portability are not issues. These symbols can be generated quickly and with relative ease across all environments and contexts.

Gestures, body language, and facial expressions Gestures (e.g., pointing and reaching), body language (e.g., crossing your arms and putting your hands on your hips), and facial expressions (e.g., smiling and grimacing) are culturally specific methods of communicating that occur naturally during communicative interactions of neurotypically developing individuals. Although nonvocal, these behaviors are not "nonverbal," as they involve sending a message between a speaker (i.e., the individual emitting the gesture) and a listener (i.e., the individual receiving and interpreting the gesture) (Skinner, 1957).

Advantages of gestures, body language, and facial expressions A primary advantage relates to the overall ease with which the community at large understands gestures, body language, and facial expression. Given that there are culture-specific (i.e., gestures and body language) and cross-cultural (i.e., facial expressions) aspects to this modality, individuals who use this form of communication are likely to be readily understood by others within their own community. Additionally, for individuals with significant and/or multiple impairments that interfere with the use of more formalized, symbolic communication (e.g., manual signs and picture-based systems), gestures and body language may be an appropriate alternative, provided they possess the necessary motor and imitative skills (Nam et al., 2018). Lastly, without the need for external equipment, communication exchanges can occur with relatively low effort (Mirenda & Fossett, 2011). This reduced response effort may be particularly advantageous for the initial stages of specific interventions, such as functional communication training (FCT) (Tiger et al., 2008).

Disadvantages of gestures, body language, and facial expressions This form of communication is significantly limited with regard to the number of messages and communicative functions one can convey. For those with profound physical and/or cognitive impairments, gestures may be idiosyncratic and less discernable to non-familiar communication partners. This may result in inconsistent reinforcement, which will affect ongoing acquisition, maintenance, and generalization of communication skills (Nam et al., 2018). Further, given that many individuals with ASD experience challenges with social skill-based repertoires (e.g., emotion recognition, identifying facial expressions, and understanding nonverbal nuances in communication) (Kanner, 1943), reliance on gestures and facial expressions for communication purposes may be less than ideal.

Manual signing Manual signing (MS) refers to the use of unique, individual signs borrowed from a formalized sign language (e.g., American Sign Language; ASL). As an AAC intervention, MS is typically used for keywords that follow the grammatical and syntactical rules of the spoken language (e.g., English), rather than the formalized sign language from which they are derived. Particularly for those with developmental disabilities, MS may be modified such that it is idiosyncratic to the individual (e.g., "home signs"). Generally, these modifications are based on the learner's fine motor and imitation repertoires.

To support language comprehension, indirect consumers (e.g., parents, teachers, and service providers) can use MS to augment their speech, thereby enhancing communication *input* and, effectively, modeling the use of MS. For example, a therapist may simultaneously sign the words "stand up," "outside," and "play," when saying to the learner, "It's time to <u>stand up</u>, so we can go <u>outside</u> and <u>play</u>!" Combining visual input (i.e., MS) with auditory input (i.e., speech) increases the saliency of critical components of the message. MS can also enhance language output. Some learners may combine MS with vocalizations and vocal speech, or they may use MS alone. MS has been used over several decades to support both receptive and expressive communication skills in children, youth, and adults with developmental disabilities, including ASD. Investigations of MS as a communication-based replacement behavior have focused primarily on teaching requests, or *mands*, for desired items, activities, or breaks (Ganz et al., 2012; Holyfield et al., 2017; Morin et al., 2018; van der Meer & Rispoli, 2010). While MS can be used for other communicative purposes, such as labeling (*tacting*) or engaging in socially interactive responses (*intraverbals*), these have not been researched as extensively.

Advantages of MS There are several advantages to support the use of MS as part of an AAC intervention. A primary advantage of MS relates to portability and cost. Because MS requires no additional materials or equipment, it can be incorporated into daily interactions and activities with relative ease (Mirenda, 2003; Mirenda & Fossett, 2011; Nam et al., 2018; Sundberg & Partington, 1998). Another advantage relates to speed and efficiency of communication. Messages via MS can be delivered more quickly and with greater fluency, compared to communication boards or devices, which typically require time to scan and discriminate between symbols. Therefore, MS can lead to faster access to reinforcers, which is a critical consideration when an AAC intervention is required to replace problematic behavior; such a replacement behavior must be more efficient and effective in producing the desired reinforcer, and, in most circumstances, MS fits the bill (Ganz et al., 2019; Nam et al., 2018; Sundberg & Partington, 1998). In addition, there is some research to suggest that MS, a topography-based system (i.e., the output of each unique MS symbol is different in *form*), has distinct advantages to selection-based systems (i.e., the output involves a single response, such as pointing). Specifically, topography-based systems are more similar to, and may better facilitate, the emergence of vocal speech, another topography-based communication modality. It is important to note, however, that data regarding this issue are limited.

Disadvantages of MS Despite apparent advantages of MS-based AAC interventions, they must be considered in relation to some very significant disadvantages. It is important to note that the use of MS as an AAC intervention is not equivalent to the use of ASL (or other formal signed languages); users do not belong to the signing deaf community. Related to this is the topographical nature of MS. Each signed word involves a different handshape, location, and movement, making the target response different across vocabulary and messages. Not only does this increase the complexity of responding for the learner, it requires specific expertise on the part of the practitioner. Practitioners must know how to produce individual signs accurately, yet most lack formal training in the use of MS and, instead, acquire signed vocabulary from print or online media (e.g., video). While the availability of online video models increases the likelihood that teachers produce individual signs correctly, there are issues regarding the selection of conceptually accurate signs. For example, whereas in English the spoken word, "break" can refer to multiple meanings, there are different ASL signs to reflect individual meanings (e.g., the sign for "break" a toy is different from the sign for take a "break"). Those without sufficient knowledge of and training in the use of signed languages often use signs that are conceptually inaccurate, further decreasing the degree to which learners will be understood by members of a signing community.

Given that there is little knowledge of MS among the hearing population, individuals using MS for AAC purposes will likely have a limited verbal community, comprised only of individuals who know them well. As the verbal community plays an important role in effectively and consistently reinforcing language and communication, this is a critical shortcoming (Ganz et al., 2019; Mirenda & Fossett, 2011; Nam et al., 2018; Sundberg & Partington, 1998). In addition, those who exhibit fine motor deficits or motor imitation challenges may have pronounced difficulty emitting signs accurately (Sundberg & Partington, 1998), which could result in the adoption of modified signs. Those using such idiosyncratic "home signs" are even less likely to have a robust verbal community. While the use of modified MS could be considered a short-term option (e.g., an appropriate functional communicative response (FCR) to temporarily replace severe problematic behavior as a functionally equivalent, socially appropriate behavior), it is highly unlikely that these signs would generalize across settings and novel individuals. In fact, research suggests that trained MS rarely generalizes to other environments, individuals, or contexts (Mirenda, 2003).

20.3.1.2 Aided Symbols

Aided symbols require the use of external items and commonly include (a) three-dimensional (3D) tactile or tangible symbols, (b) two-dimensional (2D) photographs and/or line-drawing symbols, and (c) text (including Braille). A general advantage across all types of aided symbols relates to the role these symbols can play in prompting communication behaviors. The physical presence of aided symbols may serve as a salient prompt or visual discriminative stimulus (SD) (Nam et al., 2018), thereby facilitating spontaneous or independent communication responses.

Tangible or tactile symbols This approach involves the use of real objects, miniature objects, and partial objects (Beukelman & Mirenda, 2013) to represent items, activities, and so on. These items may be unaltered, such as using a spoon to represent "mealtime" or altered, such as using a piece of metal chain to represent "swings." Further, tangible symbols may be created from parts of items within the environment. For example, a piece of rubber cut from an exercise ball may be used to communicate "OT" or "bounce on the ball." Tangible or tactile symbols can, and should, be individualized based on the learner's unique needs and environment. These symbols can be used to provide augmented input (i.e., showing/giving the object to the learner to give information) or for augmented output (i.e., the learner points to, picks up, and/or gives the object as a communicative act).

Advantages of tangible or tactile symbols The primary advantage of this approach is the high degree of accuracy and point-to-point correspondence with objects in the learner's environment. Further, and particularly for individuals with ASD who may present with comorbid visual impairments and/or profound intellectual impairments, the use of tangible or tactile symbols in combination with graphic stimuli (i.e., photographs and line drawings) may facilitate individuals in making connections between tangible items and two-dimensional (2D) representations, thereby promoting their ability to use 2D representations for communication purposes.

Disadvantages of tangible or tactile symbols The main drawback to this approach relates to portability. Tangible and/or tactile symbols, being 3D, require space. The more symbols an individual uses, the more space that is needed for storage and display. While it is possible to incorporate these symbols across environments such as home, school, and community, it certainly requires careful planning and the development of systems to transport and display symbols. It can also be difficult to identify or create tangible or tactile symbols, particularly for more abstract or large items, places, or activities. Further, if a tangible or tactile symbol is unavailable for a desired item or activity, the communication response cannot occur; this may result in frustration and confusion on behalf of the learner. Given the complexity of tangible or tactile symbols, consultation with experts in the field of deafblindness, who have a wealth of experience in designing such systems, is recommended.

Photographs and line-drawing symbols Two-dimensional stimuli in the form of pictures and line drawings are common within AAC interventions. Generic or individualized photographs and/or commercially produced graphic symbols (e.g., Picture Communication Symbols, PCS®) are used to represent various vocabulary items and messages, including people, places, activities, items, actions, and so on.

Advantages of photographs and line-drawing symbols There are a number of advantages that make these symbols attractive. First, stimuli are relatively easy to develop or create. The availability of digital cameras, including those on smartphones, allow practitioners to take high-quality photos of relevant items, places, activities, etc. There are also various applications that include libraries of over 50,000 graphic symbols (e.g., Boardmaker® and SymbolStix PRIME®). Produced correctly, with corresponding text-based labels, photographs and line-drawing symbols are relatively easy to understand by most communication partners, including non-familiar partners in community settings. This ease in comprehension is likely to produce more consistent responding and reinforcement by those working with and interacting with the learner, thereby facilitating the acquisition, maintenance, and generalization of communication across individuals and environments (Beukelman & Mirenda, 2013).

Disadvantages of photographs and line-drawing symbols Although it is relatively easy to develop AAC systems that incorporate the use of photographs or line-drawing symbols, a key disadvantage relates to cost, both monetary and with regard to time. Producing 2D representations will require one or more of the following: a digital camera, access to the Internet, and/or specialized software. Additional materials such as a printer and ink, laminator, and Velcro® are required to produce nonelectronic materials. Time is also required, not only to develop the initial set of materials but to maintain those materials in the long term. Ongoing maintenance typically requires replacing print-based materials that degrade over time or are lost, and updating vocabulary items as the learner acquires new terms.

Another disadvantage relates to the use of nonelectronic systems, whereby photographs or line-drawing symbols are organized on communication displays and/or in books. Space is required to provide a robust vocabulary; the larger the vocabulary, the more pages and/or space required. Particularly for young children, such systems can become heavy and cumbersome. Finally, while such symbols can serve as a cue to communicate, users may also make requests for items or activities that are not available at a given time. Declining such requests can lead to problematic behavior; thus, instruction and/or information regarding availability and nonavailability is essential. Further, while the presence of photographs and/or line-drawing symbols can serve as an SD for engaging in a communicative response, it may be difficult to determine whether that response is under the control of the motivating operation (MO) or simply a function of stimulus control (i.e., was the request made based on actual *desire* or simply because the symbol was visible?).

Text Text and alphabet-based systems focus on the use of written words to communicate. Individuals may produce text via writing/printing, typing on an electronic device, or pointing to/selecting printed words on a communication display or speech-generating devices (SGDs). Text may also be used to enhance receptive communication (e.g., written schedules and social narratives).

Advantages of text For those with the ability to read and write, the use of text for communication purposes results in ease of communication across most environments and communication partners, especially given the increased use of text-based communication in the nondisabled population (e.g., e-mail and text messaging; Ganz et al., 2014b). Certainly, those who are able to independently produce text have the potential to say *anything*, compared to those who are reliant on systems where facilitators select and provide vocabulary (Beukelman & Mirenda, 2013). For those who are unable to *produce* text (i.e., spell) yet have sufficient sight-word reading or decoding skills, multiple words can be placed on a single page or display; as such, the vocabulary presented can be more expansive than photographs or graphic symbols. Finally, the availability of word-predictive software across consumer devices (e.g., smartphones and tablets) can assist learners in producing text during communicative interactions.

Disadvantages of text The overarching disadvantage to text-based AAC systems is the reliance on literacy skills. At the very least, the user must be able to recognize a large number of printed words. As well, communication partners must be able to read and/or write. This requirement precludes the use of text-based systems with young children or those who have learning disabilities that impact decoding, comprehension, and/or spelling skills.

20.3.2 Strategies or Techniques

For the purposes of this chapter, the following discussion will focus on AAC systems that incorporate the use of aided symbols, with a particular focus on nonelectronic and electronic systems that incorporate pointing or exchanging as communicative behaviors. Therefore, we will review AAC systems that involve (a) exchange-based techniques, (b) point-based techniques, and (c) alphabetic techniques. Embedded within this discussion will be information on the use of nonelectronic vs. electronic aids, as appropriate.

20.3.2.1 Exchange-Based Techniques

Exchange-based communication systems, such as the Picture Exchange Communication System (PECS®) (Bondy & Frost, 1994), are among the most well-researched and widely implemented aided AAC systems. When using an exchange-based technique, the learner is taught to *give* one or more symbols to a communicative partner (Flores et al., 2012). Exchange-based systems can include the use of tangible and/or tactile symbols, photographs, line-drawing symbols, and/or word cards. While AAC systems incorporating exchange-based techniques have traditionally utilized nonelectronic materials (i.e., laminated symbols), it is possible to develop exchange-based techniques using handheld technology (Wendt et al., 2019). A comprehensive discussion of PECS® (Bondy & Frost, 1994) can be found in this textbook, in the corresponding chapter.

Advantages of exchange-based techniques A key advantage to exchange-based systems is the clarity and ease with which communication partners, including young peers, are able to comprehend the learner's messages (Mirenda & Fossett, 2011; Nam et al., 2018). As these systems tend to produce timely and consistent responses, there is a greater consistency of reinforcement in the natural setting, thereby facilitating maintenance and generalization of communication responses. Additionally, exchange-based systems can be designed to be relatively portable, with little expense (Mirenda & Fossett, 2011). Given that these systems are selection-based, the response required by the learner (i.e., selecting a symbol and giving it to a communication partner) is static across all messages; the reduced complexity and response effort may be particularly helpful for those with significant intellectual and developmental delays. Additionally, with the act of obtaining joint attention is embedded within the act of communicating (i.e., the symbol is placed directly in the hand of the communication partner), limited joint attention skills do not impede communication.

Disadvantages of exchange-based techniques One disadvantage of exchange-based systems is the reliance on external equipment; in order for communication to occur, the symbols, usually housed in a communication book, must be present and readily available at all times (Mirenda, 2003; Sundberg & Partington, 1998). In addition, learners must seek out such materials in order to communicate. While there are research-supported procedures targeting the search for and retrieval of materials (Sigafoos et al., 2004), this may present challenges for those with comorbid physical impairments who lack the ability to move freely about their environment. As well, at least in some cases, the response effort required for exchange-based communication may be incommensurate with the response effort for problematic behaviors. For example, to request a "break," a learner may need to locate and/or go to the communication book, flip through and visually scan several pages of symbols, locate and select the desired symbol, and travel to the communication partner, all before making the exchange. These steps can delay access to reinforcement and may result in the learner reverting to a more efficient, yet problematic, response (such as throwing work materials). Further, the selection of a picture from a display of options requires both simple and conditional discrimination skills (i.e., being able to select a given symbol in an array of other symbols), as well as some relative form of mand, echoic, tact, and listener behavior repertoires which serve as the building blocks of more complex verbal behaviors (e.g., bidirectional naming skills) (Miguel, 2016). For example, when asked, "What do you want?" and being prompted to say "break" following an indication of motivation for a "break," the learner would need to scan between symbols (while subvocally echoing, "break"), find the correct symbol (tact), select the correct symbol (listener behavior), and give the symbol to the communication partner (mand). While these complex verbal behaviors are not necessarily prerequisites to the successful use of exchange-based systems, the absence of these repertoires may result in challenges to acquisition and spontaneous independent usage, requiring systematic prompting and prompt-fading methods for teaching accordingly.

20.3.2.2 Point-Based Techniques

Point-based techniques can be applied to nonelectronic communication displays (e.g., communication boards and books), "light" tech SGDs (e.g., devices or apps with limited messages), or "high"-tech SGDs (e.g., dedicated SGDs, smartphones or tablets with AAC apps). All of these systems involve the learner pointing to a or touching specific areas of a non-technological display that is "read" by a communication partner or by touching specific symbols on a SGD.

Nonelectronic communication displays contain symbols (e.g., photographs and line-drawing symbols) to represent vocabulary and/or messages. They are typically individualized to the learner; vocabulary is selected and organized based on the learner's needs, as well as the contexts and settings in which the learner participates, etc. Displays may be created around specific topics (e.g., a communication board for individual activities), or communication books may contain vocabulary organized in other ways (e.g., by parts of speech).

"Light"-tech SGDs include single-message devices (e.g., *BIGMack*; AbleNet, Inc.), sequential message devices (e.g., *StepbyStep*; AbleNet, Inc.), or static-display SGDs (e.g., *GoTalk*; Attainment Co.). These devices all use digitized, or recorded, speech and can be "reprogrammed" easily by re-recording new messages. Single message devices allow the learner to convey one message only (e.g., "break, please"). Sequential message devices allow the user to convey a standard sequence of messages (e.g., calling out "go," "go," "go," "stop" during a game of "Go, Go, Stop!"). Static-display devices contain a limited number of messages, ranging from as few as 2 to just over 100 messages, depending on the device. With the advent of technologies such as smartphones and tablets, there are currently a multitude of apps that perform the same functions as single message, sequential message, and static-display SGDs.

"High"-tech SGDs employ touch screen and dynamic display technology, thereby allowing for a larger, albeit infinite, vocabulary. These devices utilize digitized (recorded) or synthetic (computerized) speech. Dynamic display SGDs present vocabulary and messages via, in essence, a menu-based system, similar to folders, subfolders, and files on personal computers. The "main page" may display a number of topic areas (e.g., "school," "chit chat," and "games"). When one topic is selected, the screen changes to show a secondary menu and/or vocabulary related to that topic. For example, if the user selects "school" from the main menu, the secondary page may present school-related menu items (e.g., "math," "reading," and "recess"). If the user then selects "recess," vocabulary and messages related to recess would appear on the screen. Such systems are significantly more complex and, therefore, more expensive. To address the complexity of multiple menus, there are some dynamic display SGDs whereby messages are accessed via combinations of symbols, rather than by categories. This can reduce the cognitive demand and time required to access individual messages. Whereas dedicated, dynamic display AAC devices can cost several thousand US dollars, the popularity and accessibility of smartphones and tablets have led to a plethora of dynamic display SGD apps, such as *Proloquo2Go*, *TouchChat*, and *Speak for Yourself*, that can be purchased for, at most, a few hundred US dollars.

Advantages of point-based techniques Overall, point-based techniques are fairly simple to use. Nonelectronic communication boards and books, and light-tech SGDs, are relatively inexpensive and portable. They are also fairly easy to develop and/or program. Dynamic display SGDs, in particular, present with several additional advantages. Given that the use of handheld technologies is well-established within society, the use of SGDs in general, and SGD apps on handheld devices, in particular, is ostensibly more normative and socially valid (Lorah et al., 2013). The vocal speech produced by SGDs is more easily understood by individuals who interact with the learner, and the communicative partner does not need to be directly attending to the individual in order to receive messages (Lorah et al., 2013). Furthermore, SGDs are more adaptable, flexible, and efficient than physical exchange (Aydin & Diken, 2020). SGDs are modified with greater ease and can include an unlimited number of words and messages; this is in contrast to nonelectronic and "light"-tech systems, which are limited with regard to physical space and capacity (Nam et al., 2018). Overall, the user-friendly nature of SGDs, along with the high degree of acceptability and social validity, may help promote maintenance and generalization of communication skills across a variety of environments, communication partners, and contexts (McNaughton & Light, 2013).

Disadvantages of point-based techniques Despite these advantages, there are important considerations with regard to point-based techniques. A key concern relates to issues obtaining and maintaining joint attention. Point-based, nonelectronic systems require joint visual attention; the learner must engage in a response to gain the communication partner's attention *prior* to producing the communication response. This can be particularly difficult for learners with ASD and was, in fact, a primary driver in the development of PECS® (Bondy & Frost, 1994). Even when using point-based electronic systems, the learner must ensure that a communication partner is nearby and able to hear the device, prior to activation.

Availability and portability are also important considerations. Whether nonelectronic or electronic, aided AAC systems need to be present across *all* environments in order for communication to occur. In the case of electronic SGDs, not only do they need to be physically present, they have to *work*; issues with battery depletion, internet connectivity, and app function can interfere with effective communication. Additionally, SGDs are generally more expensive and vulnerable to wear and tear than nonelectronic AAC systems (Mirenda & Fossett, 2011). There are also some settings or activities that could damage technology (e.g., swimming pool and skiing) or specific topographies of problematic behavior (e.g., self-injury and aggression) that may damage or destroy devices. Actions can be taken, however, to prevent and/or mitigate damage to SGDs, including the use of cases and/or screen covers to reduce overall wear and tear, the purchase of device protection plans that include device repair.

There is an additional drawback specific to handheld technologies, which embed access to leisure, entertainment, academic tools, calendars/visual schedules, and the Internet within a single device (Lorah et al., 2013). The presence of these additional device functions can interfere with the reliable use of the device for communication. As such, general clinical recommendations are that a *single device be used solely for AAC*. This ensures that the user always has access to communication, regardless of the activity, and addresses issues regarding preference for "leisure" apps (e.g., games) over communication. If the use of additional apps for reinforcement and leisure activities are desired, these should be provided on a secondary device.

Lastly, the sheer amount pages and symbols can be overwhelming, particularly when using dynamic display SGDs; the complexity of navigating through many pages and symbols is compounded when an individual does not demonstrate fluency with simple and/or conditional discrimination. To address this issue, some dedicated SGDs and SGD apps allow for the modification of display settings while the learner is acquiring specific vocabulary items, including "blackout" options to simplify the display and reduce the number of symbols available. Further, some apps (e.g., *Speak for Yourself*) are designed to require fewer "hits" to access target messages. Rather than navigating through complex menus and submenus to arrive at a message after several "hits," such apps require a maximum of two "hits" to access any message within the system.

20.4 AAC Assessment and System Selection

Selecting an appropriate AAC system for a given learner can be a daunting task. In order to effectively design individualized AAC systems, practitioners must be well-versed in AAC assessment approaches and possess sufficient knowledge and expertise regarding available AAC options and interventions in order to select the most appropriate AAC system for a given learner. As well, one must stay abreast of AAC-related technological advances, which occur rapidly. Practitioners need to assess (a) communication needs, (b) opportunity barriers (i.e., policies and/or practices that may interfere with AAC intervention; knowledge and/or skill deficits that may interfere with AAC intervention), (c) current capabilities, and (d) cognitive abilities, particularly in relation to symbolic understanding, and language and literacy skills (Beukelman & Mirenda, 2013). If there are comorbid diagnoses, such as hearing, vision, and/or motor impairments, assessment regarding these functional areas will also be necessary. Practitioners also need to consider many contextual variables that will also impact the degree to which a specific AAC system and/or intervention approach is successful. These can include cultural factors, environments in which the learner participates, parent comfort with technology, access to specific resources, and so on. Practitioners then need to integrate assessment information to inform the development of an appropriate, individualized AAC system. Considerations include, but are not limited to, (a) the most appropriate type(s) of symbol(s) for the learner/context, (b) the manner in which symbols are organized, (c) the type of message output, (d) the visual display features (e.g., color, spacing, and size of symbols), and (e) whether or not to include a keyboard (Abbot & McBride, 2014).

A number of formal and informal assessment methods have been used across several decades as part of the AAC assessment and system selection process; given that the use of AAC interventions for individuals with ASD is relatively new, much of the research and practice has historically focused on those with severe speech and physical impairments. Overall, there is limited research on clinical decision-making processes related to the selection and design of individualized AAC systems (Schlosser & Raghavendra, 2004); even highly skilled AAC practitioners find the decision-making process complicated (Boesch et al., 2016). In order to better understand the factors both relevant and irrelevant to AAC assessment and system identification, it is important to review the history of AAC assessment practices.

20.4.1 AAC Assessment Models

20.4.1.1 Candidacy Model

Prior to the 1970s, communication interventions commonly focused on the development of speech, rather than AAC. As such, only those persons able to produce, or imitate, vocalizations, who possessed sufficient cognitive capacity to understand and produce verbal language were selected for treatment (Kent et al., 1972; Hourcade et al., 2004). Throughout the 1970s and 1980s, AAC interventions emerged that were guided by decision-making models, including the candidacy model. The goal of the candidacy model was to (a) identify individuals likely to benefit from AAC and (b) determine when it would be most appropriate to provide AAC intervention. Because it was believed that AAC would interfere with the development of speech, practitioners were cautious regarding the selection of recipients for AAC services. Typically, individuals needed to demonstrate "failure" to develop vocal-verbal behavior following intensive speech therapy before they could be considered for AAC services. Candidates for AAC had to have relatively equivalent chronological and developmental/intellectual "ages" (i.e., measures of intelligence within the normal range of functioning); those with intellectual and/or developmental disabilities, including those with ASD, were typically excluded as candidates for AAC, based on the belief that they were "too disabled" to benefit from AAC (Hourcade et al., 2004). From both a behavior analytic and ethical perspective, candidacy criteria were highly subjective and prevented many from accessing communication interventions that could have been pivotal to the development of their functional communication skills (Mirenda, 2017).

20.4.1.2 Communication Needs Model

In the 1980s, the communication needs model (Beukelman & Mirenda, 1998) emerged, with a specific focus on addressing the gap between current abilities and presenting needs of the learner. Throughout the 1980s and 1990s, this model guided practitioners in identifying candidates for AAC, determining which AAC approach would best address the learner's unmet communication needs and planning for implementation in home, school, and/or community settings. While somewhat less restrictive, this approach to assessment continued to make predictions regarding AAC success based on cognitive ability; as such, service provision was limited to those with, at worst, mild cognitive impairments (Kangas & Lloyd, 1988).

20.4.1.3 Participation Model

The participation model (Beukelman & Mirenda, 2013), which surfaced in the 1990s, presumed that *all* individuals with disabilities, regardless of severity, could benefit from appropriate, individualized AAC intervention. The participation model stresses (a) learner strengths, (b) access to quality AAC interventions, and (c) sufficient opportunities to communicate during meaningful and motivating activities in the natural environment (Iacono et al., 2016; Mirenda & Iacono, 1990). As illustrated in Fig. 20.1, this model guides clinical decision-making by first considering discrepancies between the learner's communication and participation and that of their peers. Once discrepancies are identified, assessment focuses on *both* the learner and the context(s). As with prior models, numerous learner skills and challenges are identified, in order to determine which AAC methods will likely be effective.

Within this model, cognitive skills are assessed, but not for the purpose of "weeding out" those with more significant challenges; instead, such assessment assists the team in identifying the most appropriate form(s) of symbols, instructional strategies, and other related factors to ensure communication success. Interventions are determined based on an analysis of individual capabilities and constraints; necessary environmental adaptations are put in place to facilitate and encourage communication; and additional interventions are identified to increase natural abilities that may further facilitate the development of communication skills (e.g., ongoing

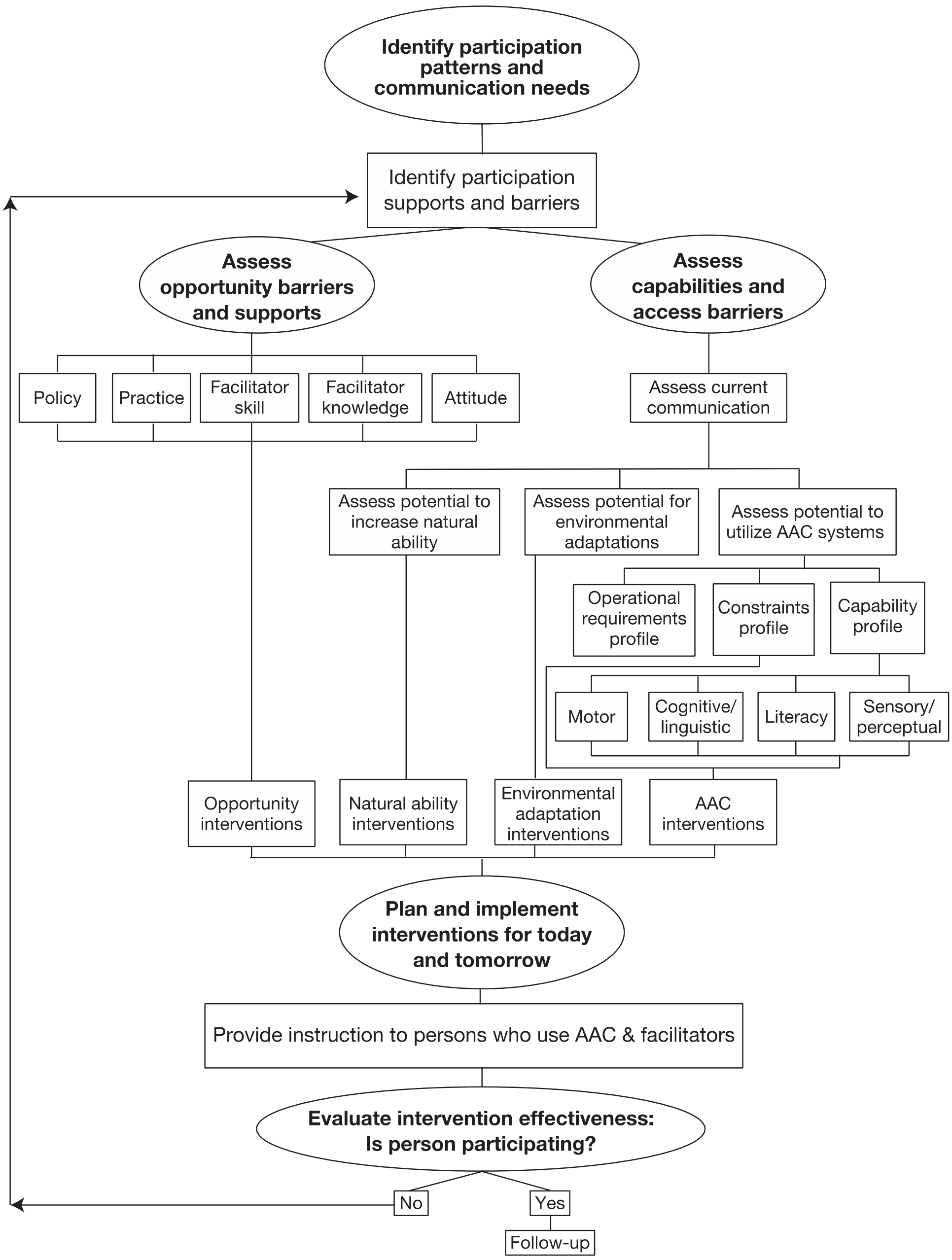

Fig. 20.1 Participation model (Beukelman & Light, 2020)

speech therapy). An examination of the context(s) in which the learner participates reveals opportunity barriers and supports that may help or hinder the implementation of AAC interventions. An awareness of these barriers and supports allow practitioners to (a) address barriers (e.g., providing training and information to improve facilitator skill and knowledge) and/or (b) take advantage of opportunity supports (e.g., beginning intervention with a staff member who is enthusiastic regarding AAC intervention).

From a participation model framework, there is the understanding that an individual's AAC use is ever evolving; thus, the team plans AAC interventions and supports for "today" as well as for "tomorrow." Instruction and support to the learner and facilitators (e.g., parents, school staff, and peers) is provided by a practitioner with AAC expertise, and ongoing evaluation is conducted to determine if AAC interventions result in increased participation and communication. If not, participation supports and barriers are re-evaluated, with changes made accordingly.

20.4.2 Additional AAC Assessment Considerations

20.4.2.1 Predictors, Moderators, and Mediators

Increasingly, researchers have attempted to identify the *predictors*, *moderators*, and *mediators* that correspond with positive AAC outcomes. *Predictors* have a main effect on the overall outcomes; they include participant characteristics associated with success. *Moderators* relate to the differential responding to various interventions; they can help identify the conditions and/or interventions most likely associated with success for a given learner. *Mediators* refer to specific factors that are assessed during the delivery of an intervention to help explain why and how individuals respond.

Analyses of results from group-based longitudinal experimental studies of AAC interventions for learners with ASD have revealed a number of predictors, moderators, and mediators (Ganz et al., 2011, 2012, 2014a; 2015; Sievers et al., 2018; Sievers et al., 2020). Predictors associated with positive AAC outcomes for individuals with ASD include (a) cognitive ability, (b) severity of ASD symptoms, (c) language comprehension, (d) language use, and (e) communication complexity/competence (Vandereet et al., 2011; Pasco & Tohill, 2011). Further, moderators of AAC success that have been identified include (a) joint attention, (b) object exploration, (c) verbal imitation (i.e., echoics), (d) motor imitation, and (e) matching skills (Gregory et al., 2009; Layton, 1988; Yoder & Compton, 2004). While predictors and moderators are comprised of within-learner characteristics, mediators are entirely comprised of factors outside of the learner. These include (a) AAC knowledge of the communication partner, (b) perception of AAC, (c) frequency of AAC exposure, and (d) adult input (Sievers et al., 2018).

While knowledge of these predictors, moderators, and mediators may have some utility in matching AAC interventions to individual learners, it is critical to recognize that current research in this area is primarily correlational; factors such as cognitive ability or severity of ASD symptoms should not function as gatekeepers or prevent access to AAC interventions. Instead, awareness of these factors should guide the team in selecting AAC interventions most likely to support the development of communication skills via AAC; cognitive impairments should *never* impede access to AAC interventions.

20.4.2.2 Response Efficiency

Another important consideration when selecting an AAC intervention for a given learner relates to the concept of response efficiency. Within the behavior analytic literature, selection of a given AAC system has been evaluated in direct relation to the matching law, concurrent schedules of reinforcement, and any problem behavior the FCR is intended to replace (e.g., Ringdahl et al., 2016). Response efficiency can be analyzed with respect to the specific schedules of reinforcement provided for problem behavior(s) vs. an appropriate alternative; as long as problem behavior is reinforced on a less-frequent schedule than the appropriate alternative, the matching law predicts that the individual will allocate responding to the response that most efficiently accesses the reinforcer (i.e., the FCR). Therefore, regardless of the symbol(s) and/or techniques used, practitioners must ensure that communication via AAC is more efficient with regard to accessing reinforcement when compared to the problem behavior(s); doing so will aid in both promoting the acquisition and maintenance of the appropriate FCR (Horner & Day, 1991; Johnston, 2006; Kelley et al., 2002).

20.4.2.3 Response Effort

Directly related to response efficiency is the overall effort required when using AAC. Behavior-analytic research suggests that the allocation of learners' responses consistently match lowest effort conditions (Ghaemmaghami et al., 2018; Horner & Day, 1991). In other words, for learners to acquire and maintain new communicative responses via AAC, those responses must be *easier* to perform, compared to idiosyncratic and/or problematic responses. Furthermore, response effort and response efficiency are interconnected. If the response effort required to access reinforcement via AAC is so high that it produces ratio strain (i.e., the "tipping point" between how much effort is needed to access a given reinforcer), the individual will reallocate responding to the least effortful response (e.g., problem behavior). Therefore, it behooves practitioners to pay particular attention to response effort *and* response efficiency as it relates to any potential AAC intervention.

20.4.2.4 Preferences

It is well-established that interventions are more likely to be accepted and adopted when the individual preferences of the learner are incorporated. Methods for establishing "buy-in" and assent of the learner are critical components of behavior analytic interventions; thus, consideration of learner preferences when selecting an AAC intervention will substantially increase the likelihood that AAC use will maintain long-term (DeCarlo et al., 2019; Hanley et al., 1997; Tiger et al., 2008; van der Meer et al., 2014). It may, however, prove challenging to determine an individual's preference regarding one or more AAC system components, particularly when working with individuals who have difficulty discriminating or effectively communicating choices or preferences.

Researchers have evaluated methods to incorporate individual preference when selecting AAC components and devising AAC systems (Lund et al., 2017). Over the past decade, meta-analyses have focused on comparing learner responses to different AAC approaches, in order to identify clear preferences. While some evidence suggests that individuals with ASD may prefer exchange-based techniques over MS, and SGDs over both exchange-based techniques and MS, significant variability and inconsistency in findings leave the question unanswered (Alzrayer et al., 2014; Couper et al., 2014; Flores et al., 2012; Ganz et al., 2012; Gevartner et al., 2013; Lorah et al., 2013; Muharib & Alzrayer, 2018).

Further rigorous studies have evaluated preference by arranging concurrent choice-making experiments where, following FCT and communication-based training across different multiple AAC systems, the systems are simultaneously offered to the learner and "available" for usage. In these arrangements, the selection/utilization of the given AAC system does suggest learner preferences (Cannella-Malone, 2018; Kunnavatana et al., 2018; Ringdahl et al., 2016; Sigafoos et al., 2005, 2009; Son et al., 2006; Torelli et al., 2016; Winborn et al., 2002; Winborn-Kemmerer et al., 2009; Winborn-Kemmerer et al., 2010); however preferences are consistently idiosyncratic to each learner and their presenting skills, making any overarching claims about preferences for all learners with ASD moot (van der Meer et al., 2011). Further, given that preferences may change over time, ongoing evaluation is necessary, particularly as the learner's skills evolve and the presenting environment(s) change (Lorah, 2016).

Given that each learner with ASD will present with their own unique preferences, individualized evaluation of preferences must drive the selection of AAC interventions. Furthermore, recognition that AAC users with ASD comprise a heterogenous group means that there will never be a "one-size-fits-all" approach to AAC system design (e.g., type of symbol, technique(s) used, and nonelectronic vs. electronic). Ultimately, decisions about AAC systems should not be based on diagnosis; rather, such decisions must be grounded in data on presenting behaviors, skills, needs, and preferences of the learner, in relation to the individualized goals and the environment(s) within which the individual operates.

20.4.2.5 Assessment of Barriers to and Facilitators of AAC Intervention

Contextual fit, a relatively new construct that expands social and ecological validity, is an important consideration when implementing any type of intervention, including AAC interventions. Albin and colleagues (2002) suggested that behavior support plans were more likely to be implemented with fidelity if strategies, procedures, and elements of the intervention aligned with the values, knowledge, skills, resources, and supports available to implementers. Aspects related to contextual fit include factors that serve as barriers and facilitators to intervention success. Research on contextual fit within the field of AAC has identified factors that impede or promote the implementation of AAC interventions (Johnston, 2006). Ultimately, the degree to which AAC interventions fit the broader context will impact the overall effectiveness of AAC interventions and must be considered as part of the assessment process (Donato et al., 2018).

Many barriers to successful AAC implementation relate directly to the systems in which learners receive educational and other service-based supports. These may include policies that restrict access to and funding for AAC services, materials, and/or professionals with expertise in AAC assessment and intervention. As well, a lack of access to ongoing professional development opportunities directly related to AAC assessment and intervention can serve as a further barrier to high-quality AAC service provision. Finally, inconsistent and contradictory advice and information provided to families and other consumers of AAC services is an additional impediment (Donato et al., 2018). There are also barriers that are somewhat context-specific. The time required for system development and maintenance and/or a lack of facilitator training and implementation support can interfere with AAC implementation. When working with electronic AAC systems, in particular, additional barriers may include (a) a lack technical competence, (b) mechanical and software issues, and (c) complexities of AAC software and apps, particularly for SGDs (Donato et al., 2018). When implementing AAC in family settings, practitioners may encounter (a) parental perceptions that AAC will prevent oral speech and associated resistance to AAC, (b) parental difficulty implementing AAC interventions within the context of a busy, family life, (c) parental discouragement that results from the child's lack of motivation, attention, and/or initiation, and (d) the presence of challenging behaviors.

While an awareness of barriers can be daunting to the practitioner, it's important to recognize that thorough assessment and thoughtful intervention planning can assuage the negative impact of these, and other, barriers.

The research and practice literature also identifies a number of facilitators that can counteract barriers to successful AAC implementation. To increase the likelihood of contextual fit and, ultimately, successful AAC implementation, research recommends that services be (a) family-centered, (b) delivered by those with sufficient knowledge, training, and expertise, and (c) collaborative in nature (Donato et al., 2018). To increase "buy-in," research recommends that AAC interventions utilize technologies and methodologies that (a) are user-friendly, (b) require as little response effort as possible, both for users and facilitators, (c) embed additional features, including photo and video technology and access to the Internet, (d) are used by the population at large (e.g., smartphones and tablets), and (e) are multimodal (e.g., incorporate aided and unaided approaches) (Donato et al., 2018). In the end, practitioners will need to evaluate a number of factors not directly related to the learner in order to understand the broader contextual barriers and identify relevant facilitators. If a given AAC intervention is not feasible for the majority of the people in the learner's life, then compromises in the selection of an AAC intervention, such that contextual fit can be achieved, will significantly increase the likelihood of that intervention being adopted and implemented successfully.

20.4.2.6 Cultural Validity

Last, but certainly not least, we must consider broader cultural- and diversity-related influences (Hetzroni & Harris, 1996). Many of our learners come from homes that include cultural practices and languages different from our own. Families may hold different beliefs and values with regard to disability, communication, and the role of professionals. It is imperative that practitioners recognize and incorporate diverse cultural perspectives and influences into the assessment and intervention process. While beyond the scope of this chapter, readers are encouraged to engage in ongoing professional development related to working with families from cultural and linguistically diverse backgrounds. As it relates to AAC assessment and intervention, practitioners will need to be responsive and humble when presented with differing values and beliefs; in particular, assessment and intervention planning should account for a given learner's cultural and linguistic background (e.g., inclusion of culturally relevant vocabulary and inclusion of multiple languages on AAC displays and/or SGDs)

20.4.2.7 A Summary of AAC Assessment Considerations

While much attention has focused on the identification of appropriate symbol(s) and technique(s), it is ultimately important to attend to these and other essential factors, including (a) predictors, moderators, and mediators of favorable outcomes, (b) overall response effort, efficiency, and history in relation to reinforcement, (c) individual and family preferences, and (d) social, cultural, and ecological validity. A thorough and thoughtful assessment, conducted by a knowledgeable and skilled practitioner, in collaboration with families and other professionals, will increase not only the likelihood that AAC intervention(s) match the individual but also that they are socially, culturally, and ecologically valid. These considerations thereby set the stage for successful AAC intervention and, ultimately, the learner's acquisition, maintenance, and generalization of communication skills.

20.5 Behavior Analysis and AAC Intervention

AAC intervention practices have evolved tremendously over the last 70 years. While initially, interventions focused solely on the development of speech, a gradual shift in values and priorities led to the emergence of methods to augment and/or replace speech for those unable to develop reliable communication via speech. In the 1960s, with the establishment of a behavioral approach to language, methodologies were devised to teach speech and other verbal behavior (i.e., MS) to children with language deficits, including those with ASD. This approach utilized a number of behavior analytic instructional components, including systematic prompting and fading methods, shaping procedures, and reinforcement for target behaviors. Systematic data collection guided the selection and evaluation of specific instructional components for individual learners while emphasizing communication skills relevant for a learner's functional environment. Based on the erroneous belief that aided AAC systems would prevent the acquisition of speech, this early behavioral approach to language tended to exclude the use of aided symbols and, instead, promoted the use of MS and gestures (Hourcade et al., 2004; Ogletree & Harn, 2001; Zangari et al., 1994).

During the 1970s and 1980s, the focus of language interventions shifted further to consider the pragmatic function of language; interventions focused primarily on the ways in which communicative behavior operated within naturally occurring social contexts (Bryen & Joyce, 1985; Guess et al., 1976). Interventions focused on the use of unaided and/or aided AAC methods, within commonly occurring routines, to improve functional communication skills (Zangari et al., 1994). Over the ensuing decades, to the present day, the field of AAC evolved to include (a) individuals who, in the past, were deemed ineligible for AAC interventions due to intellectual impairments and (b) technologies that became increasingly available to consumer populations and lower cost. Particularly with the emergence of handheld devices in the twenty-first century, along with a plethora of AAC apps that can be purchased by anyone for, at most, a few hundred dollars, the use of SGDs has exploded.

While speech and language pathologists (SLP) have traditionally provided AAC-related services (Clarke & Williams, 2020), the use of behavior analytic interventions to target communication skills, along with the increased accessibility to handheld devices and AAC apps, and the wide adoption of ABA-based interventions for individuals with ASD has resulted in behavior analysts becoming increasingly responsible, at least in part, for the design and implementation of AAC interventions. AAC interventions, increasingly incorporated into comprehensive ABA programming, are typically provided within the context of naturalistic teaching strategies (NaTS) and/or discrete trial training (DTT) methods.

20.5.1 Naturalistic Teaching Strategies

The use of NaTS to promote functional communication within natural environments has become central to AAC interventions over the past 40 years (Bondy & Frost, 1994; Charlop-Christy et al., 2002). Akin to Milieu teaching (Hart & Rogers-Warren, 1978; McDuffie, 2013), incidental teaching (Hart & Risley, 1978; McGee et al., 1999), naturalistic environment teaching (NET) (Sundberg & Partington, 1998), and FCT (Carr & Durand, 1985), NaTS target functional communication skills using activities that are reinforcing and frequently accessible to learners within their everyday environments. Although not specific to AAC, NaTS may target mands (i.e., requests), tacts (i.e., labels), and/or intraverbals (i.e., conversations and social questions and responses) relevant to the learner's presenting environment and routines.

While beyond the scope of this chapter to provide an in-depth overview of NaTS, essentially, this approach involves careful planning and environmental arrangement to provide increased motivation and opportunities to communicate. Based on learner interests, opportunities are contrived by withholding, blocking, and/or disrupting access to preferred items, activities, and/or interactions, which increases motivation to communicate (Cosbey & Johnston, 2006; Ganz et al., 2019; Sennott & Mason, 2016). Modeling, prompting and prompt fading, and shaping are utilized to promote FCRs, which are followed by specific reinforcing consequences (Hart & Risley, 1978).

20.5.2 Discrete Trial Teaching

While NaTS are consistently utilized for teaching functional and social communication skills via AAC within natural settings, the use of DTT can also be advantageous for teaching specific AAC-related skills to learners with ASD (Rabideau et al., 2018). DTT is an empirically supported, behavior analytic instructional procedure consisting of five key components: (a) the presentation of both an establishing operation (EO) and an SD (e.g., instruction), (b) a specific prompt (as needed), (c) the response from the learner, (d) the delivery of a consequence (e.g., reinforcer), and (e) a brief intertrial interval (Smith, 2001). DTT is commonly implemented under controlled, distraction-free environments; however, these procedures have evolved to become increasingly more natural, such that they can be implemented within the context of NaTS.

DTT may be most useful when targeting a specific AAC-related responses, such as exchanging a symbol, discriminating between symbols, or activating a specific location on an SGD. While DTT can result in relatively rapid acquisition of target skills, generalization is not guaranteed without systematically incorporating such skills within the natural environment (Sundberg & Partington, 1998). Therefore, when teaching AAC-related skills via DTT, it is especially important to program for generalization at the onset of intervention. This may include engaging in multiple trials using multiple different stimuli (i.e., multiple exemplar training), across multiple individuals, in multiple environments.

20.5.3 Additional Instructional Considerations

Perhaps the most important aspect of AAC instruction relates to the infusion of communication via AAC throughout the day, across contexts and environments. Consider a typically developing baby. Parents, and others, speak thousands of words each day; language and communication are modeled daily, for approximately 1 year, before it is expected that a child will begin speaking. Compare that to individuals with developmental disabilities, including those with ASD, provided with an AAC system. In many circumstances, no one in that learner's environment models language and communication using the same AAC system. Despite this, there are expectations that the learner will somehow become a fluent AAC user. In conjunction with high-quality instructional practices, implementation of AAC should mirror the way in which typically developing infants are exposed to language and communication. Others in the environment should use the AAC system to communicate, thereby providing a model; in addition, the AAC system should be available at all times, during all activities. Given that we would not expect a typically developing child to acquire vocal-verbal communication skills in the absence of intense modeling by its verbal community, we should not expect that those with ASD will develop AAC fluency in the absence of robust AAC modeling.

20.6 AAC and Evidenced-Based Practice

Identifying methodologically sound studies and evaluating the quality of research on a given topic is critical to ensuring the credibility of recommendations regarding effective interventions for use within applied settings (Horner et al., 2005; US Department of Education, 2016). While AAC interventions have been implemented increasingly with learners who have ASD over the past five decades, one must consider the degree to which the use of AAC methodologies is empirically supported, effective, and evidence-based. Definitions of evidence-based vary depending upon the field of study and research methodology. In single-subject research, which guides much of the work in both ABA and AAC, interventions are deemed to be evidence based when a minimum of 5 high-quality studies, across at least 3 different research teams, and including at least 20 participants all show evidence of a strong functional relationship between the independent variable (i.e., intervention) and the dependent variable (i.e., target behavior) (Kratochwill et al., 2013).

Research regarding AAC practices follow one of two paths: research-to-practice and practice-to-research (Mirenda, 2017). Research that follows a research-to-practice path focuses on determining efficacy (i.e., the degree to which behavior changes when intervention procedures are implemented in a highly controlled environment by highly skilled intervention agents) and/or effectiveness (i.e., degree to which intervention procedures produce good outcomes when implemented in the natural environment by natural intervention agents). Research that follows a practice-to-research path focuses on validating interventions commonly applied in natural settings. According to the Association for Science in Autism Treatments (ASAT), a definitive source for disseminating autism-specific, evidence-based practice, data supporting the benefits of AAC are "limited," with the exception of those interventions that blend and incorporate ABA methods within the context of AAC intervention (ASAT, 2021; National Research Council, 2001).

20.6.1 Effectiveness and Efficacy of AAC Interventions

In the past 20 years, a plethora of studies have investigated the overall effectiveness and efficacy of an assortment of AAC interventions, implemented across different settings and contexts, with a variety of learners. As well, researchers have conducted meta-analyses of AAC research, particularly in relation to learners with ASD, to identify practices that can be considered evidenced-based (Aydin & Diken, 2020; Ganz et al., 2012; Ganz et al. 2015; Gevartner et al., 2013; Holyfield et al., 2017; Logan et al., 2017; Lorah et al., 2015; Muharib & Alzrayer, 2018; Nam et al., 2018; Schlosser & Raghavendra, 2004; Son et al., 2006; van der Meer & Rispoli, 2010; van der Meer et al., 2011). These comprehensive reviews reveal that, in general, (a) selection-based systems (e.g., SGDs; systems that incorporate physical exchange) are slightly more effective than MS in the acquisition of functional communication, social interaction skills, academic behaviors, and the reduction of problematic behavior and (b) systems incorporating physical exchange and SGDs are equally effective (Barlow et al., 2013; Boesch et al., 2013; Couper et al., 2014; Holyfield et al., 2017; Nam et al., 2018; Tincani, 2004; van der Meer et al., 2012). While it is important to note that not all published AAC research meets the high-quality research standards required to be considered an EBP (Aydin & Diken, 2020; Banda, 2018; Ganz et al., 2017; Logan et al., 2017; Morin et al., 2018), there are sufficient studies that do meet these criteria and provide direction for current practice and ongoing research (Schlosser & Sigafoos, 2009).

It is also important to recognize that the specific AAC methodologies or interventions identified as EBPs are such only when provided within the context of behavior-analytic interventions. This begs the question, then, if the primary focus of our attention should be on (a) the effectiveness and/or efficacy-specific AAC modalities or systems (e.g., MS, PE, and SGDs) alone or (b) the effectiveness and/or efficacy of combined AAC and ABA interventions. From a behavior-analytic point of view, it would appear that any AAC modality or system is potentially effective, if taught using established, evidence-based, behavior-analytic instructional practices. Therefore, our research should target the ways in which AAC interventions can be effectively implemented within the context of behavior-analytic programming to improve specific communication skills and/or verbal repertoires. Specific components of AAC systems should be selected based on the individualized needs of the user, family, and relevant context(s) rather than the notion that one specific AAC approach is "appropriate" for all learners with ASD.

It is also important to recognize that much of the AAC literature, particularly in relation to those with ASD, has focused primarily on establishing FCRs often as a replacement for problem behavior. There is significantly less research on the combination of AAC and ABA interventions to establish and/or expand other communication skills, such as those related to social interaction, literacy, and/or complex verbal behavior. As such, ongoing research must focus on the ways in which behavior-analytic instruction can effectively incorporate AAC interventions to increase these, and other, important skills.

20.7 Future Directions of AAC for Individuals with ASD

AAC methods have evolved dramatically over the past 70 years; the future for those who require AAC is seemingly bright and full of opportunities. As AAC-related technologies and research continue to advance, the application of these interventions becomes more readily accessible, culturally sensitive, socially acceptable, and empirically supported. At the same time, there are some important considerations to keep in mind as we work to improve and expand upon current AAC services for individuals with ASD (Light & McNaughton, 2012).

We are in desperate need for high-quality research on all of the components of AAC interventions (e.g., types of symbols and types of systems), as well as assessment approaches that assist in identifying the most appropriate AAC interventions for individual learners. We also need to expand our research beyond the use of behavior-analytic interventions to target AAC use for the purpose of manding and increase our focus on the use of such tactics to target all verbal operants within natural settings. Given that there is a rich body of literature to support the development of complex vocal verbal behavior via behavior-analytic interventions, it stands to reason that the same can be accomplished using AAC methodologies. That said, we do need to better understand this through the execution of well-designed studies designed to meet the rigorous criteria for establishing practices as evidence-based. We also need to better understand the relationship between predictors, moderators, and mediators and the acquisition, maintenance, and generalization of AAC by those with ASD.

There is also a significant need to expand AAC research and service provision beyond children. While there has been some increased attention in AAC interventions for very young children (i.e., infancy through toddlerhood) identified with intellectual and/or developmental disabilities, there is very little research focused on AAC interventions for adolescents or, especially, adults and elderly persons (Holyfield et al., 2017; Trembath et al., 2014). Given the increasing degree to which adults with developmental disabilities participate in social, community, and vocational contexts, along with their increased life expectancy, it is especially important to determine effective approaches for providing AAC services to this group.

With increased access to various AAC technologies, questions have emerged regarding the design of dynamic display systems, particularly in relation to the organization of and access to vocabulary and messages. The manner in which dynamic display AAC systems can be organized is varied and vast. This is likely another aspect of AAC system selection that will need to be determined based on individualized assessment; therefore, assessment approaches and decision-making standards should be established, such that teams can accomplish this task efficiently.

Knowing that the degree to which any AAC intervention is successful is inextricably linked to the acceptability and feasibility of that intervention from the perspective of parents and other facilitators, the consideration and incorporation of these variables into AAC-based programming is paramount. Researchers and practitioners will benefit from formally evaluating social validity, treatment integrity, and the unique preferences of individuals who are part of the AAC interventions. This may also include more formalized professional preparation and training programs for family members and practitioners who will be working with individuals who use AAC devices (Mirenda, 1997).

As well, it is important to recognize that, in most circumstances, there is not one individual on the team who possesses all of the relevant knowledge, skills, and expertise to effectively implement AAC interventions for individuals with ASD. Historically falling within the skill set of SLPs, the complexities of AAC are not well-understood by behavior-analytic professionals. Similarly, most SLPs are unlikely to possess an in-depth understanding of the behavior-analytic tactics that facilitate the acquisition, maintenance, and generalization of verbal behavior. In order to serve our learners best, it is crucial for SLPs and behavior analysts to respect one another's knowledge, skill, and expertise and collaborate effectively throughout the AAC assessment and intervention process. This means that behavior analysts must (a) be open to differing perspectives and approaches and (b) disseminate information regarding behavior analytic practices in a way that is accessible to others (e.g., avoiding jargon). Remembering that one barrier to AAC intervention, particularly for parents, relates to conflicting opinions and recommendations, it behooves us to develop the necessary soft skills for effective collaborative consultation (e.g., humility, empathy, compassion, and interpersonal skills). These skills may position us to be better able to work in conjunction with SLPs and other professionals to design the best, individualized AAC interventions possible, thereby increasing the likelihood that our learners, their families, and those who support them experience success.

20.8 Conclusion

The selection, design, and implementation of AAC interventions plays an integral role in facilitating the development of a learner's communication skills and, by proxy, that learner's participation in a variety of other contexts, including social, educational, and vocational. Each individual learner deserves an individualized approach to AAC intervention, led by professionals with sufficient expertise who collaborate effectively. Such interventions must facilitate the learner's ability to communicate in a variety of contexts using any and all modalities that are appropriate and effective for that learner. This requires an astute assessment, not only of individual strengths, needs, and preferences, but of the broader environment(s) and context(s) in which the individual participates. When supporting those with ASD, particular attention must focus on attending skills, motivation, and spontaneous initiations.

Given the wealth of research supporting the use of behavior-analytic interventions to promote the development of vocal-verbal repertoires, in general, combined with emerging research that supports the use of similar procedures to teach specific verbal operants (i.e., mands) via AAC (e.g., MS and PE), it seems prudent to apply similar tactics to (a) teach additional verbal operants (e.g., tacts and intraverbals), (b) use additional AAC strategies and/or materials (e.g., SGDs), and (c) implement these across a wide variety of contexts and settings.

Finally, there is one critical thing that we, as behavior analysts, must remember. The field of AAC, like the field of ABA, is vast and complex; no single professional can meet all of the needs of a given learner. While we certainly bring a wealth of knowledge, skills, and expertise to the table, there is so much more that we do not know. We must concede that we also lack knowledge and skills and appreciate the wealth of knowledge, skills, and expertise that other professionals, including SLPs, bring to the table. Such professional humility will serve us well in establishing and maintaining collaborative professional partnerships that are grounded in respect and a desire to work in the best interests of our learners. For individuals with ASD, communicating effectively, regardless of the modality, is both their right as individuals and our ethical responsibility as practitioners.

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Resources

Tangible and Tactile Symbols

Tangible Symbols Webcast by Elizabeth Torrey, Perkins School for the Blind: https://www.perkinselearning.org/videos/webcast/tangible-symbols

Tangible Symbol Systems Primer, Dr. Charity Rowland & Dr. Philip Schweigert: https://www.designtolearn.com/uploaded/pdf/Tangible-Symbols-Primer-07-09x.pdf

Using Tactile Symbols to Support Communication, Angela Powell: https://bit.ly/3fJD8CS

Photographs and Line-Drawing Symbols

Picture Communication Symbols/Boardmaker 7®: https://goboardmaker.com/pages/boardmaker-7

SymbolStix Prime®: https://www.n2y.com/symbolstix-prime/

PICTO4me: https://picto4.me/site?lang=en

Visuals Engine, Connectability.ca: https://connectability.ca/visuals-engine/

LessonPix: https://lessonpix.com/

Exchange-Based Communication

PECS: www.pecs.com

SPEAKall!®: Speak MODalities: http://www.speakmod.com/speakall/

Professional Development and Learning

AAC Learning Center Moodle: https://aac-learning-center-moodle.psu.edu/

AAC-RERC Webcasts: https://aac-rerc.psu.edu/index.php/pages/show/id/44

Speech-Generating Devices: Autism Internet Modules: https://autisminternetmodules.org/mod_intro.php?mod_id=35

AAC Assessment – Adults with DD: Assistive Technology Internet Modules: https://atinternetmodules.org/mod_intro.php?mod_id=135

21 Shaping: A Brief History, Research Overview, and Recommendations

Joseph H. Cihon

21.1 Shaping: A Brief History, Research Overview, and Recommendations

Shaping is one of those skills within the field of applied behavior analysis (ABA) that is commonly discussed, under-researched, and can take many years to attain fluency and effectiveness. Many professionals commonly have their own take on how to describe shaping. Some might be familiar with the analogy of shaping behavior resembling a sculptor shaping a lump of clay (Skinner, 1951), while others may be more familiar with other analogies (e.g., an engineer building a house). Regardless of the analogy, the most frequently used description the reader is likely to have encountered involves the use of differential reinforcement of successive approximations to a terminal response. While this may be common and useful as a quick account of the shaping process, it is not a comprehensive description of the shaping process and strays a bit from historical descriptions. Peterson (2000) provided one of those historical descriptions of Skinner's day of great illumination in discovering the shaping process (later published in the *Journal of the Experimental Analysis of Behavior*; Peterson, 2004).

21.2 A Historical Journey: A Day of Great Illumination

Peterson (2000)[1] was bothered for years about Skinner's description of his amazement when he first saw behavior being shaped in 1943. Specifically, Skinner (1958) stated,

> In 1943 Keller Breland, Norman Guttman, and I were working on a wartime project sponsored by General Mills, Inc. Our laboratory was the top floor of a flour mill in Minneapolis, where we spent a good deal of time waiting for decisions to be made in Washington. All day long, around the mill, wheeled great flocks of pigeons. They were

[1]The reader is strongly encouraged to contact the original manuscript.

Author NoteThe contents of this chapter would not have been possible without the mentorship of Shahla Ala'i and Jesus Rosales-Ruiz to whom I'd like to express my deepest gratitude.

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> easily snared on the window sills and proved to be an irresistible supply of experimental subjects. We built a magnetic food-magazine, which dispensed grain on the principle of an automatic peanut vendor, and conditioned pigeons to turn at the sound it made and eat the grain it discharged into a cup. We used the device to condition several kinds of behavior. For example, we built a gauge to measure the force with which a pigeon pecked a horizontal block, and by differentially reinforcing harder pecks we built up such forceful blows that the base of the pigeon's beak quickly became inflamed. This was serious research, but we had our lighter moments. One clay we decided to teach a pigeon to bowl. The pigeon was to send a wooden ball down a miniature alley toward a set of toy pins by swiping the ball with a sharp sideward movement of the beak. To condition the response, we put the ball on the floor of an experimental box and prepared to operate the food-magazine as soon as the first swipe occurred. But nothing happened. Though we had all the time in the world, we grew tired of waiting. We decided to reinforce any response which had the slightest resemblance to a swipe – perhaps, at first, merely the behavior of looking at the ball – and then to select responses which more closely approximated the final form. The result amazed us. In a few minutes, the ball was caroming off the walls of the box as if the pigeon had been a champion squash player. The spectacle so impressed Keller Breland that he gave up a promising career in psychology and went into the commercial production of behavior. (p. 94).

The reasons this bothered Peterson helps to illuminate the problems with describing shaping as the differential reinforcement of successive approximations to a terminal response. The first reason Peterson provided stems from Skinner's (1938) chapter entitled "The Differentiation of a Response." In this chapter, Skinner described experiments using successive approximations to develop lever pressing with rats. It seemed odd to Peterson that Skinner would be amazed in 1943 when he seemed to be discussing shaping all the way back in 1938. Second, Skinner seemed to describe shaping a rat's lever press in an exchange with Konorski and Miller (see Konorski and Miller, 1937; Miller and Konorski, 1928, 1969; and Skinner 1935, 1937, for the exchange) even before the publication of Skinner (1938). Peterson concluded that this description must have been speculative rather than empirical if Skinner had, in fact, not discovered shaping until 1943. Third, in 1937, *Life* magazine published a story about Skinner training his lab rat, Pliny, to perform a rather extensive behavior chain ("This smart," 1937). The training described made it seem as though Skinner had used shaping, but, as Peterson noted, this also came years before 1943.

What, then, was so illuminating about that day in 1943? Peterson (2000) narrowed it down to two main points:

> (1) the efficacy of implementing a program of successive approximation by simply watching the animal and operating the reinforcement-delivery device *by hand*, rather than making small mechanical adjustments of the physical environment, as he had always done before, and (2) the rapidity with which dramatic changes in response topography can be brought about when one does this (p. 8)

Herein lies the part of problem with describing shaping as the use of differential reinforcement of successive approximations to a terminal response. The emphasis on the *source* of reinforcement delivery, the *effect* of reinforcement delivery, and the *quickness* in changes is lost. In addition to these omissions, there are at least two other challenges worth discussion with using this common definition for shaping.

21.3 Challenge One: A Linear Perspective

Defining shaping as the use of differential reinforcement of successive approximations to a terminal response may lead practitioners to view the shaping process and, in turn, implement shaping from a linear perspective, that is, viewing how to get the learner from their current responding to the desired responding as a series of unvarying, discrete steps. This may lead to the development of an ordered list of responses for the practitioner to reinforce each step until mastery prior to reinforcing the next response in the list. While behavior analysis is built upon the assumption of determinism that all behavior is lawful and orderly, shaping behavior is unlikely to follow a series of unvarying, discrete steps in which the practitioner moves from reinforcing only one topography to the next until the terminal response occurs. Approaching shaping from this perspective is likely to prevent practitioners from analyzing moment-to-moment changes in the learner's behavior and delivering access to reinforcement or withholding reinforcement as a result of this analysis (i.e., clinical judgement, see Leaf et al., 2018; Leaf et al., 2016). Ultimately, a restricted view of responses that may be candidates for reinforcement may slow or, worse, halt the shaping process.

Approaching shaping from a nonlinear perspective (for a more detailed discussion that is beyond the scope of this chapter, see Goldiamond 1984, 2002) permits the practitioner to focus on expanding response classes, which, in turn, increases the number of responses that may be candidates for reinforcement. This more closely aligns with the effect of reinforcement – an increase in the probability of similar responses (i.e., expanding response classes) in future similar situations. In this sense, delivering access to reinforcement increases the probability of similar responses – some that may be on the path to the terminal goal and some that may not be on that path. Nonetheless, shaping should increase the number of responses the individual is emitting, giving the practitioner more behavior with which to shape. Therefore, within this nonlinear view of shaping, the practitioner can determine when and if to deliver access to reinforcement across a larger number of responses and response topographies. The likelihood that these responses and response topographies could be determined a priori in an effort to develop a series of discrete steps is low.

21.4 Challenge Two: A Lack of Reciprocity

Defining shaping as the use of differential reinforcement of successive approximations to a terminal response may also prevent practitioners from developing an understanding of the reciprocal process that is shaping. This common definition of shaping permits mechanical descriptions of shaping (e.g., programming a machine to gradually increase the effort required to access reinforcement) and implies shaping is something that happens to the learner without an effect on the person implementing the shaping procedure. That is, the learner is the focus of the shaping procedure, the learner's behavior is the only behavior of interest, and the practitioner operates outside of the effects of shaping. It is the case, however, that shaping is a reciprocal process in which the behavior of the learner and the practitioner are mutually related and affected. The learner's behavior sets the occasion for the practitioner's behavior, which then affects the learner's behavior; the learner's behavior then affects the practitioner's behavior and sets the occasion for the practitioner's behavior; and so on. Just as the learner's behavior is lawful, so is the practitioner's behavior, and both are shaped during the shaping process. It should also be noted that identification of this reciprocal process of socially meditated consequences is what made Skinner's analysis of verbal behavior possible (Peterson, 2004).

21.4.1 Shaping Defined[2]

So then, how may shaping be defined in a way that avoids these and other possible challenges? Peterson (2000) provided a definition of shaping that encapsulates what was illuminating for Skinner back in 1943. She described shaping as "a word that would suggest a distinction between the process of behavioral elaboration directed by constraints in the physical environment with mechanical connections to sources of reinforcement from behavioral elaboration directed by another organism" (Peterson, 2000, p. 9). This definition addresses challenges with respect to a linear perspective as well as the reciprocity of shaping. Cooper et al.' (2020) updated definition of shaping (from previous editions), a "three-part process whereby the analyst (a) detects a change in the learner's environment, (b) makes a discriminated judgment about whether that change is a progressively closer approximation to a ter-

[2]It is important to note that this chapter focuses on response shaping as opposed to stimulus control shaping (McIlvane & Dube, 1992).

minal behavior of interest, and then (c) differentially reinforces that closer successive approximation" (p. 541), also helps address the aforementioned challenges. What both of these definitions have in common is an emphasis on the reciprocity of the shaping process and analyzing the learner's behavior to determine which responses are, or are not, candidates for reinforcement.

21.4.2 Research Examples

Although shaping creates unique challenges for the researcher, there are examples of research evaluating shaping and the behavioral processes underlying shaping. Wolf et al. (1964) represents one of the earliest demonstrations (if not the earliest demonstration) of shaping within the experimental literature with autistics/individuals diagnosed with autism spectrum disorder[3] (ASD). Specifically, shaping was used to teach Dicky, a 3-year-old autistic boy who was at risk of permanent vision loss, to wear glasses. It is important to note that prior to this intervention and involvement of the researchers, wearing glasses had been paired with attempts to physically force wearing the glasses. Following the establishment of clicks of a toy noisemaker as a conditioned reinforcer, several empty glasses frames (i.e., without lenses) were placed around the room. Reinforcement was first delivered anytime Dicky picked up, held, or carried the frames then for approximations of bringing the frames closer to his eyes. However, the "shaper met with considerable difficulty in getting Dicky to wear the glassless frames in the proper manner" (Wolf et al. 1964, p. 309). As a result, Wolf et al., who had not previously directly intervened, spent a day directing the shaping procedure; changes to the frames were made (e.g., larger ear pieces, a roll bar); and access to reinforcers (e.g., candy, fruit) outside of shaping sessions was limited. These changes resulted in more rapid progress, and Dicky was "soon wearing his glasses continuously during the meal sessions in his room" (Wolf et al. 1964, p. 310). As Dicky continued to be successful, supplemental reinforcement was gradually faded, and wearing glasses was paired with preferred activities (e.g., snacks, going for walks). Upon his release from the hospital, Dicky was wearing his glasses for approximately 12 h each day.

Although not conducted with human participants, Schaefer (1970) offered an early example of how shaping can develop unwanted, dangerous behavior. Specially, Schaefer examined if head banging in primates (i.e., two rhesus monkeys), which was previously thought to be reflexive or physiologically occasioned, could be shaped and maintained by environmental variables (i.e., operant control). During the first session, raising a paw first occasioned reinforcement delivery, and positioning the paw above the head and then bringing it down upon the head was then shaped by delivering reinforcement for approximations. During the second session, a stimulus (e.g., "Poor boy!," "Don't do that!," "You'll hurt yourself!") was presented continuously, and the delivery of reinforcement was gradually faded. This was followed by discrimination training in which 30-second intervals were presented during which head banging occasioned the previously delivered stimulus (e.g., "Don't do that!") and the delivery of reinforcement or no response from the researcher. This study confirmed the results of previous studies in demonstrating that self-destructive behavior, such as head banging, can be shaped and maintained by environmental variables. It is also important to note that the condition that included statements, such as "You'll hurt yourself," may have been viewed as compassionate from the outside but was actually responsible for the maintenance of head banging.

Bernal (1972) trained parents of a child with severe food selectivity to implement a multicomponent intervention that involved providing access to different foods without requiring consumption, changing the portions of preferred foods, and

[3]This terminology was selected to adhere to the seventh edition of the *American Psychological Association Publication Manual* and to be inclusive of those who prefer person-first and identity-first language. When discussing prior research, the terminology used within that research is used.

reinforcing approximations related to sampling several foods rather than eating one target food (i.e., shaping). Prior to any intervention, the child's current repertoire, with respect to mealtimes, was analyzed, and the consumption of a variety of food groups was determined to be the terminal goal. The first stage of intervention, following establishing self-feeding of preferred foods, involved presentation of foods without requiring consumption. This stage of intervention resulted in the child sampling three foods she had never eaten. The following stage of intervention involved providing a preferred food contingent upon sampling new foods during mealtimes. Mealtimes were not modified in that the full meal available to the rest of the family was also available for the child. The child's responding was the basis for progression through the intervention. Following a 32-week intervention, the child was consuming 50 foods that she had previously never eaten, and the parents reported that the child's weight and diet were no longer a concern.

Butterfield and Parson (1973) provided an early example of the use of modeling and shaping for mealtime behavior. More specifically, the treatment plan for the 8-year-old child involved avoiding attention (e.g., shouting at the child) for not chewing, modeling and shaping chewing, and fading reinforcement. All procedures were implemented by the child's family members. The shaping procedure was described as "the mother was instructed to reinforce any approximation of a "crunch." [sic] She was then to successively increase the response requirement until the child bit completely through the cracker" (Butterfield & Parson, 1973, p. 286). The results showed the parents stopped scolding their child, the child's chewing increased, and the child was eating several new foods prior to the termination of the treatment program.

Renne and Creer (1976) explored the use of shaping to train children with asthma to use inhalation therapy equipment (i.e., an intermittent positive-pressure breathing apparatus). In the first experiment, eye fixation, facial posturing, and diaphragmatic breathing were sequentially trained for four participants. Tickets were delivered for engaging in a criterion response which was determined based on the participants previous responses. The tickets could then be exchanged for a surprise gift. In addition to shaping with the use of tickets, prompting was also used when training the diaphragmatic breathing response. The results demonstrated that the procedures were effective in teaching the use of the intermittent positive-pressure breathing apparatus. In the second experiment, the results were replicated when nurses were trained to implement the procedures with two additional participants.

Mathews et al. (1992) evaluated the use of shaping to teach four children, all under 5 years of age, to wear contact lenses. The shaping procedure involved the researchers providing access to reinforcement for the child following instructions permitting the researchers to touch the child's face, pull open the child's eyelid, place drops in the child's eyes, approach the child's eye with one finger, and touch the child's eye with the finger. A brief time-out was also used when the children did not follow the instruction. The parents were then trained on lens care and insertion. The procedures were effective at increasing cooperation with instructions, a decrease in the time required for lens removal or insertion, and three of the four participants demonstrated high levels of cooperation with lens removal or insertion during 3- to 10-month follow-ups.

Although not conducted with human participants, Ferguson and Rosales-Ruiz (2001) provided a unique example of the use of shaping procedures as an alternative to standard procedures using aversive techniques when using shaping to train five horses to trailer load. The procedures involved first training the horse to approach a target (i.e., a red cloth potholder tied to a string), during which the horse accessed reinforcement following touching the target. The target was then moved to different locations within the trailer (e.g., forward little by little into the trailer) based on successful trials. If the horse did not touch the target on a trial, the target was not moved on the next trial. The procedures (i.e., target training and shaping) were effective in training all of the horses to load into a trailer and at no point in time were procedures based upon punishment or negative reinforcement required.

Ricciardi et al. (2006) evaluated the effectiveness of a shaping procedure to increase approach responses to animatronic objects (e.g., dancing Elmo doll, dancing Santa Claus figure) with an 8-year-old boy with autistic disorder. The procedure involved first providing noncontingent access to preferred items placed 6 m from the animatronic objects. The distance the preferred items were placed from the animatronic objects was then gradually decreased from 6 m to 1 m (i.e., the terminal criterion). Access to the preferred items was available at each of the distance criteria. If the participant remained at the current distance for at least 90% of intervals across two consecutive sessions, the distance was reduced. The results indicated that the procedures were effective at increasing the participants' proximity to the previously avoided animatronic objects. Treating phobias, as demonstrated by the participant, commonly involves preventing escaping or distancing oneself from the items that occasion phobic responses. Ricciardi et al. demonstrated that shaping without the use of escape extinction can be a viable, effective option when treating phobias.

Newman et al. (2009) compared what they referred to as reinforcing reasonable attempts to shaping with three preschoolers diagnosed with ASD. The dependent measure involved vocal responding within discrete trial teaching (DTT) programs (e.g., answering "wh" questions, answering personal information questions, filling in missing words, expressive identification of simple shapes). In the reasonable attempts condition, "reinforcement was not contingent on equivalent or successively more accurate responses" (Newman et al., 2009, p. 69). Rather, reinforcement was provided contingent upon the participant directing any response "that might have been reinforced at any point if shaping were used to teach this skill (i.e., responding within a broader class of correct responses)" (Newman et al., 2009, p. 69) toward the interventionist or training materials. In the shaping condition, only responses that were the same or better quality than previous responses set the occasion for reinforcement (i.e., a linear shaping approach). In general, the participants acquired the targeted responses more rapidly in the shaping condition. While the reasonable attempts condition appears to align closer to the aforementioned definition and description of shaping, Newman et al. hypothesized the discrepancy across the conditions may be due to challenges in defining and standardizing what constitutes a reasonable attempt.

Koegel et al. (2012) explored the effectiveness of a hierarchical shaping intervention to increase the level of acceptance of new foods and spontaneous requests for new with three children diagnosed with autism. Specifically, Koegel et al. developed a eight-level hierarchy of acceptance which involved (1) refusing a food, (2) touching and motioning a food to the mouth, (3) putting a food on lips, (4) biting a food, (5) biting a food and putting in mouth but not swallowing, (6) chewing a food but not swallowing, (7) swallowing a food reluctantly, and (8) accepting a food without displeasure or disruptive behavior. Once a potential reinforcer was identified, the participants were informed what behavior (i.e., step on the hierarchy) was required to access the reinforcer. Once a participant was successful on a level of the hierarchy during three consecutive probes without disruptive behavior, they were advanced to the next level of the hierarchy. The results indicated that the intervention was successful in increasing the number of new foods consumed by the three participants. Furthermore, all three participants were observed requesting new foods during generalization probes.

Hodges et al. (2017) extended the results of Koegel et al. (2012) by examining the effectiveness of shaping to increase the number of different foods consumed two children with ASD. Hodges et al. differed from Koegel et al. in that there were only four levels in the hierarchy (i.e., refusal, touches food to lips, puts food in the mouth and does not swallow, and swallows food). The first phase of intervention involved the simultaneous presentation of four foods, with each food targeted individually. Once a participant reached the highest level of acceptance for the first food across three consecutive sessions, the next food was targeted. Following this first phase, multiple foods were required to be consumed per trial to access reinforcement. This began with targeting the consumption of two foods, followed by three, and, finally, all four foods from Phase 1 of the intervention. The results showed that both participants accepted the four targeted foods and consumed all four foods in the final phase of the intervention when reinforcement was contingent upon consumption of all four foods.

Fonger and Malott (2018) explored the effectiveness of a shaping procedure, in the absence of a vocal cue and prompting, to increase eye contact during pauses in instruction for three preschool-aged children diagnosed with ASD. The shaping procedure involved removal of a preferred item and waiting until the participant made an orienting response before returning the preferred item. The duration the participants had access to the preferred item was differential based on the latency between removal of the preferred item and the orienting response. Orienting within 5 s resulted in an edible reinforcer and access to the preferred item for 15 s, while orienting after 5 s resulted in access to the preferred item for 5 s. The response requirement was gradually increased (e.g., orienting to brief eye contact to eye contact for 1, 2, and 3 s) as the participants were successful. The results indicated that all three participants acquired sustained eye contact, and the effects maintained up to 1 month following the shaping procedure.

Cihon, Ferguson, Leaf, et al. (2019b) evaluated the effectiveness of a level system with a flexible shaping approach to improve synchronous engagement with two dyads of children diagnosed with ASD. Four children diagnosed with ASD who were randomly assigned to two different dyads participated in the study. Synchronous engagement differed from engagement in that for synchronous engagement to be scored; both children were required to be engaged in the same activity while also displaying favorable affect. The flexible shaping approach involved a three-tiered level system that the children moved up and down, within and across levels, based on the interventionists' assessment of the children's behavior. In describing what resulted in movement Cihon, Ferguson, Leaf, et al. noted,

> If the behavior exhibited by a participant during the interval represented a general improvement, the marker would be moved up (i.e., the children's markers moved independent of each other). Likewise, if the general quality of the behavior was below what was reasonable to expect of the child given a number of variables, the marker would be moved down. (p. 48).

Said differently, there was no a priori hierarchy developed to guide the shaping approach. Instead, the participants' behavior set the occasion for the interventionist's behavior, which then affected the participants' behavior and so on. The results demonstrated that the level system used within a flexible shaping approach was effective at increasing the percentage of intervals in which synchronous engagement was observed for both dyads.

Turner et al. (2020) provided another example of the use of shaping to improve the acceptance of foods for two children diagnosed with ASD. Specifically, Turner et al. evaluated the effectiveness of a shaping package, which included modeling and prompting, while also comparing the use of small-constant food sets and large-rotating food sets. In one condition, the same 3 foods were presented each session, and in the other condition, 3 of 15 foods were presented each session. The intervention remained the same across both food set conditions which consisted of a five-step response sequence (i.e., touch, taste, lick, mouth, and eat). Following stating the contingency (e.g., If you taste the strawberry, you can play with the toy), reinforcement was delivered contingent upon engaging in the targeted response stated in the contingency. The results indicated that the shaping package was effective at improving food acceptance for both participants; however, results related to the size of the targeted foods sets were idiosyncratic across the two participants.

Most recently, Sivaraman et al. (2021) evaluated the effectiveness of coaching caregivers via telehealth to implement graduated exposure and shaping to teach mask wearing for six children diagnosed with ASD. Sivaraman et al. developed a 15-step exposure hierarchy starting at the facemask being within 30 cm for 5 s to wearing the facemask for 10 min before removing the facemask using the loops. However, it should be noted that this hierarchy was modified for two of the participants. The caregiver delivered intervention involved conducting a multiple- stimulus without replacement (MSWO) preference assessment, stating it was time to wear a mask, providing a rationale for why the mask was important, modeling putting on the mask, and then presenting the mask to their child. When the child completed a new step in the hierarchy without engaging in problem behavior, the caregiver provided praise and access to a preferred item. Following two successful occurrences at a step, the next step in the exposure hierarchy was targeted. All six participants reached the final steps within the hierarchy (i.e., wearing the facemask for 10 min before removing the facemask using the loops), and the caregivers reported the intervention favorably.

21.4.3 Shaping as an Evidence-Based Practice for ASD

One goal of the National Standards Project (National Autism Center, 2015) was to develop evidence-based practice guidelines for autistics/individuals diagnosed with ASD. Phase 2 (i.e., the most recent iteration) of the National Standards Project (National Autism Center, 2015) provided more recent information on the effectiveness of a broad range of interventions for autistics/individuals diagnosed with ASD. Phase 2 includes shaping as an established intervention under the broad categories of Behavioral Interventions and Comprehensive Behavioral Treatment for Young Children. While Phase 2 of the National Standards Project (National Autism Center, 2015) notes the challenges with broad categories such as Behavioral Interventions and Comprehensive Behavioral Treatment for Young Children, shaping being included under two of these categories should provide practicing behavior analysts with confidence in using shaping with autistics/individuals diagnosed with ASD.

Another entity that was created to help disseminate information regarding evidence-based practices for autistics/individuals diagnosed with ASD is the National Clearinghouse on Autism Evidence and Practice (NCAEP; Steinbrenner et al., 2020). The most recent resource made available from the NCAEP was the third iteration of the “Evidence-Based Practices for Children, Youth, and Young Adults with Autism” report that “describe[d] a set of practices that have clear evidence of positive effects with autistic children and youth” (Steinbrenner et al., 2020, p. 7). Shaping is not directly referred to in the Evidence-Based Practices for Children, Youth, and Young Adults with Autism report. However, several mechanisms, principles, and procedures involved in shaping are listed as evidenced-based (e.g., antecedent-based interventions, differential reinforcement, extinction, naturalistic intervention, reinforcement, task analysis). Therefore, while shaping is not directly referred to in the Evidence-Based Practices for Children, Youth, and Young Adults with Autism report, this report still provides support that shaping is an evidence-based practice for autistics/individuals diagnosed with ASD.

Despite the resource, report, or project, shaping and the underlying behavioral mechanisms and principles responsible for the behavior change observed when using shaping have a rich literature base demonstrating their effectiveness. Shaping relies on providing access to reinforcement for some responses and not for others (i.e., extinction). There is a copious number of experimental studies that have documented the effectiveness of reinforcement to increase the likelihood of future similar responses in similar situations. A quick Google Scholar search for the terms “reinforcement” and “behavior analysis” yields over 2.2 million results, and the same search for the terms “extinction” and “behavior analysis” yields over 1.6 million results. Though anecdotal, these cursory searches illustrate the breadth of the literature base behind the behavioral principles responsible for the effectiveness of shaping. Given this vast literature base, the onus of effectiveness of shaping ultimately falls on those implementing shaping. Nonetheless, shaping may, and should, be considered an evidence-based practice.

21.4.4 Recommendations for Research and Practice

21.4.4.1 Research

As evident from the preceding section, there have been several studies evaluating the effectiveness of shaping in isolation and in combination with other procedures. Nonetheless, given the historical foundations and illuminating discovery of shaping, the research related to the use of shaping with human participants is still somewhat scant when compared to other foundational procedures (e.g., standard functional analysis; Beavers et al., 2013; Hanley et al., 2003). While there may be several reasons for this, one likely reason is the aforementioned reciprocal nature of the shaping process. This is likely the reason for the sole inclusion of data related to the participant's/"shapee's" behavior and the exclusion of the interventionist's/"shaper's" behavior within research. Each of the previously described shaping studies are examples of this phenomenon. While the shapee's behavior may be of most interest within applied research, including an analysis of the reciprocal relationship of the shapee's and shaper's behavior will be invaluable for replication purposes as well as a fine-grained analysis of the shaping process. This fine-grained analysis will offer researchers and practitioners a better understanding of the shaping process. Therefore, it is recommended that future research on the use of shaping includes data with respect to the behavior of both parties involved in the shaping process. This could be done in a similar method used by Skinner (1957) when analyzing and diagraming the relationship between the speaker and listener within a verbal episode. No matter the approach, the reciprocal nature of the shaping process is likely the biggest challenge facing researchers evaluating the effectiveness of shaping.

Relatedly, the flexibility inherent to shaping (e.g., the vast number of shaper's responses that the shapee's behavior can occasion) is likely to create challenges for researchers evaluating shaping (Cihon, Ferguson, Leaf, et al., 2019b; Cihon, Ferguson, Milne, et al., 2019a). While flexible procedures likely align more closely to what occurs within practice, providing a technological description to aid in replication efforts for procedures with flexibility will be challenging, especially when attempting to publish in behavior analytic journals. Efforts to describe shaping with respect to the shaper's and shapee's behavior will likely be useful in addressing this challenge, especially if analyzed similar to Skinner's (1957) analysis of verbal episodes. This analysis would permit identifying conditional probabilities with respect to the shaper's and shapee's behavior. For instance, we may be able to examine the probability the shaper responds with the putative reinforcer based on specific topographies of responses emitted by the shapee as well as the probability the shaper responds with the putative reinforcer in the absence of specific topographies of responses emitted by the shapee.

One criticism of the use of shaping is the length of time sometimes required to shape an organism's behavior (Cooper et al., 2020). The validity of such claims notwithstanding, future research could evaluate this criticism in several ways. Much of the research using shaping has involved combining shaping with other approaches (e.g., prompting; Turner et al., 2020), which prevents evaluation of the effectiveness and efficiency of shaping alone. Moving forward, researchers should make concerted efforts to continue to evaluate the effectiveness and efficiency of shaping in isolation. Additionally, attempts to replicate and extend previous research that have combined procedures could include component analyses of the combined procedures. This research would permit direct evaluation if the commonly included additional procedures (e.g., modeling, prompting) are just additional or necessary for the effectiveness of the intervention. If the additional procedures are found to be just that, additional, they could be removed, yielding a more efficient intervention. Future research could also compare shaping alone to other procedures to identify the conditions under which shaping is more or less effective and/or efficient than other procedures. This could be done using commonly employed single-case comparative designs (e.g., alternating treatments design; Barlow and Hayes, 1979) as well as randomized clinical trials.

The majority of the research evaluating the use of shaping procedures for autistics/individuals diagnosed with ASD has involved mealtime challenges (e.g., food selectivity). This is likely due to the continual documented success of shaping as an intervention approach for mealtime challenges (e.g., Bernal, 1972; Hodges et al., 2017; Koegel et al., 2012; Tanner and Andreone, 2015). Researchers should continue to examine the effectiveness and efficiency of shaping to address a variety of mealtime challenges, especially as an alternative to more invasive or aversive approaches (Cihon et al., 2021). However, researchers should also allocate efforts to evaluating the use of shaping procedures with autistics/individuals diagnosed with ASD across a variety of responses outside of the mealtime context. While there have been some examples of this research (e.g., Cihon, Ferguson, Leaf, et al., 2019b; Cihon, Ferguson, Milne, et al., 2019a; Fonger and Malott, 2018; Wolf et al., 1964), additional research efforts will continue to be valuable and necessary especially considering some concerns with commonly used approaches to mealtime challenges (e.g., escape extinction; see Cihon et al., 2021; Riordan et al., 1980).

Finally, there is a dearth of research on identifying and evaluating effective methods to train practitioners to shape. Given its foundational and historical underpinnings of our science, future research should identify and evaluate effective training methods. This could begin by evaluating current best practices with respect to training (e.g., behavioral skills training; Kirkpatrick et al., 2021, video modeling; Mulqueen et al., 2021) as well as other emerging training methods (e.g., the teaching interaction procedure; Green et al., 2020). Other less common or new training methods should also be explored given the complex reciprocal process that is shaping. This would include examining how many sessions, exemplars, and the like will be necessary for someone to become a fluent, effective shaper. It will also be essential to pay careful attention to the dependent measures within any study evaluating a method to train others to shape. What exactly will be measured to evaluate the effectiveness of a training method? It is likely that to determine mastery, any measurement of the trainee's behavior will need to be evaluated in the context of the learner's behavior, thus, highlighting the reciprocal nature of shaping. It will also be essential to ask, "What is the necessary criteria that will need to be met in which context(s) to determine mastery?" It is likely that common mastery criteria (e.g., 80% correct across three consecutive sessions) will be insufficient. How many responses across how many learners and contexts will be necessary for one to conclude that the trainee has mastered shaping? All of these questions are ripe for research related to training practitioners to become fluent, effective shapers.

21.4.4.2 Practice

There are many challenges related to the use of shaping within practice. Perhaps the biggest challenge relates to training practitioners to shape. The reciprocal nature of shaping prevents the use of otherwise effective methods. For example, it seems unfeasible to be able to provide a thorough protocol with a series of if-then statements for how to respond based on the learner's response. While this method may be useful for procedures such as discrete trial teaching, where responding is often categorized as correct, incorrect, or prompted, it becomes less useful when learner responding is less constrained. Even if a thorough protocol may be developed, it is undesired due to the sources of stimulus control developed. That is, the practitioner would be responding to the protocol, as opposed to the learner's behavior, therefore, preventing the development of the reciprocal shaping process. Furthermore, focusing on a protocol is likely to develop a rule-governed repertoire as opposed to a contingency-shaped repertoire, preventing the practitioner from performing well when there is no previously learned rule. Therefore, training practitioners on how to shape becomes a much more involved task for the trainer.

Training practitioners to become fluent, effective shapers will likely require ample time observing a model with in vivo narration.

Someone who is already a fluent, effective shaper could model the process while narrating the rationale or learner behavior that is occasioning their response. This may also be accomplished with one person providing the model while another discusses what is occurring in vivo with the trainee. However, simply watching a model, with or without narration, is not likely to be effective in isolation. If it were, imagine how many sports fans would have acquired the skills of those they watch each week. Therefore, any use of modeling will also need to be paired with opportunities to shape while receiving feedback from the learner and the trainer. This places an emphasis on the development of a practitioner's shaping repertoire as contingency shaped as opposed to rule governed. With this in mind, training practitioners to become fluent, effective shapers will likely take considerable time and effort. Efforts to train practitioners to become fluent, effective shapers within the clinical setting could be used to help inform research on effective training methods yet to be explored in the research.

For those practitioners and trainers seeking guidance within the literature on shaping, it is recommended here to examine the nonhuman animal training literature (e.g., Ferguson and Rosales-Ruiz, 2001; Pryor, 1999; Schaefer, 1970). The additional procedures commonly employed by those providing intervention for humans are often unavailable to those working with nonhuman animals. For example, physical prompting is likely unfeasible when working with elephants due to their size. Therefore, an emphasis on shaping in the absence of additional procedures is required. As a result, many behavior analysts providing services for nonhuman animals are likely to develop fluent, effective shaping repertoires.

21.5 Conclusion

Shaping is engrained within the history of behavior analysis and ABA (Peterson, 2000, 2004; Skinner, 1951). This chapter provided a brief overview and implications of Peterson's (2000) exploration of Skinner's discovery of shaping. Reflecting on these implications should help to inform practice and research related to shaping. This chapter also described several select research examples with autistics/individuals diagnosed with ASD as well as humans with other challenges and nonhuman animals. While the selected research examples do not represent a comprehensive literature review related to shaping, they provide examples of the effectiveness of shaping across several different populations and responses. Furthermore, there have been several empirical demonstrations of the effectiveness of shaping, and it, as well as its components, is considered an evidence-based approach for autistics/individuals diagnosed with ASD. Recommendations for future research and practice were also provided in this chapter. Perhaps the most important recommendation for those seeking to become fluent, effective shapers is to shape often. Happy shaping!

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22 Functional Analysis Methodology: Best Practices and Considerations

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22.1 Functional Analysis Methodology: Best Practices and Considerations

Commonly reported challenging behavior displayed by individuals with autism spectrum disorder (ASD) and related disabilities include physical aggression (e.g., hitting, kicking, pinching, or pulling hair of others), self-injurious behavior (SIB; e.g., biting, scratching, or hitting oneself), property destruction (e.g., breaking, throwing, or defacing items), pica (i.e., ingestion of inedible objects such as paperclips and dirt), elopement (i.e., running away or leaving an area of supervision), and disruptive repetitive behavior (Condillac, 2007; Didden et al., 2012; Matson et al., 2009; McClintock et al., 2003). These challenging behaviors may lead to various risks for the individual and their caregivers (e.g., family members, teachers, staff; Hagopian, Dozier, et al., 2013). Risks for the individual include injury or harm, interference with learning skills and accessing less restrictive environments, and increased use of psychotropic medication and physical restraint, all of which may influence quality of life (Doehring et al., 2014; Holden & Gitlesen, 2004; Kahng et al., 2002). Risks to caregivers also include potential injury, as well as financial costs associated with property destruction and enhanced care or intervention and caregiver stress (Arora et al., 2019; Doehring et al., 2014; Einfeld et al., 2010; Kurtz et al., 2020; Manan et al., 2018; Pisula, 2007). Given these and other risks associated with the occurrence of challenging behavior in individuals with ASD and related disorders, an important goal of clinical practice and research is the assessment and treatment of challenging behavior.

Functional behavioral assessment (FBA) is a term used to describe various methods to determine environmental events that influence the occurrence of challenging behavior. The outcomes of an FBA are used to derive interventions to decrease and prevent the occurrence of challenging behavior and have been promoted as a humanistic approach to deriving interventions (Hanley, 2012). Common FBA methods include indirect assessments (e.g., interviews and questionnaires; Gadaire et al., 2021), descriptive assessments (i.e., direct observation and measurement of target behavior and relevant antecedent and consequences surrounding the behavior; Thompson & Borrero, 2021), and experimental (functional) analysis (FA; i.e., direct observation and measurement of target challenging behavior while antecedents and consequences are systematically manipulated; Beavers et al., 2013; Hanley et al., 2003; Iwata et al., 1982/1994). Although

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indirect assessments and descriptive assessments are commonly used in lieu of FAs in practice (see Oliver et al., 2015; Roscoe, Phillips, et al., 2015), there are limitations to their use for determining the function of challenging behavior and deriving interventions. Indirect assessments are often unreliable in that outcomes across caregiver informants often do not match and thus suggest different functions (e.g., Dracobly et al., 2018; Saini, Ubdegrove, et al., 2020). Furthermore, indirect assessments may not provide clear outcomes regarding potential functional variables or may hypothesize all functional variables (Rooker et al., 2015). Descriptive assessments provide only correlational data and often suggest functions (e.g., attention) that mask relevant functions (e.g., Camp et al., 2009; St. Peter et al., 2005) and thus may produce false-positive or false-negative outcomes. Functional analysis is the only FBA method that has almost 40 years of empirical support regarding its reliability and validity. Furthermore, it is the only FBA method that allows for determination of a functional (cause-effect) relation between an environmental event and the occurrence of challenging behavior and thus is the gold standard in FBA methodology. In fact, researchers have suggested FAs are a critical step in the assessment and effective intervention of challenging behavior (Beavers et al., 2013; Hanley et al., 2003; Slaton & Hanley, 2018).

The purpose of the current chapter is to provide an overview of FA methodology as an evidence-based procedure, describe important aspects for designing and conducting FAs, briefly discuss the analysis of FA outcomes, and review modifications of FA methodology that may be useful in various contexts or situations.

22.2 Overview of FA Methodology

Functional analyses involve direct observation and measurement of the occurrence of target behavior while manipulating relevant antecedents and consequences under at least one test condition and a control condition (Iwata & Dozier, 2008). Often, information from indirect and descriptive assessments (or informal observations) are used to determine antecedents and consequences that are manipulated in FA conditions (Dracobly et al., 2018; Neidert, Rooker, et al., 2013; Rooker et al., 2015). During a test condition, a potential reinforcement contingency is programmed for target challenging behavior, which includes (a) an establishing operation (EO) programmed to increase the value of the putative reinforcer, (b) a discriminative stimulus (S^d) that signals the availability of the putative reinforcer, and (c) the delivery of the putative reinforcer contingent on the occurrence of target challenging behavior (Hanley et al., 2003; Iwata & Dozier, 2008). During a control condition, the potential reinforcement contingency is absent. That is, the EO, S^d, and putative reinforcer are not present (Iwata & Dozier, 2008; Thompson & Iwata, 2005). Higher levels of challenging behavior in a test condition as compared to a control condition suggest there is a functional relationship between the environmental event manipulated in the test condition and the occurrence(s) of the challenging behavior. The development of FA methodology has allowed clinicians to derive more effective and socially valid interventions and reduce reliance on punishment procedures and pharmacological interventions (Axelrod, 1987; Kahng et al., 2002; Mace et al., 1991). That is, once the function of a challenging behavior is determined via an FA, function-based interventions can be derived to (a) decrease the motivation to engage in the challenging behavior, (b) eliminate the reinforcer for the challenging behavior, and/or (c) provide the reinforcer for an alternative response (Beavers et al., 2013; Hagopian, Dozier, et al., 2013; Hanley et al., 2003). Furthermore, large-scale studies have suggested that FAs have allowed for determination of the antecedent and consequent conditions in which challenging behavior within and across populations occurs, which has been suggested to be useful for designing environments to prevent the occurrence of challenging behavior (Ala'i-Rosales et al., 2019; Hanley, 2011).

The first comprehensive FA methodology was developed and evaluated by Iwata et al. (1982/1994) to determine the influence of common environmental events on the occurrence of

SIB displayed by nine individuals diagnosed with intellectual and developmental disabilities (IDD). The researchers measured the occurrence of SIB during 15-min sessions that included three test conditions and one control condition conducted using a multielement design. Test conditions were designed to concurrently assess whether SIB was maintained by social positive reinforcement in the form of attention (i.e., brief reprimands and physical attention), social negative reinforcement in the form of escape from demands (i.e., academic, self-care, or medical demands), or automatic reinforcement in the form of sensory stimulation or pain attenuation. The control condition was designed to address all variables manipulated during the three test conditions. Following repeated exposure to the four conditions, results showed consistently higher levels of SIB in specific test conditions as compared to the control condition for six of the nine participants. These results suggested there is utility in a comprehensive operant methodology for determining the variables maintaining challenging behavior.

Due to the success of the FA methodology developed by Iwata et al. (1982/1994), many researchers have replicated and extended this "traditional" FA methodology suggesting the generality of the methodology. That is, researchers have shown FA methodology to be useful in assessing the function of other challenging behavior including physical aggression, pica, property destruction, disruptive repetitive behavior, elopement, food refusal, and inappropriate sexual behavior. In addition, FAs have shown to be useful in determining the function of challenging behavior in various populations including individuals with ASD and related disabilities, children with attention deficit hyperactivity disorder, typically developing children, individuals with Tourette syndrome, and individuals with Prader-Will syndrome. Finally, FAs have been conducted in various settings including hospital settings, schools or classrooms, homes or residences, the community (e.g., playground), and to individuals in remote locations using telehealth. See Beavers et al. (2013) and Hanley et al. (2003) for more information on the generality of FA methodology.

In addition to the generality of FA methodology, research has shown the flexibility of FA methodology in determining the influence of not only common variables manipulated in Iwata et al. (1982/1994) (i.e., attention, escape from demands, and sensory reinforcers) but also various other variables such as access to tangibles (i.e., preferred items and activities, preferred edibles), access to attention within the context of diverted-attention antecedent situations (i.e., when attention is delivered to someone else), social escape (i.e., escape from interactions with others), as well as more complex contingencies such as escape to a preferred activity or attention (e.g., conversation about preferred topics), escape to access automatic reinforcement (e.g., ritualistic behavior or stereotypy), access to self-restraint, and access to compliance with participant mands (Hanley et al., 2014). Below is a description of some of the more common FA test conditions and the omnibus control condition used in traditional FA methodology.

22.2.1 Tests for Social Positive Reinforcement

Tests for maintenance of challenging behavior by social positive reinforcement have included an attention test condition (e.g., Fischer et al., 1997; Richman & Hagopian, 1999), a diverted-attention test condition (e.g., Fahmie, Iwata, Harper, et al. 2013; O'Reilly et al., 2000; Strohmeier et al., 2014), and a tangible test condition (e.g., Mace & West, 1986; Reed et al., 2009). During an attention test condition, the EO is deprivation from attention (i.e., the therapist ignores the participant). The programmed S^d is the presence of the therapist in the room while engaged in a task activity (e.g., reading a magazine). The programmed reinforcer is brief delivery of attention that has been reported or observed to be delivered in the natural environment (e.g., verbal reprimand, statements of concern, various types of physical attention, preferred conversation). During a diverted-attention test condition, the EO is deprivation from attention, as well as therapist delivery of attention to another person present in the room (e.g., peer or another adult). The programmed S^d is the presence of the two individuals interacting. The programmed reinforcer is brief delivery of attention as in the attention test condition. Furthermore, in attention conditions, best practice involves providing the individual access to a low or moderately preferred item to compete with automatically reinforced challenging behavior but not the occurrence of attention-maintained challenging behavior (Roscoe et al., 2008). Higher levels of challenging behavior in one of these test conditions as compared to the control condition suggest maintenance by social positive reinforcement in the form of attention. During a tangible test condition, the EO is removal of a preferred item or activity (as determined by indirect assessment, direct observation, or a systematic preference assessment). The programmed S^d is the presence of preferred items and activities. The programmed reinforcer is brief delivery of preferred items or activities. Higher levels of challenging behavior in this test condition as compared to a control condition suggest maintenance by social positive reinforcement in the form of tangibles. It is important to note that tests for a tangible function should only be included if strong evidence from indirect and direct assessments suggest a potential functional relation to avoid false-positive outcomes (Rooker et al., 2011).

22.2.2 Tests for Social Negative Reinforcement

Tests for maintenance of challenging behavior by social negative reinforcement have included an escape from demands test condition (e.g., Iwata, Pace, Kalsher, et al., 1990; McComas et al., 2000) and an escape from social interaction test condition (e.g., Harper et al., 2013; Taylor & Carr, 1992a, 1992b). During an escape from demands test condition, the EO is presentation of learning trials for tasks that have been reported or observed to be nonpreferred or difficult (e.g., self-care tasks, academic tasks, vocational tasks). The programmed S^d is the presence of the therapist and task materials. The programmed reinforcer is brief removal of demands and materials (i.e., escape). Higher levels of challenging behavior in this condition as compared to the control condition suggest maintenance by social negative reinforcement in form of escape from demands. During a social-escape test condition, the EO is continuous social interaction (i.e., the therapist interacts with the individual in close proximity). The programmed S^d is the presence of the therapist near the individual. The programmed reinforcer is brief removal of social interaction (i.e., the therapist stops interacting with the individual and moves away). Higher levels of challenging behavior in this test condition as compared to a control condition suggest maintenance by social negative reinforcement in the form of escape from social interactions (Harper et al., 2013; Taylor & Carr 1992a, 1992b).

22.2.3 Test for Automatic Reinforcement

Tests for maintenance of challenging behavior by automatic reinforcement include an alone or ignore test condition (e.g., Querim et al., 2013; Vollmer et al., 1995). In the no interaction/alone condition, the EO is deprivation from stimulation (i.e., a barren environment). The S^d is the presence of a barren environment either while the individual is alone in the room or in the room with the therapist to ensure safety. The reinforcer is not mediated by others, and thus not programmed, but is produced by engaging in the challenging behavior (e.g., hand flapping may produce visual stimulation; hand-to-head SIB may attenuate pain). Higher levels of challenging behavior in this condition that persists over time suggest maintenance by automatic reinforcement.

22.2.4 Control Condition

A common control condition used in FA methodology is an omnibus control condition, often referred to as the play condition (Fahmie, Iwata, Querim, et al., 2013; Iwata et al., 1982/1994). In this condition, all variables manipulated in test conditions are controlled for by programming for the absence of relevant EOs and no longer programming reinforcers for challenging behavior. Thus, the antecedents programmed in the play condition include continuous access to preferred items and activities to interfere with the occurrence of automatically reinforced challenging behavior, continuous access to preferred attention to decrease the motivation to engage in challenging behavior to access attention, and no presentation of demands (or other aversive events). Furthermore, there are no programmed reinforcers for challenging behavior. Thus, low levels of target challenging behavior should be observed in this condition, which make it an ideal control condition under most situations (Betz & Fisher, 2011; Iwata & Dozier, 2008). However, the play condition may not be the best control condition for challenging behavior potentially maintained by escape from social interaction because it involves dense schedules of attention delivery (Fahmie, Iwata, Querim, et al., 2013; Harper et al., 2013). Therefore, an ignore or alone control condition may better control for the variables manipulated in this test condition (Fahmie, Iwata, Querim, et al., 2013).

22.3 Designing Functional Analyses

In addition to the generality and flexibility of FA methodology, research has suggested refinements to traditional FA methodology, which has culminated in suggestions for best practice, particularly with respect to increasing the efficacy, efficiency, and safety of the methodology (Beavers et al., 2013; Hanley et al., 2003; Saini, Fisher, et al., 2020). Thus, the information in this section outlines best practices in designing FAs, which includes discussion of determining (a) target challenging behavior, (b) procedural practices and safeguards in conducting FAs of severe challenging behavior, (c) FA conditions, (d) setting, therapists, and modality to conduct an FA, (e) session duration, (f) experimental design of FA, and (g) other best practices for promoting clear and efficient FA outcomes.

22.3.1 Determine Target Challenging Behavior

One of the first steps in designing an FA is to determine which challenging behavior(s) will be assessed. To determine this, clinicians should use indirect assessments and descriptive assessments (or informal direct observations) to identify challenging behavior displayed by the target individual and to derive operational definitions of the behavior. Once challenging behavior and their definitions are determined, a clinician must determine the relative priority of the individual's challenging behavior (i.e., the order with which behavior should be assessed and treated). Challenging behavior that poses a risk to the health and safety of the individual or those around them or interferes with the individual's learning or quality of life (i.e., access to long- and short-term reinforcers) should be prioritized for assessment and treatment (Neidert, Rooker, et al., 2013). Further, challenging behavior that occurs at high frequencies should be prioritized over behavior that occurs infrequently. However, if a low-frequency challenging behavior is of concern, various modifications to FA methodology may be necessary (e.g., extend the session duration or conduct under more naturalistic conditions; Kahng et al., 2001) as it may be difficult to identify the behavioral function (Davis et al., 2012). Additional information regarding these and other modifications is discussed below.

In many cases, an individual may engage in multiple challenging behaviors that require assessment and intervention (i.e., each behavior poses risks or barriers for the individual). In these situations, a clinician may have difficulty assigning priority and may opt to assess multiple topographies of challenging behavior simultaneously (i.e., place contingencies on multiple response topographies during the FA). Although this is a common practice that continues to increase in the literature (Beavers et al., 2013), it is important for clinicians to consider the implications this practice may have on the outcomes of the assessment. That is, combining challenging behavior topographies into one assessment may mask the true function of individual topographies of behavior (Asmus et al., 2013). For example, as shown by Asmus et al. (2013), when stereotypic behavior and disruptive behavior were combined in one FA the occurrence of stereotypic behavior occurred at high levels across conditions (suggesting an automatic function), which masked the function of disruption that occurred at lower levels. It was not until the two behaviors were assessed in separate analyses that a clear function was identified for the participant's disruption, which was maintained by social variables. In addition to masking, the function of a single response topography, including multiple topographies of behaviors in one FA, may increase the likelihood of obtaining results that suggest the behaviors are maintained by multiple sources of reinforcement (i.e., multiply controlled; Beavers & Iwata, 2011). This outcome may result in interventions that are ineffective or countertherapeutic for some functions (e.g., Smith et al., 1993).

However, assessing several target behaviors simultaneously in a FA may be more efficient, which is an important consideration for clinicians. One option is to target the most problematic challenging behavior in the FA (i.e., place contingencies on this behavior) while simultaneously collecting data on graphing and analyzing the occurrence of other relevant topographies (Bell & Fahmie, 2018). However, if a clinician decides to place contingencies on multiple challenging behaviors in an FA, it is recommended that behaviors are limited to only a few topographies (Hanley et al., 2003) that are likely to be in the same response class (Saini et al., 2020). That is, including challenging behavior that is likely to be maintained by social reinforcement *or* challenging behavior likely to be maintained by automatic reinforcement, rather than including all response classes, will decrease the likelihood of masking relevant functions or suggesting multiple control outcomes. Furthermore, when including multiple topographies, it is best practice to graph and analyze data for each topography separately, which may lead to more differentiated outcomes (Derby et al., 2000).

22.3.2 Determine Procedural Safeguards and Practices

Because FAs are designed to evoke and reinforce the occurrence of challenging behavior, the target individual and therapist may be at risk for injury or harm (Hanley et al., 2003; Fisher et al., 2013). Thus, once the target challenging behavior has been identified and objectively defined, it is important for clinicians to conduct a risk assessment to determine whether the benefits associated with conducting an FA of challenging behavior outweigh the risks (Deochand et al., 2020; Fisher et al., 2013; Iwata & Dozier, 2008; Wiskirchen et al., 2017). Furthermore, based on the results of this assessment, clinicians can develop appropriate procedural safeguards to reduce risks and maximize benefits in conducting an FA with a particular individual (Saini et al., 2021; Deochand et al., 2020; Iwata & Dozier, 2008; Weeden et al., 2010). Wiskirchen et al. (2017) proposed a risk assessment as a formal clinical decision-making model and recommended assessing and managing risk across four primary domains: (a) clinical experience of those conducting the FA, (b) intensity of the target challenging behavior, (c) suitability of the physical environment in which the FA will be conducted, and (d) the number and composition of support staff available to assist in the FA. We review considerations for each of these domains below.

Various professionals should be involved in the design, implementation, and oversight of FAs of severe challenging behavior. First, to the extent possible, clinicians should consider medical evaluation and professional oversight to (a) determine whether behavioral assessment should be conducted, (b) provide ongoing evaluation of potential risk or injury, and (c) determine when FA sessions should be terminated (Iwata et al., 1982/1994). Although ongoing and day-to-day medical professional oversight is feasible at inpatient facilities and hospitals, other environments do not have medical staff to conduct ongoing evaluations. Thus, clinicians should exercise additional procedural safeguards to ensure the safety of the individual. Another professional that should be involved in the development and implementation of an FA is a Board Certified Behavior Analyst (BCBA) with expertise in FA methodology and function-based intervention. In addition, the BCBA and therapists associated with the case should be trained to implement best practices to increase the safety of the individual and others involved (Hanley, 2012).

When considering the intensity of the target challenging behavior, one should ask questions about (a) the utility of alternative assessment procedures in lieu of conducting an FA, (b) whether the challenging behavior will be more intense in or out of the assessment, and (c) whether the occurrence of the challenging behavior will result in injury (Hanley, 2012). Challenging behaviors that are life-threatening or may result in hospitalization or severe harm should be assessed using other FBA methods. Furthermore, modifications to standard FA methodology may need to be addressed to decrease harm, if it is determined that an FA is feasible (see below). However, it is important to consider that the reason an FA is considered is because the individual already regularly engages in the challenging behavior in their daily life and likely contacts contingencies that are programmed in an FA (Kahng et al., 2015).

Determining whether the target individual will be at greater risk during the FA than they normally experience throughout a typical day presents an additional consideration of risk mentioned by Hanley (2012). Best practice in FA methodology involves various procedures (e.g., programming S^ds to enhance discriminated responding, providing reinforcers on a continuous schedule, and providing consequences for lower-intensity behavior or attempts at behavior; see additional information below) that are specifically included to produce lower levels of target challenging behavior as those observed in the everyday environment (Kahng et al., 2015). Thus, the occurrence of the target challenging behavior in an FA may not expose the individual or others to any greater risk of injury than what occurs outside of the FA. To empirically evaluate whether challenging behavior is more dangerous inside or outside of an FA, Kahng et al. (2015) reviewed records of 99 participants admitted for the assessment and treatment of SIB to determine the amount and severity of injuries sustained within versus outside of the FA context using a severity index scale (i.e., Self-Injury Trauma [SIT] Scale; Iwata, Pace, Kissel, et al., 1990). Results showed that although the rate of injury during the FA was relatively higher than outside of the FA, levels were low regardless of the context. Additionally, when injuries did occur, they scored very low on the severity index scale. This is particularly important given the severity of the SIB displayed by these participants and may suggest even less injury for individuals with less severe SIB. It is also important to note that research suggests FAs are not likely to increase the intensity or occurrence of challenging behavior outside of the FA (e.g., in the classroom or home; Shabani et al., 2013).

In addition to considering professional oversight and intensity of the behavior, clinicians should consider additional safety procedures when conducting FAs of challenging behavior that may cause harm to the individual or others. These procedures include (a) modifications to the assessment environment to increase the safety of all parties involved in the FA, (b) a system for monitoring injuries and preventing escalation of challenging behavior, and (c) the presence of trained staff who can provide first aid for minor injuries (Iwata & Dozier, 2008; Neidert, Rooker, et al., 2013). First, clinicians should ensure that the assessment environment includes soft stimuli (e.g., toys and task materials) and padded floors, walls, and tables to reduce the likelihood of injury or destruction from throwing items or SIB (Hanley, 2012). Second, monitoring of injuries should be ongoing; clinicians should conduct routine evaluations of injuries prior to each session, following every few sessions if little or no challenging behavior occurs, and following sessions in which the participant's physical condition or level of responding meet a criterion for termination. In addition, clinicians should create session-termination criteria to prevent injury. Sessions can be programmed to terminate following minor tissue damage such as reddening or breaking of the skin (Betz & Fisher, 2011) or based on the frequency of challenging behavior that occurs in the session or a period of time during the session (e.g., Iwata et al., 1982/1994). Third, all primary staff should be trained in basic first aid such that they can perform immediate treatment on minor injuries, as well as when they should call for medical assistance for more involved injury. Furthermore, additional trained staff may be necessary to help ensure safety and implement crisis management procedures (Kahng et al., 2015). Finally, all safety procedures should be reviewed during the informed consent and assent process. For this process, the clinician should provide the rationale and method for conducting an FA, explain the results of the risk assessment, and describe the safeguards used to address these potential risks (Iwata & Dozier, 2008; Neidert, Rooker, et al., 2013).

In addition to the procedural safeguards mentioned above, clinicians should consider other strategies for blocking or interfering with the occurrence of challenging behavior to protect the individual and others from harm or injury. Response blocking is a strategy that involves preventing the occurrence of challenging behavior by briefly disrupting the occurrence of a potentially harmful response (Reed et al., 2013). For example, if an individual were to engage in hand-to-head SIB, the therapist might prevent the individual's hand from reaching the head by placing their hand in the way to block the hand-to-head contact. Although response blocking is designed to reduce injury, its primary limitation is that it might inadvertently function as either a positive punisher or a positive reinforcer, which may result in false-positive of false-negative outcomes (Le & Smith, 2002). If practitioners use response blocking during an FA, researchers recommend it be used consistently and across all conditions (Neidert, Rooker, et al., 2013).

In addition to response blocking, protective equipment may be used to prevent injury (Fisher et al., 2013). Protective equipment includes devices or clothing that are worn by the target individual or therapist, as well as materials or devices placed in the environment to prevent injury and decrease risks. Clinicians should use the results of a risk assessment and the topography and severity of the challenging behavior to inform the type of protective equipment to use. For example, an individual with head-directed SIB might wear a padded helmet to help prevent injury to their head. For instances of physical aggression, the therapist may wear arm, chest, or leg pads under their clothing to protect them from biting, hitting, or kicking displayed by the individual. Despite the potential advantages of using protective equipment, their use may interfere with determining the function of challenging behavior and in some situations may exacerbate challenging behavior. For example, previous research has shown that wearing protective equipment for SIB may obscure FA results when the challenging behavior is maintained by automatic reinforcement because protective equipment may function as sensory extinction or punishment for engaging in the automatically reinforced challenging behavior (Borrero et al., 2002; Le & Smith, 2002; Moore et al., 2004). As with response blocking, researchers recommend protective equipment be used consistently across all FA conditions (Neidert, Rooker, et al., 2013).

In summary, after a risk assessment indicates the need for safety procedures, clinicians should consider several procedural safeguards when developing and conducting an FA that can help to ensure the safety of those involved and to decrease the likelihood of damage to the assessment environment. Deochand et al. (2020) developed an FA risk assessment decision-making tool based on the domains described by Wiskirchen et al. (2017) that may assist clinicians when assessing risk and considering procedural safeguards and practices when conducting FAs. Furthermore, researchers have developed and evaluated methodological modifications to standard FAs to address safety concerns, which involve decreasing the occurrence of severe challenging behavior in FAs (see below).

22.3.3 Design FA Conditions

Another important consideration in FA methodology is to determine which FA conditions will be conducted, as well as how those FA conditions will be conducted. This information is often derived from information gathered in indirect assessments and descriptive assessments. Although information gained from informant responses to indirect assessments are commonly unreliable (Dracobly et al., 2018; Saini, Ubdegrove, et al., 2020) and descriptive analyses do not provide information on the functional relation between the events observed (Bijou et al., 1968; Thompson & Iwata, 2007), the results of these assessments can be used to generate hypotheses about possible maintaining variables, which can guide the development of test conditions and inform certain aspects about the conditions that will be conducted within an FA (Hagopian, Rooker, et al., 2013).

For instance, the data gathered during indirect and descriptive assessments may be used to inform specific characteristics of the antecedents or consequences arranged for each condition. That is, if an attention test condition is being designed, practitioners may look to the results of the indirect and descriptive assessments to determine the specific type of attention that commonly follows the behavior and incorporate this type into the FA condition to recreate the naturally occurring environmental conditions and enhance the ecological validity of the assessment (Kodak et al., 2007). The same can be done for determining the types of demands or aspects of demand delivery (e.g., rate) that are likely to evoke challenging behavior and the type of preferred tangibles that are withheld or removed that evoke the behavior of concern. Furthermore, researchers have developed methods for systematically identifying types of attention (e.g., Fisher et al., 1996; Roscoe et al., 2010), types of demands (e.g., Call et al., 2009; Roscoe et al., 2009), or tangible items offered (e.g., Fisher et al., 1992) during test (and control) conditions of an FA.

In addition, if information gathered during indirect or descriptive assessments strongly suggest there are only one or two potential environmental events that might evoke and maintain the target behavior, the clinician may choose to only focus on designing test conditions to assess the isolated influence of each of these variables and need not worry about conducting other test conditions (Iwata & Dozier, 2008); Holehan et al., 2020; Strohmeier et al., 2014). For example, if results of these assessments suggest a hypothesized automatic reinforcement function, then consecutive alone/no interaction test conditions may be conducted to determine whether the target behavior persists in the absence of social contingencies. If the target challenging behavior persists across alone/no interaction conditions, then the outcomes suggest an automatic reinforcement function; if the target challenging behavior decreases across conditions, then outcomes suggest maintenance by social contingencies (Querim et al., 2013), which would require further assessment. Furthermore, if results of the assessments suggest a hypothesized social function such as social positive reinforcement in the form of attention, then an attention test condition can be conducted and rapidly alternated with a test-specific control condition in which continuous attention is provided (Strohmeier et al., 2014). Not only does this strategy likely produce a more efficient FA given that only the hypothesized variables maintaining the behavior are tested, but this could also minimize the risk of identifying false-positive outcomes due to delivering non-indicated, but potent consequences (e.g., preferred tangibles) on the occurrence of challenging behavior (Retzlaff et al., 2020; Rooker et al., 2011). However, there are several limitations of this strategy, as well as important considerations when using this strategy. One limitation is that additional analyses may be necessary if clear effects are not observed based on the hypotheses generated. Another limitation is that other functions of the target behavior may be missed because they were not assessed in the FA. Finally, an important consideration when conducting only one or two test conditions is what control condition is best to use (see Fahmie, Iwata, Querim, et al., 2013).

Finally, if FA outcomes are inconclusive or unclear, additional indirect assessments and descriptive assessments may need to be conducted to determine whether idiosyncratic contingencies (antecedents and/or consequences) should be tested in modified FA conditions (Roscoe, Schlichenmeyer, et al., 2015). This process might include conducting a closed- and open-ended indirect assessment for identifying idiosyncratic events to subsequently test in a modified FA (see Schlichenmeyer et al., 2013).

22.3.4 Determine Setting, Therapists, and Modality of FA

Although many studies on the use of FAs have been conducted in inpatient clinics (Beavers et al., 2013), research has demonstrated FAs can be effectively implemented across various settings. Furthermore, research has shown an increase in FAs conducted in more naturalistic settings (Beavers et al., 2013; Germansky et al., 2020). The bias observed in the literature toward conducting FA sessions in inpatient clinical settings may be a product of the increased degree of control afforded in these environments (Hanley et al., 2003), particularly with respect to isolating the influence of relevant variables. Furthermore, conducting sessions in a controlled setting as opposed to the natural environment may also allow for greater safety precautions (e.g., padded session room) to mitigate risk of harm for the individual and others (Weeden et al., 2010). Finally, conducting sessions within an individual's natural environment may be disruptive to the ongoing activities (e.g., in a school setting or in the community), may require additional staff involvement to ensure the safety and adequate supervision of other individuals in the environment (e.g., other children in a classroom), and will likely require upfront planning to control for possible confounding variables present in the setting (Iwata & Dozier, 2008; Lang et al., 2010).

Although research has demonstrated that FAs conducted in controlled environments can effectively identify contingencies responsible for the maintenance of challenging behavior, it is possible that the relevant stimuli present in the natural environment cannot be replicated in the contrived setting (Hanley et al., 2003); thus, a practitioner may not be able to approximate the natural conditions under which a behavior occurs in a contrived setting. An intervention derived from FA results may only be effective if the contingencies under which the behavior was observed in the assessment are representative of those contingencies in the individual's natural environment (Lang et al., 2010; Mace et al., 1991). Thus, it is important that clinicians, whether they decide to conduct a session in the individual's natural environment or in a controlled alternative environment, ensure the setting closely mimics the conditions under which the individual typically engages in challenging behavior.

In addition to the setting, another variable that may influence the outcomes of FAs is who serves as therapist (Saini, Fisher, et al., 2020). Functional analyses have historically included trained clinicians and researchers as therapists resulting in successful outcomes. However, several comparison studies (e.g., Kurtz et al., 2013; Ringdahl & Sellers, 2000; Thomason-Sassi et al., 2013) have suggested that who serves as therapist in FAs may influence the outcomes. That is, challenging behavior may show a different function based on whether a caregiver who has a substantial history with the individual versus an unknown individual serves as therapist. Recent research has shown that caregivers (e.g., teachers, staff, and parents) can be effectively trained to serve as FA therapists (Germansky et al., 2020) and inclusion of caregivers as therapists may help to clarify unclear FA outcomes (Kurtz et al., 2013). Thus, although including caregivers as therapists may involve additional planning, training, and coaching, it may be one method to enhance the external validity of FAs. Furthermore, inclusion of caregivers as therapists may increase the likelihood of increased treatment integrity with their implementation of the intervention (Germansky et al., 2020); however, more research is needed to validate this possibility.

With respect to modality of FAs, they have traditionally been conducted in person. However, with the rising popularity of telehealth (i.e., health-related services delivered via telecommunication technology; Boisvert et al., 2010) as a cost-effective service delivery model in other disciplines (Morrison et al., 2001), researchers have begun evaluating this modality as a behavioral service delivery modality. Telehealth is a particularly viable solution for delivering assessment services and behavioral consultation to underserved areas (Bloomfield et al., 2020) such as individuals living in rural areas that may have difficulty accessing certain services or may be required to travel long distances to receive necessary support (Bolin et al., 2015; Pollard et al., 2017). Additionally, telehealth may be a service delivery option for FAs in schools given that they may not be consistently implemented in schools due to constraints in the school setting (e.g., lack of FA expertise among school staff; Pennington et al., 2017), which may result in challenging behavior being left untreated and, as a result, negatively impacting student success.

Thus, given the increased flexibility the telecommunication modality affords, researchers have evaluated the use of this technology to deliver services effectively and efficiently. With respect to the use of telehealth for the implementation of FAs, research has demonstrated the efficacy of remote coaching for teachers, parents, and other staff to implement FA procedures across various locations (e.g., in home, at a clinic, in schools; Schieltz & Wacker, 2020). The telehealth modality provides clinicians with a cost-effective (Wacker et al., 2013) and efficient way to deliver services even when an individual or organization (e.g., school, clinical site) has barriers constraining their access to services.

Although telehealth has been demonstrated to be a viable modality for behavior analysts to deliver services, there are several variables to consider when determining if this service delivery model is right for a change agent or their client (Lerman et al., 2020). First and foremost, it is recommended that clinicians receive training on how to effectively utilize this modality to ensure competence before delivering services (Cox et al., 2020). Furthermore, clinicians must mitigate risk of harm to their client when providing services; thus, a clinician must consider the severity of the individuals challenging behavior and the resources available in the individual's environment when determining if telehealth is an appropriate modality (Pollard et al., 2017). If the severity of an individual's challenging behavior would warrant the use of additional measures in a clinical setting to ensure safety (e.g., response blocking, additional staffing, padding in the room), the clinician should ensure the same resources are available in the setting in which the individual will receive services (e.g., in their home, school setting; Lerman et al., 2020). If an individual engages in severe challenging behavior and does not have access to the necessary resources to keep them safe, receiving services via telehealth may not be an appropriate modality for service delivery. For additional information regarding best practices and problem solving in telehealth services, we refer the reader to Lerman et al. (2020).

Although using telehealth has been shown to cut costs significantly (Wacker et al., 2013), there are initial startup costs a practitioner may need to consider. Wacker et al. (2013) shared that it cost $1800 to set up a clinic-based telecommunication system. Although a practitioner may not require as expensive of a setup as the one used by Wacker et al., a reliable internet connection, a computer with a webcam, headphones, and HIPPA compliant video software are some of the requirements for delivering services via telehealth successfully (Lee et al., 2015).

22.3.5 Session Duration

Although early studies on FAs involved the use of 15-min sessions (Iwata et al., 1982/1994), researchers have focused on determining the session duration that results in clear FA outcomes. To determine the influence of shorter session durations on the validity of FA outcomes, researchers have evaluated the extent to which brief exposure to FA conditions resulted in similar outcomes to FAs containing longer exposure to conditions (e.g., Griffith et al., 2021; Wallace & Iwata, 1999). For example, Wallace and Iwata (1999) conducted a retrospective analysis of 46 FA data sets and analyzed the FA outcomes of the data based on different session durations (5 min vs. 10 min vs. 15 min). Results showed that the outcomes for 10- and 15-min sessions were identical, and differences were observed between 5- and 15-min sessions in only three cases. Thus, recommendations for best practice, particularly in the assessment of severe challenging behavior, are to start with brief, 5-min sessions and extend session duration if repeated exposure does not produce clear FA results (Betz & Fisher, 2011). For example, if the rate of target behavior is low, it may be necessary to extend session duration to allow time for the EO to evoke challenging behavior such that condition-specific consequences can be delivered (Davis et al., 2012; Tarbox et al., 2004). In this case, one way to clarify FA outcomes would be to conduct 10 min or longer sessions to increase the likelihood of challenging behavior in the FA (Kahng et al., 2001).

22.3.6 Experimental Design

According to Beavers et al. (2013), most published FAs have identified clear behavioral functions using multielement experimental designs. However, there may be situations when a multielement design is not feasible or pertinent for indicating behavioral function and alternative designs may need to be employed such as a reversal design or a sequential, test-control (or pairwise) design (Iwata et al., 1994). We describe each of these three approaches below, discuss unique characteristics and considerations for each, and review the pros and cons for each design.

22.3.6.1 Multielement Design

The multielement design is often selected as the initial experimental design for an FA because it involves rapidly alternating test and control conditions and is likely to produce more efficient results when compared to using a reversal design. Multielement designs are also less susceptible to extraneous variables (e.g., sleep deprivation, illness) given all conditions are equally exposed to the variables as they are rapidly alternated. The primary limitation of the multielement design is that when levels of challenging behavior occur at similar levels across conditions (i.e., undifferentiated), it is unclear whether this pattern implicates automatic reinforcement as the maintaining variable or whether the results are due to multiple-treatment interference (i.e., carryover effects). Thus, additional modifications and designs might be necessary to clarify outcomes. If this pattern does emerge, one way to differentiate automatically reinforced behavior from multiple-treatment interference is to conduct a series of extended alone/no interaction sessions (Querim et al., 2013; Vollmer et al., 1995). If the target response does not persist during the extended alone/no interaction sessions, automatic reinforcement can be ruled out and multiple-treatment interference is the likely explanation for the pattern of undifferentiated responding. If this is the case, it may be that the individual's behavior is failing to discriminate between the differential antecedent and consequent variables programmed across each of the conditions. Therefore, the next step would be to adjust the design to arrange isolated or extended exposure to a single test condition using a reversal (Vollmer et al., 1993) or a test-control (pairwise; Iwata et al., 1994) design.

22.3.6.2 Reversal Design

When results are unclear in a multielement design, it may be due to a failure of the individual's behavior to discriminate across several, rapidly alternating test conditions in the multielement design (i.e., multiple-treatment interference) or because the EO for engaging in the target behavior is not at strength due to relatively brief exposures across alternating test and control conditions. Therefore, a potential solution might be to arrange the test and control conditions in a more traditional reversal-type design (Vollmer et al., 1993), in which the test and control conditions are presented sequentially. That is, one condition (test or control) is presented at a time and sessions are conducted within each condition until clear trends in responding are observed. By programming this extended exposure to each test condition, it provides an opportunity for the potential EO to build in strength across consecutive sessions and for the individual's behavior to experience consistent consequences to clarify the target behavior function. The primary limitation of this approach is that it is not efficient and is only recommended when results of the initial multielement FA are undifferentiated or when only a few sessions are required to determine behavioral function.

22.3.6.3 Test-Control (Pairwise) Design

A sequential, test-control (or pairwise) design (Iwata et al., 1994) combines the best features of the multielement and reversal designs to control for each of the potential limitations associated with these approaches. In general, this design consists of several phases implemented in a sequential fashion (like the reversal design); however, each phase consists of two conditions (a test and a control) presented concurrently in a multielement format. By combining these design elements, this approach reduces the likelihood of interaction effects (limitation of multielement design) by alternating between a single test and control condition within each phase and minimizes the primary limitation of the reversal design by programming a control condition within each phase (as opposed to it being implemented sequentially in its own phase), which may be a more efficient method when compared with the reversal design. Although the pairwise design may not be superior to either the multielement or the reversal design, its use might be considered when multielement data provide unclear results or when the effects of multiple variables cannot be examined efficiently within the context of a reversal design. Therefore, this approach should be considered after the traditional multielement FA outcomes are undifferentiated.

22.3.6.4 Progressing from Brief to More Extended FA Methods

The overarching goal of FA methodology is to employ an approach that accurately identifies the maintaining variable(s) of the target challenging behavior in an efficient manner, so the results can be used to inform an effective function-based intervention as soon as possible. Therefore, it stands to reason that behavior analysts should approach the design of the initial FA such that it could produce differentiated response patterns as quickly as possible without compromising experimental precision. However, not all experimental analyses yield conclusive results, and more extended or complex analyses should be pursued when behavioral function is not quickly identified.

Vollmer et al. (1995) proposed a decision-making model that was designed to complete an assessment as quickly as possible while attempting to establish as much experimental control as possible. For instance, the initial phase (i.e., Phase 1) consisted of a brief assessment (i.e., single exposure to each test condition) and only progressed onto a full multielement design in Phase 2 if differentiation was not produced under brief exposure to the test and control conditions. Next, progression to Phase 3 would only happen if undifferentiated responding occurred during the multielement FA. In this model, Phase 3 consisted of exposure to extended alone/no interaction sessions to rule out an automatic function. Finally, if behavior did not persist during the Phase 3 test for automatic reinforcement, Phase 4 would consist of experiencing the test and control conditions in the reversal-type design described above.

Since the publication of Vollmer et al. (1995), there have been many advances in FA methodology that could be considered and incorporated into an FA progression decision-making model. Hagopian et al. (2013) showed that if initial FAs resulted in unclear outcomes, the use of additional modifications in FA methodology (i.e., experimental design, antecedents, consequences) clarified the outcomes in nearly all cases. Based on contemporary research on FA modifications, we present another FA progression decision model that might be used, which is similar to that outlined by Henry et al. (2021). First, if it is hypothesized that the target behavior could be maintained by automatic reinforcement, Phase 1 could consist of consecutive alone/no interaction sessions to rule this potential function in or out (Querim et al., 2013). Next, if automatic reinforcement is not hypothesized or ruled out, Phase 2 could consist of using a pairwise design to test hypothesized social functions derived from indirect and descriptive assessments (or other brief methods for testing common functions such as the trial-based FA) and progressing to a traditional (full) FA with best practice recommendations (see Henry et al., 2021) if results are inconclusive (Phase 3). Following Phase 3, if these approaches do not produce differentiation, Phase 4 could be adopted wherein session duration could be extended to program longer EO exposures or an alternative design could be employed to mitigate potential interaction effects associated with alternating between too many conditions. Finally, if responding is still undifferentiated in Phase 4, Phase 5 could explore the possibility of unique or idiosyncratic environmental variables (e.g., Hagopian, Rooker, et al., 2013; Roscoe, Schlichenmeyer, et al., 2015; Schlichenmeyer et al., 2013) and making modifications to session conditions (i.e., antecedents, consequences) or design of the FA to capture these unique features of the individual's everyday environment.

22.3.7 Additional Considerations

Although FAs often result in clear outcomes, inconclusive (undifferentiated) outcomes sometimes occur (Hagopian, Rooker, et al., 2013). These outcomes might include (a) low levels of behavior across all conditions, (b) high levels of behavior across conditions, or (c) variable levels of behavior across conditions. In addition to the best practices and considerations for designing and conducting FAs discussed already (e.g., rule out medical causes for target behavior, include one or a few target behaviors in FA, determine conditions based on pre-FA assessment procedures, consider alternative designs, program for stimuli from the natural the environment, extend session duration), several other procedures should be included to increase the clarity, safety, and efficiency of FAs. First, in traditional FAs, the order of conditions should be programmed in a fixed sequence (i.e., ignore, attention, play, escape) to capitalize on programmed EOs in previous conditions (Hammond et al., 2013). Second, additional discriminative stimuli such as different therapists, different rooms or locations, or different colored shirts worn by therapists across conditions should be programmed to enhance discrimination across conditions (Conners et al., 2000). Third, presession access to programmed reinforcers should be limited to decrease the likelihood of satiation effects (O'Reilly & Carey, 1996). Fourth, a period of time without challenging behavior should be programmed before beginning subsequent sessions (McGonigle et al., 1987). Fifth, contingencies for target challenging behavior, as well as less intense occurrences of challenging behavior (or attempts at challenging behavior), should be programmed on a fixed-ratio (FR1) schedule of reinforcement to decrease the severity of challenging behavior (Hanley, 2012).

22.4 Analyzing Functional Analysis Outcomes

In FAs, observers collect data on the occurrence of target challenging behavior, which are then summarized (i.e., aggregated for each session) and graphed for analysis. Visual analysis is commonly used to determine the variables maintaining challenging behavior, which involves decisions based on the level, trend, and variability of data paths. Results showing higher levels in a single test condition as compared to the control condition suggest maintenance by the variable. However, results showing higher levels in several test conditions as compared to the control condition suggest multiple controls. Although visual analysis is the most common procedure for determining FA outcomes, more structured criteria to aid in visual analysis have been proposed (e.g., Hagopian et al., 1997; Roane et al., 2013; Saini et al., 2018; Standish et al., 2021) to produce more reliable and valid interpretations of the data, as well as potentially increasing FA efficiency. Furthermore, this approach may serve as an important aid when training visual analysis skills to behavior analysts (Saini et al., 2018). However, to date, it is unclear the extent to which these criteria are used outside of certain research publications.

Furthermore, in addition to summarizing and analyzing aggregate data via visual analysis, conducting and graphing within-session analyses (e.g., Kahng & Iwata, 1999; Roane et al., 1999; Vollmer et al., 1993, 1995) may provide additional information regarding the function of challenging behavior. Within-session analyses may involve a minute-by-minute analysis of responding during a session. For example, the occurrence of challenging behavior across minutes in a session may be beneficial for identifying potential carryover effects from a previous session (e.g., initial burst in responding) or extinction of responding within a session (e.g., challenging behavior decreases over the session duration). Furthermore, within-session analyses might involve determining the level of responding within the EO-on (reinforcer absent) and EO-off (reinforcer present) periods of a session, which may provide additional information regarding functional variables (Fahmie & Hanley, 2008; Kahng & Iwata, 1999; Vollmer et al., 1993). For example, if most challenging behavior occurs when the EO is off during a condition, differentiation across conditions may be irrelevant. Conducting within-session analyses could help to identify the extent to which momentary changes in EOs influence responding.

22.5 Variations in FA Methodology

Although there is an overwhelming amount of empirical support for the use of FA methodology in the assessment and treatment of challenging behavior, practitioners sometimes avoid its use mainly due to efficiency and safety concerns (Oliver et al., 2015; Roscoe, Schlichenmeyer, et al., 2015). Therefore, researchers have derived variations of the methodology as options for conducting FAs. These modifications include using trial-based FAs, latency-based FAs, precursor FAs, and synthesized contingency analyses (SCAs). We provide an overview of these modified FAs and review considerations for their use.

22.5.1 Trial-Based FA

One modification of FA methodology that may address efficiency and safety is the trial-based FA (TBFA; e.g., Austin et al., 2015; Bloom et al., 2011; Sigafoos & Saggers, 1995). Trial-based FAs are typically conducted within the context of ongoing activities and tasks and involve a discrete-trial format. That is, practitioners conduct brief trials (3–7 min in duration) that include a test segment and a control segment to test potential reinforcers for challenging behavior. During the test segment, the therapist implements programmed antecedents and consequences; however, contingent upon the occurrence of the target challenging behavior, the therapist delivers the putative reinforcer (except for no interaction trials) and then begins the control segment. The percentage of trials with the target challenging behavior in each test condition is compared to the percentage of trials in the relevant control condition. Researchers (Bloom et al., 2011; LaRue et al., 2010; Rispoli et al., 2013) have compared TBFAs to standard FAs and observed exact correspondence between analyses for 10 out of 17 participants (59%; Rispoli et al., 2014). In cases in which exact correspondence was not attained, the experimenters found partial correspondence for a subset of other participants (Bloom et al., 2011; LaRue et al., 2010).

Some of the primary advantages of implementing TBFAs is they are easy to implement by caregivers (e.g., Bloom et al., 2013) and more applicable to assessment during ongoing activities in the natural environment (e.g., Bloom et al., 2011; Sigafoos & Saggers, 1995). In addition, TBFAs typically require fewer personnel and resources to conduct (Kodak et al., 2013) due to their relative ease of implementation (Austin et al., 2015; Dowdy et al., 2020). Although TBFAs provide a simple, convenient, efficient, and relatively effective method for determining the function of challenging behavior, several potential disadvantages of this approach exist. First, the short trial durations of TBFAs result in minimized exposure to the putative EO, which may be insufficient for evoking challenging behavior (Bloom et al., 2011; Dowdy et al., 2020;

Rispoli et al., 2013). Therefore, TBFAs might require oversight by someone who is able to identify appropriate conditions for initiating trials (i.e., presence of putative EO; Bloom et al., 2011; Kodak et al., 2013); otherwise, results may be inconclusive. For example, if the test segment during the escape test is only 2 min in duration, this may not be enough time to evoke the occurrence of challenging behavior, thus resulting in a false-negative outcome. Second, 40% of TBFAs conducted in previous studies did not result in accurate predictions of the function of challenging behavior, and extended analyses were required to determine the variables responsible for maintaining challenging behavior (Rispoli et al., 2013).

22.5.2 Precursor FA

One method for addressing the safety, and potentially the efficiency, of FAs is the precursor FA, which involves conducting an FA on less severe challenging behavior that reliably precedes the occurrence of the target challenging behavior (Dracobly & Smith, 2012; Heath & Smith, 2019; Smith & Churchill, 2002). This recommendation is based on the research on response-class hierarchies (Harding et al., 2001; Lalli et al., 1995; Shabani et al., 2009), which suggests that potentially less severe or problematic behavior (e.g., whining, crying, fidgeting, yelling) often precedes severe challenging behavior and is part of the same functional response class. Thus, FAs of the precursor behavior should allow one to infer the function of the severe challenging behavior based on the outcome of the FA of the precursor behavior.

In an early study on precursor FAs, Smith and Churchill (2002) observed that two participants who engaged in severe challenging behavior also reliably engaged in less severe behavior prior to the occurrence of severe challenging behavior (precursor behavior). In separate FAs of the precursor behavior and severe challenging behavior, results showed that both behaviors had the same function, and when the contingency was only placed on the precursor, few instances of severe challenging behavior occurred. Overall, these results showed the precursors were likely to be in the same functional response class as the severe challenging behavior and suggested this methodology might be a way to determine the function of severe challenging behavior without causing undue risk to the individual, other therapists, or damage to the environment. Since this publication, various researchers have replicated and extended this work (e.g., Dracobly & Smith, 2012; Fritz et al., 2013; Langdon et al., 2008; Najdowski et al., 2008).

Prior to conducting a precursor FA, clinicians must first determine which behaviors are precursors (i.e., behaviors that are likely to be in the same functional response class) to the severe challenging behavior. To date, researchers have used several procedures to determine precursors, which range from simple and efficient methods such as caregiver interviews (e.g., Najdowski et al., 2008) and direct observations (e.g., Smith & Churchill, 2002) to more time-consuming and systematic procedures that include collecting data on the occurrence of potential precursors and severe challenging behavior and calculating various analyses such as conditional probabilities and lag sequential analyses (e.g., Borrero & Borrero, 2008; Fritz et al., 2013).

To date, research on precursor FAs suggests it is a valid method for determining the function of challenging behavior; however, researchers suggest they be reserved for severe challenging behavior that, if evoked, poses risk to the individual or others (Fritz et al., 2013; Saini, Fisher, et al., 2020). Finally, there are two primary limitations associated with precursor FA methodology. First, researchers have yet to determine the most efficient and effective strategy for identifying precursors to severe challenging behavior (Lydon et al., 2012). In addition, the current systematic methods suggested for identifying precursors include the production of severe challenging behavior (e.g., Smith & Churchill, 2002) or are likely too technical and time-consuming for clinicians to implement (e.g., conditional probabilities and lag-sequential analyses; Borrero & Borrero, 2008). Thus, Heath and Smith (2019) suggest clinicians use precursor

FAs only when precursors can be readily identified and incorporated into the assessment (i.e., not time-consuming or cumbersome to identify). Second, there may be individuals who display severe challenging behavior that do not present any identifiable precursor behaviors, making this approach irrelevant for such cases.

22.5.3 Latency-Based FA

Another method for increasing safety and efficiency is the use of a latency-based FA, which involves using a latency measure to the first occurrence of challenging behavior (e.g., Lambert et al., 2017; Thomason-Sassi et al., 2011; Traub & Vollmer, 2019) rather than repeated measures (i.e., rate, duration) of the challenging behavior during FA sessions. For instance, during each FA session, the observer records the time that elapses from the beginning of the session to the first occurrence of challenging behavior. In addition, the therapist delivers the programmed consequence and terminates the session once the challenging behavior occurs. Thus, conditions in which shorter latencies to the first occurrence of challenging behavior are observed as compared to control conditions suggest variables that maintain challenging behavior.

Although a common characteristic of FA methodology involves the repeated occurrence of challenging behavior within a session to determine response strength under various environmental conditions, previous research (Killeen & Hall, 2001; Thomason-Sassi et al., 2011) suggests that response latency may also be a good measure of response strength. Thomason-Sassi et al. (2011) demonstrated that response latency is a valid measure for challenging behavior during FAs. In one experiment, the researchers created two separate graphs for 38 previously conducted FAs using repeated measures. In one graph, the researchers graphed the latency to the first occurrence of the target behavior using the data streams for each session and used the original response repetition measure (e.g., rate) in the other graph. Comparisons of the two graphs for each challenging behavior showed correspondence on the function of challenging behavior for 33 out of 38 data sets (87%). In a second experiment, the researchers conducted one latency-based FA and one rate-based FA on the challenging behavior displayed by ten participants. Results showed correspondence (the same function) between the two FAs for nine out of ten participants. Additionally, the results of this study showed that when compared to FAs conducted using a rate measure, latency-based FAs determined the function of challenging behavior with fewer instances of challenging behavior. Overall, these data suggest that response latency may be a viable measure for target behavior during FAs. Furthermore, because this measure requires fewer instances of challenging behavior and likely results in overall shorter FA duration, this methodology may be quite useful for increasing the safety of conducting FAs of severe challenging behavior.

In addition to potentially increasing the safety and efficiency of FAs for severe challenging behavior, latency-based FAs have several other potential advantages. First, the use of a latency measure in FAs may avoid the potential confounds (e.g., extinction of automatically reinforcing challenging behavior) from the use of blocking or wearing protective equipment during FAs (Neidert, Rooker, et al., 2013). Second, a latency measure may be useful in situations in which the occurrence of the severe challenging behavior (e.g., elopement and property destruction) makes it difficult to restore the original environmental condition such that behavior can recur within session without introducing a potential confound (Neidert, Iwata, et al., 2013; Traub & Vollmer, 2019). For example, elopement cannot recur without repeatedly returning an individual to the original location/antecedent context each time it occurs, which may introduce extraneous variables that interfere with determining the function of challenging behavior. Third, some challenging behavior (e.g., vomiting) may be best assessed using a latency measure because the occurrence of the behavior is limited due to physiology.

Although there are several advantages to the use of latency-based FAs, there are also some potential limitations. First, because sessions are terminated contingent upon the first occurrence of challenging behavior, this approach limits an individual's exposure to the number of sessions and types of session contingencies, which may interfere with discrimination of session contingencies (Thomason-Sassi et al., 2011). However, the use of procedural strategies to enhance discrimination of the different conditions (e.g., condition signaling stimuli or designs such as the pairwise design) might be helpful to address this limitation. Second, because there are no repeated measures within a session, this limits the ability for within-session analyses that can be useful for clarifying functions of challenging behavior (Vollmer et al., 1993). Third, certain EOs might require more exposure than others before their influence evokes challenging behavior (e.g., instructional context may not become aversive until demands are presented over time). Finally, although the evidence available supports the validity of the latency-based FA, this evidence is limited in that the generality of the methodology has not been evaluated and only a handful of studies with a few participants have validated the outcomes of latency-based FAs with function-based interventions.

22.5.4 Synthesized Contingency Analysis (SCA)

In addition to synthesizing contingencies to clarify unclear FA outcomes, practitioners and researchers might conduct an SCA from the beginning of the FA process when synthesizing contingencies may be beneficial for situations in which isolating contingencies could pose practical challenges (e.g., blocking access to toys in the home or classroom when a break is delivered in the escape condition; Saini et al., 2019; Slaton & Hanley, 2018) or when hypotheses following indirect assessment and direct observation *strongly* suggest an idiosyncratic combined function. Typically, FA contingencies have consisted of a single establishing operation, discriminative stimulus, and consequence (Beavers et al., 2013; Hanley et al., 2003); however, recent research has suggested that differentiated FA outcomes may not be found with isolated contingencies (e.g., Hanley et al., 2014, Payne et al., 2014) as challenging behavior may be more sensitive to a synthesized or combined contingency (Hanley et al., 2014). Specifically, SCA procedures include a combination of establishing operations, discriminative stimuli, and consequences in a single test condition. Most recently, researchers have begun referring to FAs in which contingencies are synthesized as Practical Functional Analyses (PFAs; Ferguson et al., 2020; Hanley & Gover, n.d.).

In one of the initial studies on the use of synthesized contingencies from the beginning of the FA process, Hanley et al. (2014) evaluated whether differentiation in challenging behavior occurred across synthesized test conditions as compared to condition-specific control conditions with three children with ASD and evaluated the effects of treatment based on the outcomes of the FAs. Results showed that all participants' challenging behavior occurred at higher levels in the test condition as compared to the control condition. Furthermore, interventions derived from synthesized functions of challenging behavior that included functional communication training (FCT) and delay denial training were effective for decreasing challenging behavior and increasing appropriate behavior. Similar results have been replicated in additional evaluations of SCAs (e.g., Jessel et al., 2016, 2018, 2020; Santiago et al., 2016).

Although research has shown positive outcomes with SCAs, several limitations of the methodology have prompted research and discussion (see Slaton & Hanley, 2018; Tiger & Effertz, 2020). The main limitation of SCAs is that contingencies are synthesized in test conditions, and thus the extent to which isolated contingencies influence challenging behavior is unknown (Fisher et al., 2016; Holehan et al., 2020; Jessel et al., 2016; Tiger & Effertz, 2020). Thus, the use of synthesized contingencies without first determining the effects of isolated contingencies may lead to interventions based on irrelevant variables that could (a) result in more complex and resource intensive interventions and (b) create additional problems in habilitation and education of individuals (e.g., delivering escape when it is not a maintaining variable for challenging behavior may result in less instructional time for the individual; Fisher et al., 2016; Tsami & Lerman, 2019). To address these limitations, researchers have compared the utility of isolated versus synthesized contingencies in FA methodology (e.g., Fisher et al., 2016; Greer et al., 2020; Holehan et al., 2020; Slaton et al., 2017). Results indicated synthesizing contingencies are not necessary to produce differentiation, and there are little to no differences between treatments informed by isolated and synthesized contingency FAs. See Chap. 23 for a more detailed review of synthesized contingencies.

22.6 Conclusions

In summary, almost 40 years of research have shown the efficacy of FA methodology for determining maintaining variables for challenging behavior that are useful for deriving intervention and prevention procedures. Furthermore, from the moment FA methodology was introduced, there have been consistent efforts to address practical concerns and barriers one may face when conducting FAs in clinical environments (Hanley, 2012). Results of this research have culminated in various best practices for conducting FAs as outlined in the current paper. In addition, modifications of FA methodology have resulted in procedures to enhance the efficiency and safety of FAs. From these modifications, suggestions for when to use one methodology over another can be derived. For example, researchers have suggested that if there are few constraints with regard to the assessment (e.g., ample amount of time and resources, target behavior is unlikely to result in injury, high degree of control in assessment environment), a traditional FA should be conducted using best practice recommendations for developing and implementing various FA conditions (Tiger & Effertz, 2020; Saini et al., 2020). This not only allows for determination of isolated functional variables to inform intervention but may also allow for determination of variables that do not influence challenging behavior or variables that may be included in intervention (see Tiger & Effertz, 2020). However, researchers recognize this is not always the case and that some situations warrant modifications. Therefore, as outlined in various sections above, researchers suggest that (a) if the behavior of interest is severe and there is a high probability the individual or therapist will experience injury, a precursor or latency-based FA should be conducted; (b) if the behavior of interest is one that is not easily reset after its occurrence or delivery of contingencies might produce a confound (e.g., elopement), a latency-based FA or trial-based FA should be conducted; (c) if the environment where the assessment is to be conducted will be difficult to control or assessment in the natural environment is preferred, then a trial-based FA should be conducted; and (d) if a specific function is suspected via indirect assessment and/or direct observation, a consecutive alone/no interaction series (i.e., suspected automatic function), pairwise evaluation of the hypothesized social variable, or synthesized contingency analysis (i.e., suspected combination of functions) should be conducted.

Although best practices and FA modifications have provided support for the flexibility of FA methodology, it remains unknown whether practitioners are able to independently identify and evaluate considerations for which procedure and methodology are most relevant to a specific case. Thus, there is a need for a problem-solving tool to assist practitioners in choosing the most efficient and effective procedures and methodologies under various situations and contexts. Future research is needed to develop and examine the degree to which flow charts or problem-solving tools may support practitioners in making these decisions. Furthermore, given what we know about the conditions under which challenging behavior is evoked and maintained, guidelines for proactively arranging environments and establishing systematic prevention procedures in educational and clinical settings with populations at risk for developing challenging behavior (Fahmie et al., 2016; Hanley et al., 2007) are important next steps. Finally, FA methodology is only as good as the intervention it informs; therefore, continued efforts to improve upon methods for programming durable treatment effects that prevent or mitigate relapse are needed.

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Practical Functional Assessment

23

Joshua Jessel

23.1 Practical Functional Assessment

Functional analysis methodologies for assessing environmental contributors to problem behavior have existed for decades with case studies documented in the research literature as early as the 1960s (Lovaas et al., 1965; Lovaas & Simmons, 1969). The functional analysis remains an influential step in the process of treating problem behavior because of its intuitive appeal in understanding the conditions under which problem behavior occurs before any treatment is developed. The systematic manipulation of environmental events, characteristic of the functional analysis, informs the design of function-based treatment procedures that result in (a) improved therapeutic outcomes (Campbell, 2003; Heyvaert et al., 2014), (b) reduced reliance on aversives (Pelios et al., 1999; Rooker et al., 2013), and (c) a more humane approach that incorporates the individual's circumstances (Hanley, 2012). The abundance of research to support the use of the functional analysis, along with the personalized approach to clinical assessment, comfortably establishes the general functional analysis process within the framework of evidence-based practice (Smith, 2013).

While adherence to a specific set of procedures is not required when relying on functional analysis methodologies, developing a standard practice can improve dissemination and adoption of empirically supported methods among clinicians. One of the earliest demonstrations of the functional analysis has been replicated by applied researchers so frequently over the years that many proponents have proposed this format to be accepted as the standard practice (Jessel, Hanley, & Ghaemmaghami, 2020). Iwata et al. (1982/ Iwata, Dorsey, Slifer, et al., 1994) implemented a functional analysis with multiple test conditions evaluating general classes of isolated reinforcement (i.e., positive social, negative social, automatic) that were rapidly alternated with a play control to identify the environmental contributors to self-injurious behavior (SIB) of individuals diagnosed with intellectual and developmental disabilities admitted to an inpatient hospital. These procedures have since been designated the traditional approach to functional analysis.

The uniformity of the procedures of the traditional approach and simplicity of identifying a potential of three generals categories of functional reinforcement likely influenced widespread adoption among applied researchers. However, recent surveys provide a much different picture among clinicians, suggesting that the functional analysis has been sparsely used in practice due to practical barriers to application (Oliver et al., 2015; Roscoe et al., 2015).

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Furthermore, the efficiency and precision of functional analysis have historically been lacking with early reports suggesting upward of 16 h to conduct a functional analysis (Iwata, Pace, Dorsey, et al., 1994) and an initial success rate of less than 50% (Hagopian et al., 2013; Slaton et al., 2017), which may have led to an erosion in public opinion and confidence in the practical utility of the functional analysis. Thus, the long-standing efficacy of the functional analysis is somewhat marred by its inability to meet the integration goals of evidence-based practice (i.e., widespread approval and use in clinical services).

Clinicians have specifically noted the lack of time or resources necessary to conduct a functional analysis, which has impeded its use, and have suggested that the benefits often do not outweigh the potential risks of establishing an unsafe environment during the assessment period (Hanley, 2012). Considering that the functional analysis procedures were originally designed in an inpatient hospital with access to highly trained staff members and health professionals, difficulties were bound to arise for the many clinicians attempting to conduct assessments of problem behavior in the home, school, or outpatient clinic settings. It is likely because of these barriers that clinicians have abandoned the functional analysis and applied researchers have returned to the laboratory to evaluate elements of practical concern such as efficiency, cost effectiveness, and safety. This practitioner-informed research has led to the development of comprehensive programming for assessing and treating problem behavior intended to be of direct value for those in any environment in which the behavior analyst has been constrained to indirect or descriptive assessments as the sole means for informing the design of function-based treatments due to concerns of practicality.

This is not to say that indirect and descriptive assessments have no purpose. Many researchers have pointed out the shortcomings of closed-ended approaches for implicating general classes of reinforcement (e.g., Thompson & Iwata, 2007; Zarcone et al., 1991), but open-ended approaches that obtain qualitative information have been empirically validated as a means for identifying individualized and ecologically relevant contingencies to be evaluated during subsequent functional analyses (Jessel et al., 2016). That is, closed-ended assessments that force the implementer to choose between predetermined functions of problem behavior tend to lack correspondence with the outcomes of the more empirically rigorous, functional analysis (Fryling & Baires, 2016). Rather than attempting to replace the functional analysis, indirect and descriptive assessments may find greater benefit as a supplemental tool incorporated into the process with open-ended queries that refine and identify unique contingencies to be further evaluated. This collective process of using open-ended assessments to create a functional analysis that incorporates a contingency representative of a child's individualized experiences has come to be termed the practical functional assessment (PFA).

The PFA is a specific functional assessment process directly influenced by elements of clinical significance. The PFA includes three stages for guiding clinicians in the design of individualized functional analyses for each client in need of assessment and treatment services for problem behavior. In other words, there is no set of generic contingencies to be targeted. Instead, the PFA references the experiences of each client to probe a potential history of reinforcement that has contributed to problem behavior. The entire PFA process can be completed within a single clinical visit, allowing the clinician to quickly advance to the far more important stages of implementing effective, function-based treatment. To fully understand the purpose of the PFA, it may be best to first describe the relevance of subjective interpretation when drawing conclusions regarding behavioral functions (Jessel et al., in press).

23.1.1 The Continuum of Interpretation

The functional assessment is a category of tools for identifying environmental variables to be manipulated and incorporated in subsequent treatments. It does not, and cannot, identify some sort of "True" function in the absolute sense as if this function of problem behavior exists internally within the individual waiting to be illuminated like an X-ray finding a malignant tumor. Instead, the functional assessment can only build subjective confidence in an identifiable contingency's representation of that which the client has likely experienced in the past and is currently contributing to problem behavior. In other words, a history of reinforcement for problem behavior is a construct, and the clinician's job is to (a) use the functional assessment to reduce any believable alternative interpretations of potential causes and (b) reach some decision-making threshold that often leads to the implementation of empirically supported treatment procedures to successfully reduce similar problem behavior.

The interpretation exists on a continuum. On one side is open speculation with multiple explanations and little evidence to support treatment decisions. This is essentially the point at which the clinician is first informed of the family in need of services. Fortunately, any clinician's training in behavior analysis at least limits the interpretations to monistic speculation (there is no need to open the continuum further to wild and unrestricted conjecture) of operant contingencies allowing for initial assumptions that the problem behavior is evoked by antecedents (e.g., establishing operations and discriminative stimuli) and sensitive to reinforcement. However, the interpretation remains large, and little can be said about the specifics of the contingency.

The clinician can move along the continuum, reducing the degree of interpretation, by asking questions about the context in which problem behavior is said to occur. Any indirect reports obtained from the caregivers allows the clinician to begin to make hunches, eliminating some now irrelevant experiences the client is unlikely to have had and honing in on those specific encounters described by caregivers. The hunches of functional relations can be informally arranged in the presence of the clinician crafting direct observations of correlated occurrences between interview-informed, environmental events and problem behavior. The clinician only reaches the other end of the continuum when those observed contingencies are systematically manipulated and a functional relation is implicated. At this point the degree of interpretation is minimal, nothing more than minor apprehension, and the clinician is able to predict with confidence what will reduce problem behavior.

23.1.2 Practical Functional Assessment Process

The PFA follows the logical reasoning of interpretation in a process that progressively reduces the number of inferences that must be made regarding problem behavior. The PFA thereby intuitively pushes the clinician along the interpretative continuum reaching an ultimate goal of a sufficient display of functional control in an efficient manner. What makes the PFA particularly unique in comparison to more traditional functional analysis methodology is this interpretation of the context as a whole that contributes to the problem behavior of each client, rather than a less precise portrait of isolated classes of generic reinforcement. The latter establishes the larger assumption that what environmental events impact the problem behavior of the group is likely to similarly impact the problem behavior of the individual.

Therefore, the purpose of the PFA is to *establish an empirical understanding of the ecologically relevant contingencies of reinforcement historically contributing to problem behavior, thus validating the experiences of the client and caregivers, while minimizing practical barriers, and maintaining accountability as health professionals strive to implement current evidence-based practices*. To accomplish this, the PFA includes three phases (i.e., open-ended interview, brief observation, functional analysis), with each phase providing additional support for the next.

23.1.2.1 Open-Ended Interview

The PFA begins with an open-ended interview (see practicalfunctionalassessment.com for an example) with one or two caregivers, preferably those of whom have the most experience with the client and have witnessed the problematic context first hand on multiple occasions. This could include parents and caretakers if the problem behavior occurs in the home, teachers and teacher's assistants if the problem behavior occurs in the school, other clinicians and therapists if the problem behavior occurs in the clinic, or a combination of multiple individuals who are experiencing problem behavior in different settings.

Although the open-ended interview is primarily intended to be used to collect qualitatively rich information about caregiver experiences, clinicians are also suggested to use this time to build rapport because this is likely to be the first encounter with the client and their family. To do so, the open-ended interview includes questions strategically asking caregivers to describe what they are going through (see Table 23.1). By contrast, closed-ended interviews constrain caregivers to a limited set of predetermined conclusions that may or may not be reflective of their direct experiences. The open-ended interview is, therefore, an opportunity to convince those who are experiencing immense stress that you are there to empathize and help, rather than to criticize and change. That is, the clinician, guided by the open-ended interview, provides a platform for the caregivers to detail their personal circumstances that have led to them seeking out the help of professionals. The open dialogue establishes a level of trust with the clinician and introduces the process as a collaboration, with caregivers playing a direct role in informing the personalized assessment and treatment procedures.

The open-ended interview begins with the collection of background information such as the client's language abilities and preferences. Understanding the client's baseline language abilities can be used initially to deduce potential difficulties during social interactions (e.g., problem behavior after appropriate requests are denied) and will eventually aid in the operational definition of communication responses to target during treatment. Identifying any preferences will help ensure that the clinician is able to establish a rich environment that is highly motivating to teach new skills that replace problem behavior. In addition, understanding the context in which the client is happy, relaxed, and engaged is vital for further evaluation during subsequent phases of the PFA, as well as for treatment.

The next set of questions during the open-ended interview center on the extent of the problem that is experienced. This includes collecting information on the topographies of problem behavior while creating hierarchies of response classes based on the level of reported concern, range of intensities, and temporal occurrence of different responses. Problem behavior may be reported to be evoked in one, intense, and emotional outburst; however, the extended exposure to the evocative events is far more likely to have an additive effect causing the client to begin with benign low-intensity responses before escalating to more dangerous topographies in tandem with the percolation of response requirements without access to reinforcement (Magee & Ellis, 2000; Warner et al., 2020). During this portion of the interview, the clinician is also attempting to operationally define different topographies of non-dangerous and dangerous problem behavior to be reinforced during the functional analysis.

The final questions of the interview complete the puzzle of the putative contingency by probing for information regarding immediate environmental influences within the context in which problem behavior is occurring. For example, questions are asked regarding the situations in which problem behavior is likely to occur, particular activities that are likely to evoke problem behavior, or specific triggers for problem behavior. These questions on antecedent events are followed by those on consequences asking caregivers to specify how they react, calm down, or distract the client after problem behavior occurs. The entirety of these questions is intended to create a holistic understanding of the contingency contributing to problem behavior in its entirety. Therefore, the qualitative information obtained during the open-ended interview should broaden the clinician's perspective to novel, idiosyncratic contingencies that impact each client individually rather than restrict classification to a limited array of general classes of reinforcement that leave ample room for interpretative uncertainties (see Table 23.2).

Table 23.1 Information on the open-ended interview

Section	Objectives	Questions
Background	*Create an understanding of the client's language abilities to determine difficulties with social interactions and targets for future communication training* *Identify highly motivating context and establish rich reinforcement*	1. Describe his/her language abilities
		2. Does he/she attend private/public/home school/no school/other?
		3. Describe his/her play skills and preferred toys or leisure activities
		4. What else does he/she prefer?
		5. Is your child taking any medication(s) for their problem behavior? If yes, list all medications
Problem behavior	*Operationally define all functionally related topographies of problem behavior to be targeted in further assessments* *Establish hierarchy of non-dangerous and dangerous problem behavior*	6. What are the problem behaviors? What do they look like?
		7. What is the single-most concerning problem behavior?
		8. What are the top three most concerning problem behaviors? Are there other behaviors of concern?
		9. Describe the range of intensities of the problem behaviors and the extent to which he/she or others may be hurt or injured from the problem behavior
		10. Do the different types of problem behavior tend to occur in bursts or clusters and/or does any type of problem behavior typically precede another type of problem behavior (e.g., yelling preceding hitting)?
Putative contingency	*Develop function hunches regarding antecedent events that have and will evoke problem behavior* *Develop function hunches regarding consequent events that have and will reinforce problem behavior*	11. Under what conditions or situations are the problem behaviors most likely to occur?
		12. Do the problem behaviors reliably occur during any particular activities?
		13. What seems to trigger the problem behavior?
		14. Does problem behavior occur when you break routines or interrupt activities? If so, describe
		15. Does the problem behavior occur when it appears that he/she won't get his/her way? If so, describe things that the child often attempts to control
		16. How do you and others react or respond to the problem behavior?
		17. What do you and others do to calm him/her down once he/she engaged in the problem behavior?
		18. What do you and others do to distract him/her from engaging in the problem behavior?
		19. What do you think he/she is trying to communicate with his/her problem behavior, if anything?
		20. Do you think this problem behavior is a form of self stimulation? If so, what gives you that impression?

Note. Original questions were developed by Dr. Gregory Hanley and published in Hanley (2012)

23.1.2.2 Brief Observation

After the open-ended interview, the clinician must take the time to collect the qualitative information replete with anecdotes and colloquialisms and then analyze that which is obtained through the lens of the three-term contingency. The caregivers may know *when* they are likely to see problem behavior but the explanatory conclusions regarding *why* problem behavior occurs are drawn by the clinicians using their training in principles of behavior analysis. The brief observation includes the unsystematic arrangement of

Table 23.2 General classes of reinforcement and their interpretative uncertainties

General class	Interpretative uncertainties
Attention	*Is physical attention involved? Is it access to preferred conversation? Does the client direct the conversation? Does the client initiate and specify the conversation? Does the attention correspond to a specific activity? Does the attention involve singing a song? What about imaginative stories?*
Tangible	*Is the tangible presented as independent play? Will the client specify the preference to play interactively? Does the client direct play during access to the activity? Does the caregiver direct play during access to the activity? Is this period of free play intended to be enjoyed with peers?*
Escape	*Escape to what? Is the client attempting to escape and gain access to attention (return above for more clarification)? Is the client attempting to escape and gain access to tangibles (return above for more clarification)? Is the client attempting to escape and gain access to stereotypy, daydreaming, or sleep? Does the client escape from academic instructions? Does the client escape from homework with the caregivers? Does the client escape from chores? Does the client escape from interactive situations with others? Does the client escape from adult directions during preferred activities?*

Note. Automatic reinforcement is not included because the level of specificity is unlikely to be measurable in any functional analysis arrangement

those individualized variables and in some cases has been referred to as a contingency probe (Coffey et al., 2021). That is because the putative contingency and environmental events included in the contingency have yet to be evaluated and may need calibrating as the clinician directly observes how the client responds under those circumstances. The contingency can be calibrated in two potential ways during the brief observation.

First, the open contingency class can be expanded to include new topographies of problem behavior that are observed. When the evocative events are presented during the brief observation, the caregivers are able to provide further feedback confirming additional precursors or behaviors that are indicative of the client "becoming mad" and potentially escalating. The clinician can then create operational definitions of those previously unreported topographies of non-dangerous behavior. Second, ecological relevance of the contingency can be refined as the clinician attempts to recreate the problematic context experienced by the caregivers. Therefore, the brief observation is an opportunity for caregivers to (a) suggest additional changes to the contingency in the event that problem behavior does not reliably occur in the presence of the evocative stimuli and eliminate in the presence of the reinforcing stimuli or (b) confirm the relevance of the contingency with the inverse occurrence of predictable change in problem behavior.

It is important to note that the brief observation is an intermediary step intended to bridge the gap between interpretation after the open-ended interview and before the functional analysis. Some researchers have considered forgoing the brief observation, instead transitioning immediately to the functional analysis (e.g., Rajaraman et al., 2021; Ward et al., 2021). Although the brief observation may be identified as an optional step of the PFA, novice clinicians may want to follow the PFA process in its entirety, only removing steps as their level of confidence improves with repeated implementation. Circumventing the brief observation may result in a more efficient process for those skilled in forming ecologically relevant contingencies based on caregiver reports; however, the brief observation's removal could also result in a less efficient process if the clinician must repeatedly calibrate the functional analysis procedures by returning to the open-ended interview until the contingency is fully, and properly, developed.

23.1.2.3 Functional Analysis

The functional analysis is the final phase of the PFA process. Through the systematic manipulation of environmental events in two conditions (i.e., test, control), the functional analysis empirically validates both the caregiver reports from the open-ended interview and informal correlations from the direct observation. While the functional analysis is individualized, and therefore a differ-

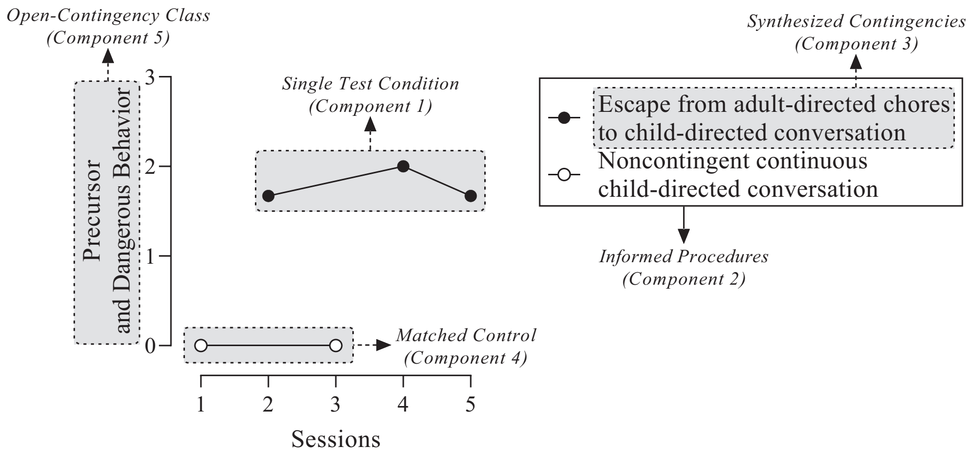

Fig. 23.1 Example IISCA highlighting the five core components

ent experience for every client, there are a few core procedural components that distinguish this functional analysis format from others (Jessel, Hanley, & Ghaemmaghami, 2020). The combined use of these core components have come to identify the functional analysis as the interview-informed, synthesized contingency analysis (IISCA; Jessel et al., 2016). An example of the IISCA including hypothetical data highlighting each component can be found in Fig. 23.1.

Core Component 1 (Single Test Condition) The first component of the IISCA is an analysis with a single test condition. Reducing analytic clutter has multiple benefits including improving discrimination of experienced contingencies (Iwata, Duncan, Zarcone, et al., 1994) and practicality (Iwata & Dozier, 2008) by limiting that which needs to be evaluated. Thus, the IISCA will always be conducted with one test condition per control. That is not to say that multiple IISCAs cannot be implemented with a single individual (e.g., Hanley et al., 2014; Ghaemmaghami et al., 2016; Santiago et al., 2016). It merely refers to a procedure maintaining an intimate relation between that which is included in the test and control conditions of the IISCA. In fact, a single IISCA is only implemented when problem behavior is said to be sensitive to a single, synthesized contingency. If functionally dissimilar problem behavior is implicated during the open-ended interview, the clinician has two options.

First, distinct IISCAs can be conducted simultaneously, each evaluating the disparate contexts with their own single test condition. For example, Hanley et al. (2014) determined that one participant's problem behavior (i.e., Bob) was likely to occur both when directed by a teacher to complete math problems using a specific teaching technique or when others interrupted and began directing play with his tablet. Therefore, two test conditions were evaluated in their own IISCA with a respective control condition. In one IISCA, the researcher directed math worksheet completion only allowing independent access to the worksheet following problem behavior in the test condition and allowed noncontingent independent access to the worksheet throughout the control. In the other IISCA, the researcher interrupted play with the tablet and returned to child-directed play contingent on problem behavior. The contingency was then removed in the control condition and the child directed play with the tablet regardless of problem behavior.

The second option is to conduct the IISCA evaluating the more problematic context as reported by the caregivers and delaying further IISCAs until the treatment is complete. This option is more so a probe of the generality of treatment effects across functionally distinct conditions. For example, problem behavior may be reported to occur when completing classwork in the school and when screen time with the tablet is restricted in the home. The clinician may choose to first target the problematic context in school because of the potential impact on educational goals and then probe the in-home context later. When using this delayed probe option, the clinician is hoping the effects spread openly to reduce the necessity of implementing multiple treatment conditions. That is, this is targeted care with the eventual failure to identify additional functions determining when treatment for all problem behavior is complete. Continuing to see problem behavior during multiple IISCAs would be indicative of the need to repeat the treatment process in each disparate context.

Core Component 2 (Informed Procedures) The second core component of the IISCA specifies the individualized nature of the procedures. Only that which is informed by the open-ended interview and observation are included in the test and control conditions. There is no need to rely on generic contingencies when rich information can be obtained from caregivers and incorporated into an individualized evaluation without impacting the efficiency of the functional analysis. To the contrary, individualizing procedures can improve the efficiency in which functional relations can be identified (Bowman et al., 1997; Hagopian et al., 2007; Hausman et al., 2009) and the IISCA itself is considered a quick alternative to other, more extended functional analysis methods.

For example, Bowman et al. (1997) initially conducted a functional analysis evaluating generic contingencies of reinforcement for the destructive behavior of two children admitted to an inpatient unit. Despite spending upward of 14.5 h conducting sessions of the functional analysis evaluating generic classes of reinforcement, the results were inconclusive and could not be used to support a function-based treatment. In response, the researchers collected reports from caregiver and observational data from staff members. By reducing the degree of interpretation with the inclusion of indirect and descriptive assessments, Bowman et al. were able to identify the problematic situation encountered when denying requests. The informed test condition included honoring any reasonable requests contingent on problem behavior and the informed control condition included honoring requests noncontingently regardless of problem behavior. Immediate differentiation was obtained after using the informed procedures during the functional analysis and a subsequent function-based treatment nearly eliminated problem behavior for both participants.

It is important to point out that informing the procedures of the IISCA is intended improve the ecological precision of that which is tested. Problem behavior may be found to be sensitive to general classes of reinforcement but that does not infer that they have historically been influenced by those reinforcers. Especially considering the programming of dense reinforcement during functional analysis, there is a chance that problem behavior will be strengthened with the contingent presentation (or removal) of any highly preferred (or aversive) events. Thus, informing procedures of the functional analysis have been recommended to avoid the potential establishment of novel contingencies supporting problem behavior with the use of powerful arbitrary consequences (Jessel et al., 2014; Shirley et al., 1999). The closer we are to representing that which the client has experienced in the past during the functional analysis, the more likely the clinician is going to probe a problem rather than create one. The IISCA is committed to evaluating problem behavior's sensitivity to contingencies of historical relevance by including informed procedures.

Core Component 3 (Synthesized Contingencies) In another attempt to retain ecological relevance, contingencies of reinforcement are synthesized as they naturally occur. This includes a combination of multiple variables that could be synthesized during an IISCA (Slaton & Hanley, 2018). The clinician may find it necessary to synthesize different antecedents, such as establishing operations that are likely to precede and evoke problem behavior. For example, any distractions (e.g., activities, games, cellphones) are going to be simultaneously removed when the child is presented with homework. By doing so, the synthesized establishing operation increases the value of not only escaping from the homework but also regaining access to those preferred items. The consequences could also be synthesized in the test condition with the simultaneous contingent removal of homework instructions and return of the preferred items.

In the example above, positive and negative reinforcement is combined in the synthesized contingency, but this need not always be the case. Two forms of positive reinforcement are synthesized when presenting interactive play (i.e., tangible and attention). Two forms of negative reinforcement are synthesized when removing teacher-directed math completion (i.e., verbal instructions and work material). Furthermore, multiple forms of positive and negative reinforcement are synthesized when removing teacher-directed math completion and presenting interactive play. There are an infinite number of potential combinations in which contingencies can be synthesized. The importance is not to needlessly combine the contingencies into some unnatural amalgam to cause problem behavior under the worst of circumstances. The same can be said about any attempt to decouple contingencies in analogue arrangements of isolated reinforcement the client is unlikely to experience in their everyday lives. Instead, the level of synthesis is dependent on an accurate representation of the problematic context as a whole.

Core Component 4 (Matched Control) Any functional analysis attempts to reduce confounds by eliminating extraneous variables that could be contributing to the effects obtained. The best control condition should therefore act as a sort of reflection of the test condition including the same variables while only eliminating the contingent relation (Thompson & Iwata, 2005). Interpretations of effects become obscured when the level of synthesis or isolation in one condition is not represented in the other. For example, there is little to be inferred regarding problem behavior's sensitivity to preferred conversations if the test condition isolates the attention and the control condition includes a synthesis of play with tangible activities in addition to the attention. There is something to be said about *suppressing* problem behavior in the control condition by any means and *eliminating* problem behavior in the control condition by the same means.

The control condition could also improperly differ from the test condition with the inclusion of qualitatively dissimilar consequences. In other words, one form of attention could be incorporated in the test condition (e.g., reprimands), while another form is incorporated in the control (e.g., general praise). Each difference between the test and control conditions adds a level of uncertainty regarding the influence of the targeted environmental variables of interest until the clinician reaches an inability in determining if they understood behavioral change or simply caused it. The matched control includes the same level of synthesis and same variables as is represented in the test condition, the only difference between the two conditions being the contingency. In the test condition, the synthesized reinforcers are presented contingently following problem behavior; whereas, those same synthesized reinforcers are presented noncontingently throughout the control condition.

Core Component 5 (Open-Contingency Class) Safety during a functional analysis is always a concern considering that this is the only period in the assessment and treatment process in which putative establishing operations and reinforcers will be arranged to purposefully evoke and potentially strengthen problem behavior, respectively. However, that which is experienced should be a controlled reaction with minimal risk. As an analogy, a stress test is conducted for those who have symptoms of heart disease to help the physician determine if there are blockages in arteries. This test typically involves some light physical activity (e.g., walking on a treadmill, using a stationary bicycle) and measures for minor abnormalities in heart rate or blood pressure. The minor abnormalities are indicative of more severe, potentially life-threatening events such as a heart attack or stroke. Clinicians working with individuals who exhibit problem behavior must hold themselves to a similar standard of safety and care to ensure that "minor abnormalities" in problem behavior are observed during a functional analysis. The extent of severity does not need to be caused in order to predict and reduce the problem from occurring in the future.

For this purpose, when conducting an IISCA, the reinforcers are provided for a range of different topographies of problem behavior that have been reported by caregivers to be functionally related and co-occur in the same environment (Warner et al., 2020). The open-contingency class is meant to include non-dangerous problem behavior (e.g., crying, yelling, swearing) that are believed to occur before or co-occur with any escalation to other dangerous and severe topographies (e.g., SIB, aggression, property destruction). These problem behaviors have often been identified as precursors and are predictive of a worsening in problem behavior (Borrero & Borrero, 2008; Smith & Churchill, 2002). Therefore, providing the reinforcers contingent on these precursors to problem behavior during the IISCA serves particularly to reduce risk by eliminating any motivation to exhibit more dangerous topographies. This is opposed to the far less efficient process of progressively reinforcing and extinguishing each topography of problem behavior in a closed-contingency class, creating the inevitable escalation to dangerous and unsafe levels (Hanley et al., 2003). Finding the level at which problem behavior can be turned off while maintaining a healthy inference regarding the functional class of behavior will reduce the necessity of relying on the occurrence of dangerous problem behavior during the IISCA.

23.1.3 Treatment Utility

Beyond elements of practical relevance, any functional assessment for problem behavior should only be used if it informs effective action on the part of the clinician. Simply put, there is no need for an assessment that is unable to identify a unique contingency to be manipulated in a treatment with the expressed purpose of reducing problem behavior and teaching deficit skills. This pragmatic validation process has been termed treatment utility (Hayes et al., 1987; Kratochwill & Shapiro, 2000), and a functional assessment is determined to have treatment utility if the results consistently inform a successful treatment. The PFA is of no exception, and its treatment utility has been validated on multiple occasions (see Coffey, Shawler, Jessel, Nye, et al., 2020) including large-n consecutive case series (Jessel, Ingvarsson, Metras, Kirk, & Whipple, 2018; Slaton et al., 2017); however, it is important to highlight the generality of the procedures in socially relevant contexts.

23.1.3.1 Case Examples (Home)

Problem behavior in the home can be particularly worrisome for parents who often lack appropriate training and resources to implement safe assessment and treatment procedures on their own. In addition, it is easy to fall into the habit of eliminating any behavioral requirements in the home in order to avoid unmanageable problem behavior. Rose and Beaulieu (2019) implemented the PFA with two children diagnosed with ASD who exhibited problem behavior such as inappropriate vocalizations, aggression, and property destruction. All sessions were conducted in the respective homes and included a combination of parents and in-home therapists. Following the open-ended interview and observation with the caregivers, Rose and Beaulieu identified individualized contingencies to be evaluated during the IISCA. The mother of one child (i.e., Anna) reported difficulty terminating interactive play, and the test condition involved the mother informing the child that playtime was over while taking the toys with her to different location in which the child did not have access. The other child (i.e., Owen) reportedly exhibited problem behavior when preferred items were visible but unavailable. The in-home therapist, therefore, placed items out of reach and blocked or denied any attempts to access those items in the test condition.

Differentiation was obtained during the IISCAs for both children with problem behavior only being observed in the test condition. The treatment was conducted in three stages, teaching communication skills, tolerance skills, and cooperation skills, before extending the procedures to different rooms with caregiver implementers. In addition, the therapists administered a social validity questionnaire and maintenance probes to assess whether the caregivers found the treatment procedures and outcomes to be acceptable and whether treatment effects continued to maintain reductions in problem behavior across time. The positive results were validated by the caregivers and sustained in the home as long as 6 weeks after the treatment sessions were discontinued.

23.1.3.2 Case Example (School)

Problem behavior that occurs in the school presents its own set of difficulties, not the least of which can result in the interruption of learning opportunities and potential exclusion from social contexts. In fact, problem behavior in the school can result in the necessity for costly one-on-one services separate from the classroom or even expulsion.

Taylor et al. (2018) extended the PFA process to a 12-year-old boy diagnosed with autism spectrum disorder (ASD), attention-deficit/hyperactivity disorder (ADHD), and dyspraxia (i.e., a neurological disorder that impacts coordination). Not long after transitioning to middle school, the child had to be removed from the classroom due to his aggression, property destruction, and elopement. Taylor et al. began the PFA process by conducting the open-ended interview twice: once with his teacher and former teaching assistant together, and again with his mother. All caregivers indicated the classroom setting to be the problematic context, and the clinicians evaluated the reputed arrangement in the IISCA following a 30-min observation. During the test condition, the child's tablet was removed, and he was instructed to complete classwork at his table. Access to the tablet away from the table was returned following any instances of problem behavior, and immediate differentiation was observed in comparison to the control condition that included noncontingent access to the tablet.

The results of the IISCA were used to inform the teaching of multiple skills, which eventually led to the child being reintegrated back into the classroom with the teachers and teaching assistants implementing the treatment procedures while maintaining near elimination of problem behavior. Taylor et al. (2018) completed the study by conducting two surveys with both parents and school staff members, once at the end of the treatment and again after the first school term ended. All adults rated the PFA and treatment procedures and outcomes as highly satisfactory.

23.1.3.3 Case Example (Outpatient Clinic)

Apart from hospitalization, outpatient clinics may be the most well-equipped environment to conduct a functional assessment on many occasions because the student-to-teacher ratio is typically low, and all therapists are consistently trained and supervised by experienced behavior analysts. However, this does not infer that a clinic has unlimited resources and time to specifically devote to problem behavior. Especially considering that a clinic providing early intensive behavioral intervention (EIBI) services will focus on teaching adaptive and functional skills.

Ferguson et al. (2020) implemented the PFA with a young girl who exhibited problem behavior (e.g., verbal threats, aggression, property destruction) that was resistant to earlier assessment and treatment services received prior to the admittance to the EIBI clinic. The open-ended interview was conducted with both of the child's parents together at one time. The parents indicated that problem behavior often occurred when their child did not get her way and when they tried to control her activities. Therefore, a context in the test condition was arranged whereby therapist restricted access to preferred items while denying any requests and directing her to complete other activities that were available. During the control condition, no adult direction was provided, and any reasonable requests were honored with continuous access to preferred items. The

IISCA implicated a socially mediated, synthesized function when problem behavior was only observed in the test condition. In addition to communication skills, Ferguson et al. progressively introduced increasingly complex tasks directed by the therapist. By the terminal goal, problem behavior remained low, and the child was engaging in more adult-directed EIBI programming throughout the day than before the PFA process began. Finally, the parents completed a standardized assessment for measuring stress, which revealed a decrease in reported stress found across all domains (i.e., child characteristics, parent characteristics, situational/demographic life stress).

23.1.4 Procedural Variations

It is important to remember that the PFA is a guide to IISCA development and that which is considered an IISCA need only maintain the five core components. That is to say that the IISCA is not a functional analysis with a standardized set of specific procedures. The clinician is free to make changes to the functional analysis while maintaining the classification as an IISCA. In fact, multiple variations to the IISCA currently exist (Metras & Jessel, 2021) and have been developed to serve different practical purposes (see Fig. 23.2 for a flowchart on guided usage). It is important to point out that these procedural variations are not necessarily unique in-and-of-themselves, but their application to the IISCA are. Similar changes have historically been made to improve the practicality of more traditional functional analysis procedures such as changing the measure of problem behavior (Sigafoos & Saggers, 1995; Thomason-Sassi et al., 2011), reducing the session duration (Wallace & Iwata, 1999), or reducing the number of sessions (Northup et al., 1991). Therefore, variations of the IISCA share related modifications for improving adoption among clinicians. Each variation of the IISCA format including hypothetical data is presented in Fig. 23.3.

23.1.4.1 Full IISCA

The original procedures, designated the full IISCA (although often abbreviated to IISCA), are conducted with the informed test condition being rapidly alternated with the matched control in a multielement design (Hanley et al., 2014; Jessel et al., 2016). Problem behavior during the full IISCA is measured as a rate on the order of minutes with the expectation of optimal responding during the test condition around two responses per min if reinforcement is presented in intervals of 30 s. That is, the rate of problem behavior should be sensitive to the immediate fluctuations in reinforcement, and if problem behavior were to occur at every establishing operation opportunity when the reinforcer is removed, the clinician would predict a response every 30 s. Responding below optimal rates would be indicative of a lack of motivation and may suggest the need for including higher-quality reinforcers when teaching. On the other hand, above optimal performance would be more problematic and indicate either that problem behavior is likely to occur in bursts or that all reinforcers responsible for problem behavior were not properly synthesized into the contingency (i.e., uncontrolled establishing operations continue to influence problem behavior). In any case, clinicians are attempting to evoke problem behavior during the full IISCA at the controlled, optimal level.

The most efficient organization of the test-control sessions is presented in the following order: (1) control, (2) test, (3) control, (4) test, (5) test. In addition to efficiency, it is best to start with the control condition of noncontingent rich reinforcement to establish rapport and trust with the client. Two control sessions are often sufficient in cases where problem behavior is entirely eliminated; however, more sessions can be interspersed within the IISCA if problem behavior occurs and trend, level, or variability need to be visually analyzed. The final consecutive test sessions disrupt the rapid alternation between the control sessions and provide additional confidence that the putative contingency is influencing problem behavior when it is introduced. Thus, the full IISCA need only a minimum of five sessions to implicate a functional relation.

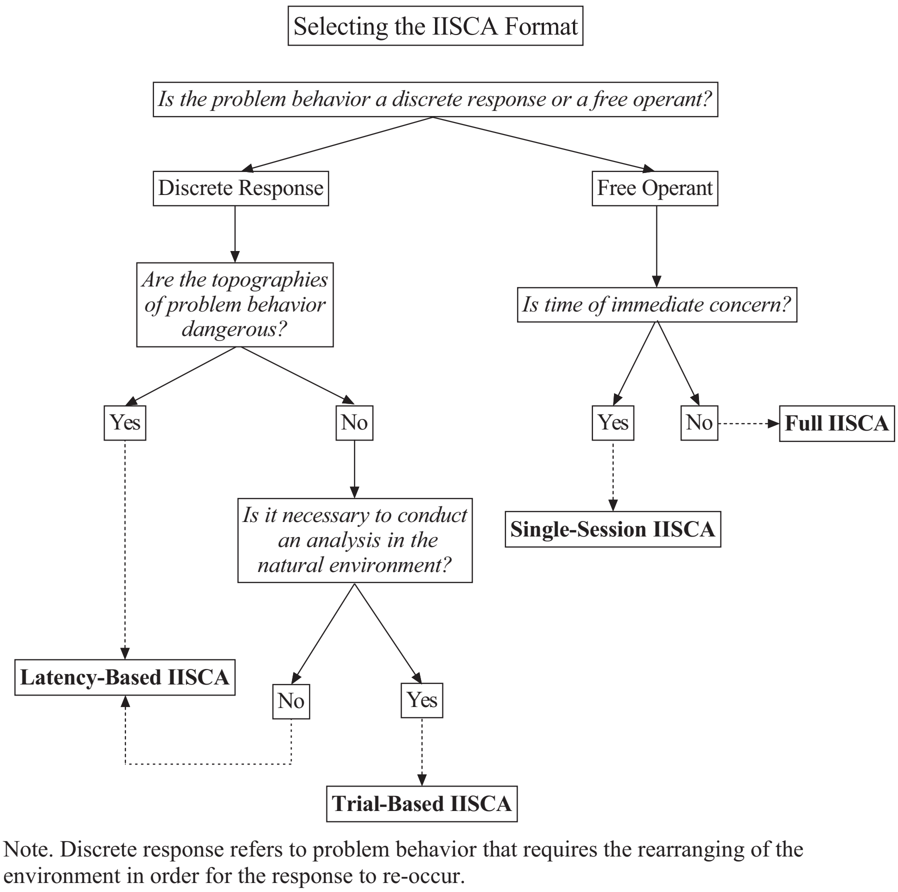

Fig. 23.2 Flowchart of IISCA formats. Note. Discrete response refers to problem behavior that requires the rearranging of the environment in order for the response to reoccur

Although the duration of the full IISCA can vary depending on the number of sessions conducted and the session duration, it is often suggested that the entire IISCA can be completed in 25–35 min in most applications (Coffey, Shawler, Jessel, Nye, et al., 2020; Jessel et al., 2016; Jessel, Ingvarsson, Metras, Kirk, & Whipple, 2018). In addition, the full IISCA could be as brief as 15 min due to the tendency to obtain immediate differentiation between the test and control conditions when using 30 s access to reinforcement in the test condition (Coffey et al., 2021; Jessel, Metras, et al., 2020b). Jessel et al. (Jessel, Metras, et al., 2020b) conducted a series of 26 full IISCAs using 10-min sessions and reanalyzed rates of problem behavior during the first 5 and 3 min to determine if session brevity would negatively impact interpretations of functional control. The authors found minimal detriments to interpretations of control and obtained the same positive outcomes with an additional eight full IISCAs using 3-min sessions. Thus, if time is of concern, the clinician could implement a 15-min full IISCA with a high level of certainty that differentiation will be achieved in that time. However, if any concerns of the problem behavior occurring at low rates were to arise during the brief observation of the PFA, this would be indicative of the need to extend session duration.

23.1.4.2 Single-Session IISCA

The single-session IISCA was designed to improve the efficiency of the process further, specifically for cases in which (a) the interpreta-

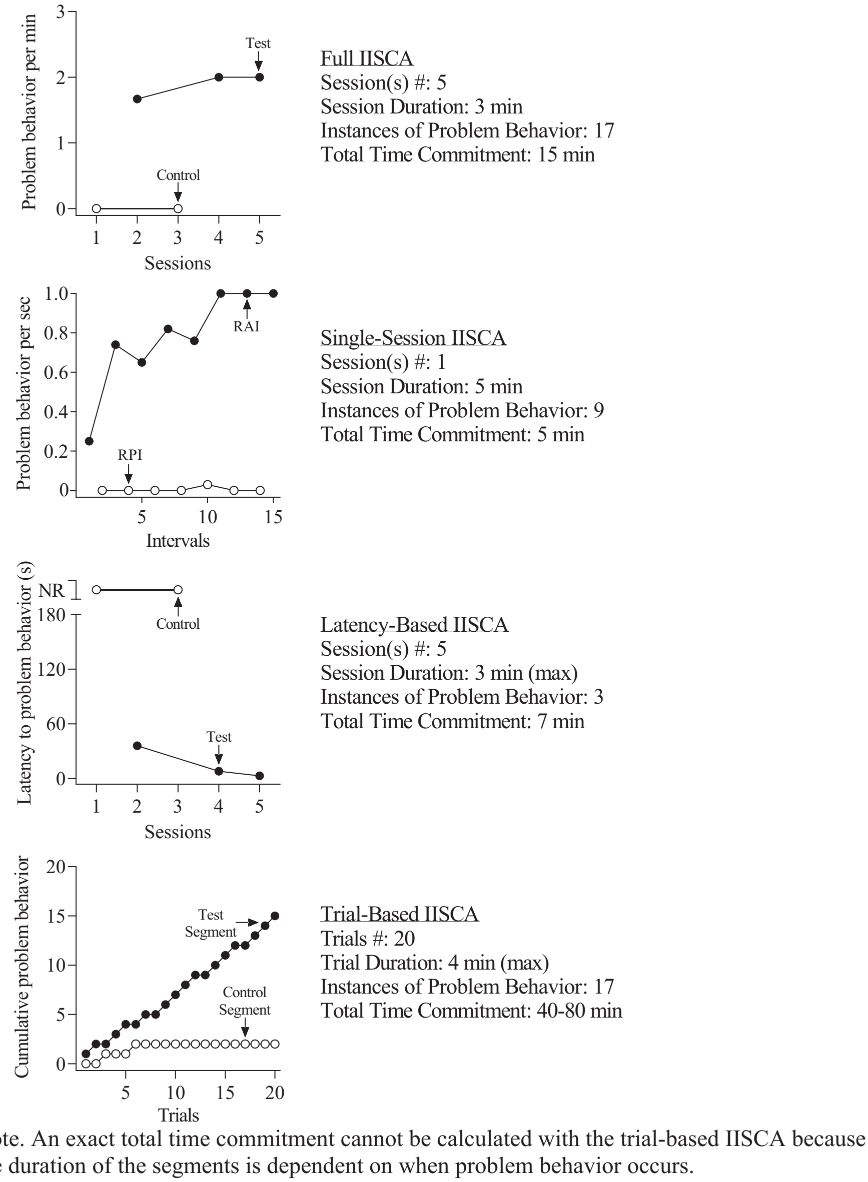

Fig. 23.3 Examples of the IISCA variations with hypothetical data. Note. An exact total time commitment cannot be calculated with the trial-based IISCA because the duration of the segments is dependent on when problem behavior occurs

tion following the open-ended interview and observation is minimal or (b) the problem behavior is severe and repeated instances could significantly impact safety for those involved (Jessel et al., 2019; Jessel, Metras, et al., 2020a). The single-session IISCA is defined by its use of only a single test session from the full IISCA with all else being equal. Because a single session is conducted, the rate of problem behavior cannot be measured on the order of minutes, and instead a within-session analysis of responding is conducted analyzing problem behavior within seconds. Thus, the control condition is no longer used, and interpretations of differentiated responding are obtained during intervals where the reinforcer is present and absent from the test session.

The test session of an IISCA includes two distinct intervals the client will experience. The reinforcer present interval (RPI) represents the 30 s access to the reinforcers following problem behavior. The RPI is analogous to the control condition, and problem behavior is predicted to not occur during this time because the client has access to the synthesized reinforcers (i.e., the value for responding is abolished). The reinforcer absent interval (RAI) represents the period of time in which the reinforcers are removed and the establishing operation is in place. The RAI is discontinued only following instances of problem behavior. Higher rates of problem behavior should be observed during the RAIs in comparison to the RPIs. The number of RAIs and RPIs experienced by the client is dependent on how quickly problem behavior occurs during the RAI. At optimal levels of responding, the client may experience as many as 12, 20, or 40 total intervals if the single-session IISCA was 3, 5, or 10 min, respectively. However, an analysis completed entirely in 3 min may be more susceptible to detriments in interpretations of functional control, and if clinicians are committed to conducting the single-session IISCA, they may want to consider using 5- or 10-min sessions (Jessel, Metras, et al., 2020a). Devoting a maximum of 10 min to a functional analysis is still relatively brief, and this preparation eliminates the reliance on multiple sessions of exposure to evocative events and problem behavior.

Due to the similarities between the single-session IISCA and the full IISCA, clinicians could also implement a model of progressively introducing sessions as needed (cf., Vollmer et al., 1995). For example, a control condition can be conducted following the single-session IISCA if within-session differentiation is not initially obtained. If the clinicians were to repeatedly alternate between the control condition of the full IISCA and the single-session IISCA (i.e., test condition), the data can then be aggregated as a representation of responses per minute across sessions, and the clinician would have essentially conducted a full IISCA. Therefore, the single-session IISCA lends itself to extension when necessary.

The popularity of the single-session IISCA as a practical and efficient alternative has engendered a subset variation of its own that has recently been termed the performance-based IISCA (Metras & Jessel, 2021). The duration of any interval, RPI or RAI, experienced by the client during the performance-based IISCA is entirely determined by the client's targeted behavior. In addition to problem behavior, other positive measures are included such as indications of the client being happy, relaxed, and engaged. That is, the RPI is not a typical fixed time of 30 s, and the duration is extended until remnants of the establishing operation are no longer felt, leading to a return in the state of behavioral quietude or calm before problem behavior was exhibited. The procedures of the performance-based IISCA are likely to improve the acceptability of process and ensure that the client experiences a far greater ratio of a preferred context over aversive evocative events.

23.1.4.3 Trial-Based IISCA

The trial-based IISCA converts the measure of problem behavior from a rate to a percentage of trials. The benefit of the trial-based IISCA is the ability to seamlessly insert the trial into the natural milieu of the classroom or home setting. If problem behavior is believed to occur during academic tasks, the teacher can implement a trial during scheduled work periods rather than having to set aside time during the busy schedule to implement an IISCA in an analogue setting. The same can be said for a parent who often experiences problem behavior during instructions to complete chores (i.e., trials can be implemented during times in which the child is expected to complete the chores). The repetitive nature of presenting and removing reinforcers in a full IISCA could also exacerbate problem behavior with more advanced individuals who may find such interactions as awkward and off-putting. Therefore, the implementation of the trial-based IISCA will hardly be noticeable when conducted correctly because it should be representative of the client's contextually relevant ecology.

Trial-based methods have been incorporated into functional analysis technology in the past (Sigafoos & Saggers, 1995); however, the extension to the IISCA was a more recent development. Curtis et al. (2020) evaluated the trial-based IISCA with three participants diagnosed with autism. A total of 20 trials were conducted that included the sequential implementation of control and test segments. The maximum duration of each segment was programmed at 2 min but each segment could, in theory, be as brief as 1 s if problem behavior occurred immediately because segments were discontinued following an instance of problem behavior. The client would experience the noncontingent access to the synthesized reinforcers until problem behavior occurred or 2 min elapsed (i.e., control segment) before the establishing operation was introduced and continued until the same criteria were met (i.e., test segment).

Although an improvement in ecological validity, the efficiency of the trial-based IISCA is negatively impacted by two elements of the procedures. First, the clinician may have to wait hours or days for the natural establishing operation to be arranged if they are to avoid contriving the events in an analogue setting. Second, the trial-based IISCA is somewhat limited by the fact that a fixed number of trials must be conducted when data are represented as the traditional aggregate percentage across segments. That is, the data cannot be visually analyzed at any point, preventing the ability to make ongoing decisions regarding functional control. The ability to conduct an ongoing visual analysis of the data can improve the efficiency of the functional analysis (Saini et al., 2018) by discontinuing the implementation of trials when a function is implicated. With some evidence suggesting that differentiation can be achieved in as little as five trials (Dowdy et al., 2021), clinicians may want to consider representing data of the trial-based IISCA as a cumulative record (see bottom panel of Fig. 23.2).

23.1.4.4 Latency-Based IISCA

The latency-based IISCA maintains the entire structure of the full IISCA while only changing the measure of rate of responding to latency (Jessel, Ingvarsson, Metras, Whipple, et al., 2018; Lambert et al., 2017). Sessions of test and control conditions are rapidly alternated; however, the session is terminated after the first instance of problem behavior. Therefore, that which is programmed is not necessarily that which is experienced. For example, Boyle et al. (2020) conducted the latency-based IISCA with a boy diagnosed with ASD who would often run away from caregivers to engage in stereotypy with a door. In the test condition, the child was positioned away from the door and instructed to stay with the adult for 5 min. The latency to the first instance of elopement was recorded, the session terminated, and the response consequated with escape from adult supervision to gain free access to stereotypy with the door. The authors found that differentiation can be obtained with as little as a single response per session when latency is used as a measure of response strength.

It is important to point out that interpretations of control based on visual inspection of graphed data when using a latency-based IISCA are a mirror image of other IISCA formats. Elevated levels of problem behavior during the test condition are often associated with response strength when using measures such as rate or frequency. A brief latency, on the other hand, represents a response that is immediately evoked under specific occasions (Thomason-Sassi et al., 2011). Therefore, the expectation during the latency-based IISCA is an inverse visual depiction of low levels of problem behavior during the test condition (i.e., quick responding) and high levels or, more preferably, no problem behavior during the control condition (i.e., slow responding).

There are multiple practical benefits to conducting the latency-based IISCA. First, measuring latency reduces each condition to a single instance of problem behavior. This means that on many cases a functional relation can be established in as little as three instances of problem behavior. This can be a substantial improvement in the safety of the functional analysis process when considering that exposure to repeated instances of severe or dangerous topographies can result in physical harm to the client or clinician. During the latency-based IISCA, the clinician can provide the reinforcer immediately following any signs of escalation (i.e., precursors) and reestablish a state of calm before either continuing onto the control condition or repeating the test condition.

A second practical benefit of the latency-based IISCA is that some instances of problem behavior are not so easily measured as free operants. That is because the environment needs to be arranged in a certain manner for that discrete response to occur. For those whose problem behavior consists of disrobing, once the last article of clothing is removed, they are unable to emit the response again. Those who elope from caregivers can no longer elope again unless they are caught and returned to the same level of supervision from which they were attempting to escape. There are multiple examples of discrete topographies of problem behavior that do not fit the more common repeated-instances model of the functional analysis. In addition, forcing the measure of these discrete responses as a rate may be detrimental to ecological validity because repeated instances may not be representative of the client's experiences. In the case of elopement, returning the client to the original evocative context may involve providing confounding physical forms of attention antithetical to the putative contingency attempting to be evaluated (Neidert et al., 2013). The latency-based IISCA seems best suited to evaluate such problem behavior that consists of discrete responses.

Third, the benefit of terminating a session following a single instance of problem behavior results in a more efficient analysis. In one of the first evaluations of the latency-based IISCA, Jessel, Ingvarsson, Metras, and Whipple et al. (2018) found that it took less than 10 min to conduct. Therefore, the clinician should consider conducting the latency-based IISCAs when safety, ecological validity, and efficiency are of concern.

23.1.5 Further Considerations

The PFA serves as an intuitive tool for practitioners; however, as with any other functional assessments, certain difficulties may arise for which the original procedures cannot properly prepare the clinician. In such instances, the clinician would do well to consider what to do during circumstances where (a) differentiated outcomes are not achieved and (b) when automatic reinforcement is implicated as a potential source of reinforcement for problem behavior.

23.1.5.1 Undifferentiated Outcomes

A function-based treatment can only be developed and implemented after the PFA successfully provides empirical evidence supporting procedures likely to be effective. Any delay to treatment can often be a stressful period for parents and teachers as they wait for the results of the assessment without any direction on how to solve the problems they are experiencing. Fortunately, marked improvements have been made in functional analysis technology, and high levels of control are likely to be afforded by the IISCA with initial success rates as high as 73% (Jessel et al., 2016) and 85% (Jessel, Metras, et al., 2020b). This still infers, however, that in some cases the clinician will need to problem solve when the IISCA fails to identify a socially mediated function of problem behavior.

The PFA includes a combination of proactive and reactive strategies for improving the efficient identification of socially mediated functions. The PFA process of conducting an interview and observation proactively shapes the contingency evaluated during the IIISCA to be representative of the natural environment, which increases the probability of obtaining differentiated outcomes. In other words, modifications after the IISCA is conducted are less likely to be necessary because those modifications are already implicated by the interview and observation to be included in the initial IISCA iteration. In addition, the PFA is a transparent process that should incorporate caregiver involvement throughout every step. Beyond the interview where caregivers are directly asked specific open-ended questions, they should be present during the observation and IISCA. That way, the caregivers can continue to (a) consent to the procedures, (b) provide additional information based on their own observations, (c) be probed with follow-up questions when needed, and (d) validate the ecological relevance of the test condition. All of which can be assumed to improve the success of the IISCA.

Reactive strategies involve further modification to the IISCA when differentiation is initially not achieved. When this happens, the clinician should return to open-ended questions and observations to modify the procedures depending on the further input from caregivers. For example, the caregiver may suggest that the contingency is correct, but the client has not been exposed to the evocative events long enough (e.g., "He is getting mad, I can tell"). In which case, the clinician could either continue to implement the contingencies from the initial IISCA but extend session duration or ask the caregiver to identify other potential precursors that are occurring more frequently. Both modifications are attempting to address low-rate problem behavior (Hanley, 2012). In other cases, the assumption may be that important variables were overlooked and the contingency needs to be recalibrated. For example, caregivers may further specify individuals who are likely to be present when problem behavior occurs (e.g., "It only happens with dad") or a highly restricted response to only certain items (e.g., "It needs to be with *his* tablet"). Thus, modifications to the contingency are deemed necessary, and this cyclical process is repeated until differentiation is obtained.

23.1.5.2 Automatic Reinforcement

There is also a chance that problem behavior is not sensitive to socially mediated reinforcement and that the behavior itself produces its own source of reinforcement. The process of the PFA includes questioning on the potential for automatically reinforced problem behavior during the open-ended interview. When automatic reinforcement is implicated, the clinician can forgo any test-control comparison and instead implement a screening of extended alone conditions (Querim et al., 2013). That is, before evaluating socially mediated functions, the clinician can first attempt to rule out sensitivity to automatic reinforcement. The client is either placed in a room alone or with an adult present who will ignore all behavior and is only present to protect the client in the case of severe SIB. If problem behavior continues to occur in this condition devoid of social reinforcement, automatic reinforcement is inferred and treatment procedures can be developed including sensory extinction (Iwata, Pace, Cowdery, & Miltenberger, 1994) or noncontingent delivery of items that are believed to compete with the source of automatic reinforcement (Piazza et al., 2000). In addition, a function-based treatment restricting access to the automatically reinforcing problem behavior to brief intervals contingent on alternative behavior can even be used in cases such as stereotypy, where the topography of problem behavior is not harmful (Potter et al., 2013; Slaton & Hanley, 2016).

A second possibility exists for those who exhibit automatically reinforced SIB to further evince functionally relevant properties. The process involves distinguishing between three categories of subtypes of SIB based on the different patterns observed in the alone and control condition during the functional analysis (Hagopian et al., 2015). The alone condition is representative of a barren environment essentially limiting the only source of reinforcement to the client's own behavior, if the SIB is, in actuality, automatically reinforcing. The control condition is representative of a rich environment with multiple sources of reinforcement that could compete with automatic reinforcement and suppress the occurrence of SIB. Therefore, once the open-ended interview from the PFA implicates automatically reinforced SIB, the clinician can use the results to further identify specific items or events to be included in the enriched environment of the control condition (Jessel & Metras, in press).

Based on the alone (i.e., test) and enriched (i.e., control) comparison, the clinician can identify three patterns of SIB. First, differentiation between the alone and enriched condition is obtained with elevated levels of SIB observed in the alone condition and low levels observed in the enriched condition. This differentiated outcome is delineated as Subtype I. Second, the outcome can be undifferentiated with high levels of SIB observed across the alone and enriched conditions. This undifferentiated outcome is delineated as Subtype II. Third, the outcome can again be undifferentiated, but SIB is not observed with the participant instead exhibiting high levels of self-restraint. This undifferentiated outcome is delineated as Subtype III. The distinction between functional properties of automatically reinforced SIB is important to make because it could influence treatment decisions (i.e., treatment utility) with reinforcement alone often proving effective with Subtype I, the necessity to combine supplemental treatment components (e.g., punishment, response blocking, restraint) with reinforcement for Subtype II, and the reliance on restraint with Subtype III (Hagopian et al., 2015; Hagopian et al., 2016).

23.2 Conclusions

Functional analysis technology has been around for decades yet is seldom used among clinicians. It seems that those working with individuals who exhibit problem behavior in the home and school have overwhelmingly found experimental procedures developed in the inpatient hospital to be cumbersome and unwieldly. Without widespread adoption, traditional functional analysis methods have left the goals of evidence-based practice somewhat fractured and incomplete. In other words, the scientific findings supporting traditional functional analysis methods were at odds with elements of practical utility, and clinicians were largely unable to fully integrate the model into practice along with caregiver-informed values. This has led to the clinician-informed development of functional analysis procedures oriented toward elements of practical relevance. The PFA was designed to test for problem behavior's sensitivity to ecologically relevant contingencies in a safe and efficient manner. Furthermore, the PFA process, including the IISCA, has been found to be socially acceptable among constituents and often leads to successful reductions in problem behavior with corresponding improvements in replacement skills. Although only a recent development, the PFA has grown to inform research on multiple formats and will, hopefully, continue to advance functional analysis technology toward embodying evidence-based practice with client-centered values and parent-preferred procedures.

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24 Treating Problem Behaviors Through Functional Communication Training

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24.1 Treating Problem Behaviors Through Functional Communication Training

Functional communication training (FCT) is one of the most common and effective treatments for problem behaviors exhibited by individuals with autism spectrum disorder (ASD) and related disorders (Gerow, Davis, et al., 2018). Systematic reviews have concluded FCT is an evidenced-based practice for individuals with ASD and related disorders (Gerow, Hagan-Burke, et al., 2018; Gregori et al., 2020; Kurtz et al., 2011; Walker et al., 2018; Wong et al., 2015). FCT is a differential reinforcement of alternative behavior procedure used to teach an appropriate, functionally equivalent response, which competes with socially mediated problem behavior. Oftentimes, the target behavior might include severe problem behavior such as aggression, self-injurious behavior, or property destruction. Without effective treatment, problem behaviors are likely to increase and impede one's opportunities to socialize with peers, caregivers, and others in various settings such as school, community, personal residence, or place of employment (Doehring et al., 2014). Furthermore, academic growth and skill acquisition may be interrupted with the onset of frequent problem behaviors (Fragale et al., 2016).

Carr and Durand (1985) first evaluated the use of FCT to decrease disruptive behaviors exhibited by four children diagnosed with developmental disabilities. Their antecedent assessment showed that for two participants, problem behaviors occurred most often when presented with difficult demands. For another participant, problem behaviors occurred during periods of low attention. For the final participant, problem behaviors occurred most often during both difficult demand and low attention situations. Carr and Durand taught the participants to request assistance with the demand and/or recruit attention. FCT resulted in immediate reductions in disruptive behaviors and increases in the appropriate functional communication response (FCR). They concluded that teaching individuals who engage in problem behavior a functionally equivalent response is an effective method of reducing problem behavior. Since Carr and Durand's seminal study, numerous studies have continued to explore the utility of FCT as a function-based intervention for problem behaviors (Gerow, Davis, et al., 2018; Neely et al., 2018; Walker et al., 2018).

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24.2 Teaching the Functional Communicative Response

FCT is a function-based treatment typically used to treat problem behaviors maintained by socially mediated positive (e.g., access to preferred items or attention) and negative reinforcement (e.g., termination of an aversive event). Therefore, a functional analysis must be conducted to ensure that the FCR is functionally equivalent to the problem behavior. After the behavioral function is identified, it is important to identify an appropriate form of FCR for that individual. These might include topography-based responses such as vocal (e.g., "excuse me," "break please") or gestural responses (e.g., pointing or reaching for an item). Alternatively, they might be selection-based responses such as the use of augmentative communication devices (e.g., picture cards, Proloquo2go). The response chosen should be identified on a case-by-case basis and consider cultural and other contextual variables (e.g., the family's preferred language) to ensure the most appropriate form of FCR is identified for that individual. Behavior analysts should ensure they consult with the individual and stakeholders to identify what would be the most appropriate FCR prior to conducting FCT. For example, if an individual exhibits vocal speech, it would be appropriate to teach an alternative, vocal response in that individual's preferred language as opposed to using a picture-exchange system.

The initial implementation of FCT typically requires a dense reinforcement schedule for the FCR, which allows for quicker acquisition. This in turn may lead to quicker reductions in problem behavior. A continuous reinforcement schedule is typically used during the training of the FCR, and over time, the reinforcement schedule should be thinned to allow for periods in which reinforcement is unavailable while maintaining reductions of problem behavior.

It is also important to consider the effort or efficiency of FCRs to ensure the individual is more likely to emit the appropriate response relative to problem behavior (Horner & Day, 1991; Richman et al., 2001). Richman et al. (2001) compared the effectiveness of two FCRs, signing "please" and exchanging a communication card for one child with developmental delays whose problem behavior was maintained by positive reinforcement in the form of access to preferred toys and possibly parental attention. During the first phase, they used a concurrent operants arrangement to provide their participant with 30-s access to toys contingent on either aggression or handing his mother the communication card. During the second phase, the participant was provided with 30 s of access to toys contingent on signing "please" or handing his mother the communication card while aggression was placed on extinction. Their results showed that when the communication card and signing "please" were concurrently reinforced, the participant allocated most of his responding to the sign. Richman et al. hypothesized that the sign required less response effort and time. That is, to use the communication card, the child needed to orient and move toward the card, pick up the card, orient and move toward his mother, and place the card in her hand. Signing "please" only required the child to orient toward his mother and bring his hand to his chest to sign.

Appropriate prompting procedures to teach the FCR may differ depending on the individuals. For example, Libby et al. (2008) recommended that most-to-least with a delay (MTLD) be used if the individual's learning history is unknown, most-to-least or MTLD is preferred if errors have historically hindered the individuals learning or evoked problem behavior, and least-to-most is preferable for individuals who have previously been successful learning using this technique. In summary, Libby et al. recommended that the prompting technique should be tailored to the individual.

24.3 Reinforcement Schedule Thinning: Why Is It Important and How to Do It

FCT reinforcement schedule thinning has been demonstrated to be an essential component of FCT (Durand & Moskowitz, 2015; Hagopian et al., 2011; Kurtz et al., 2011; Muharib et al., 2019;

Tiger et al., 2008). One of the primary purposes for schedule thinning is include reducing the rate of the FCR and minimizing the resurgence of problem behavior during extinction periods (Betz et al., 2013). Common scheduling thinning procedures is the use of multiple schedules, contingency- and time-based delays, demand fading, or a combination of components.

24.3.1 Multiple Schedules

Multiple schedules are commonly used to promote schedule thinning (Greer et al., 2016; Saini et al., 2016). It includes two distinct schedule components for which a unique stimulus signals the availability of reinforcement with a discriminative stimulus and the unavailability of reinforcement with an S^{Δ} (stimulus delta). After stimulus control is obtained over the target behavior(s), gradual increases in the duration of the extinction component or gradual reductions in the duration of the reinforcement component (Hanley et al., 2001) are introduced to establish a schedule more likely to be observed in the naturalistic environment. Often, therapist-arranged stimuli are used because they are salient and substantially different from one another (e.g., red and green boards; Fisher et al., 1998). For example, Campos et al. (2020) used FCT to teach three participants who engaged in problem behaviors maintained by positive reinforcement in the form of access to tangible items an appropriate communication response (i.e., vocal responses). This resulted in an increase in the FCR and a decrease in problem behaviors. They then used a multiple schedule, which included different colored index cards or poster boards correlated with reinforcement or extinction. After discriminated manding was observed, the extinction component was gradually increased until a final duration of 240 s was reached. Furthermore, Campos et al. taught parents to successfully implement the procedures, and social validity measures showed that parents were very accepting and willing to implement the procedures.

Naturally occurring stimuli (e.g., talking on the phone) have also been used (Balka et al., 2016; Kuhn et al., 2010; Leon et al., 2010; Shamlian et al., 2016) to signal the availability or unavailability of reinforcement. For example, Shamlian et al. (2016) taught three participants with problem behavior reinforced by access to preferred items to discriminate between therapist-arranged discriminative stimuli (i.e., the presence or absence of a colored bracelet worn by the therapist) and easy or difficult naturally occurring activities that signaled the availability (i.e., non-busy activities) or the unavailability (i.e., busy activities) of reinforcement. Overall, participants acquired discriminated responding more rapidly when therapist-arranged stimuli were used relative to the naturally occurring stimuli. These results and the general paucity of research evaluating naturally occurring stimuli suggest a need to shift our focus to the use of naturally occurring stimuli.

It is important to note that multiple schedules might not be an effective method of FCR reinforcement schedule thinning for all individuals. Pizarro et al. (2020) evaluated various skills such as matching and tacting colors, a listener responding task, and an intraverbal task to determine if their participants' responding was correlated with discriminated responding during the multiple-schedule arrangements. Overall, listener responding and tacting colors were strongly correlated with the likelihood that multiple schedules would be effective. Therefore, researchers and practitioners should consider the individual's prerequisite skills before utilizing multiple schedules for reinforcement schedule thinning.

Most of the research evaluating schedule thinning using multiple schedules includes a reinforcement and an extinction component. However, given that perfect treatment integrity is unlikely when the target behavior is problem behavior (Fryling et al., 2012; DiGennaro Reed et al., 2011), especially in the naturalistic environment, future research should evaluate to what extent multiple schedules can be implemented with less-than-ideal levels of integrity. It is also possible we should focus on incorporating multiple schedules for behaviors that are more likely to result in higher levels of integrity. This is especially relevant given the influx of research evaluating the resurgence of problem behavior (Briggs et al., 2018; Muething et al., 2020).

24.3.2 Contingency- and Time-Based Delays

Another common schedule thinning method includes contingency- and time-based delays. Mace et al. (2010) evaluated three methods of implementing contingency- and time-based delays to reinforcement following the FCR. A functional analysis and a response class hierarchy assessment indicated that problem behaviors were maintained by positive reinforcement (access to a computer). The three methods of denied access were (a) the experimenters said "no" with an explanation; (b) the experimenters said "no" with an explanation but provided an option to participate in another preferred activity; or (c) the experimenters said "yes" to computer access contingent upon the learner completing a less preferred activity. Reductions in problem behavior were still evident even when access to the reinforcer was denied following the FCR and when contingencies of task completion were in place following the response. Results showed that target behaviors (including aggression) occurred at higher levels when the participants were told "no" with an explanation compared to the other two conditions. No problem behaviors occurred when the participants were provided an option to participate in another preferred activity. Finally, less severe problem behaviors, such as loud vocalizations, occurred during 50% of sessions when the participants were told they could have access after they completed a less preferred activity. These results correspond to the effectiveness of delayed access to reinforcement for preventing escalating target behaviors when an alternative, preferred activity is provided.

Hanley et al. (2014) showed that contingency- and time-based delays may be effective in thinning the reinforcement schedule with a supplementary tolerance response following the delay for three children diagnosed with ASD. Experimenters (a) taught a replacement behavior with FCT; (b) gradually increased the complexity of the FCR; (c) introduced delays, denials, and training a specified response to earn reinforcement after denials and delays; (d) reinforced easy responses during tolerance denial and delay training; (e) reinforced more complex responses during tolerance denial and delay training; and (f) programmed for generalization across various environments. FCRs generalized beyond the training environment and maintained after 14 weeks. Results showed that these components were effective in reducing problem behavior while increasing appropriate behavior. However, it was unclear if time- and contingency-based delay tolerance were necessary to reduce problem behavior.

Ghaemmaghami et al. (2016) extended Hanley et al. (2014) by conducting a comparative analysis of time- and contingency-based delay tolerance training with four individuals. Before introducing FCT, five training trials were implemented. Trials included (a) an instruction, (b) FCR modeled by experimenters, (c) role-playing, (d) gaining access to reinforcement, and (e) praise and/or corrective feedback of the FCR. Once FCT was introduced, participants gained access to reinforcement for approximately 60 s before each session. All reinforcers were removed once the session started; however, reinforcers remained in the room beyond reach (e.g., experimenters paused the DVD player and turned the screen away from the participant). All problem behaviors were placed on extinction, and FCR resulted in 30-s access to reinforcement. Their results showed that contingency-based delays were more effective than time-based delays in maintaining low rates of problem behavior without suppressing appropriate communication supporting previous research (Fisher et al., 2000; Hagopian et al., 1998; Hanley et al., 2001).

Although it might be useful to provide a signal to indicate the availability or absence of reinforcement (Vollmer et al., 1999), Hagopian et al. (1998) found that this may not always be the case. They found that a brief signal at the beginning of the delay interval weakened the FCR and resulted in increased levels of problem behavior. Other studies have found that stimulus control may also be possible, even when only one scheduled is signaled (Fisher et al., 1998; Jarmolowicz et al., 2009).

24.3.3 Concurrent Chains Schedule

Another FCR schedule thinning procedure involves chained schedules. These are typically used to thin FCT reinforcement schedules for problem behavior sensitive to negative reinforcement in the form of escape from aversive stimuli (e.g., demands; Berg et al., 2007; Falcomata et al., 2013; Wacker et al., 2005). One example of a chained schedule is demand fading, which involves increasing the number of demands needed before the FCR may be reinforced. This method of reinforcement thinning allows clinicians to increase the number of demands required before reinforcing the FCR so that they may match similar schedules of reinforcement in a naturalistic environment. Demand fading is often used if the FCR is emitted at high rates such that reinforcement is provided at an unreasonable extent, resulting in a reduction in opportunities to comply with directives.

Davis et al. (2018) used FCT and demand fading to reduce severe problem behavior and increase compliance with a 7-year-old boy diagnosed with attention deficit hyperactivity disorder. Contingent on compliance with demands, the participant was provided with a high-quality break from work which included 30-s access to his iPad. Contingent on aggression, a low-quality break from work was provided, which only included a 10-s break from work. If he did not complete the demand, experimenters continued to provide reminders to complete his work if he wanted his iPad. Demand fading consisted of 5-min sessions in which the experimenter increased the number of letters required before presenting the S^D for a break (green card). When the green card was present, a request for a break resulted in a high-quality break, while requests for a break with no green card present resulted in low-quality breaks. The reinforcement schedule was first thinned by doubling the number of letters that the participant needed to write, followed by increasing the schedule by ten responses until reaching the terminal schedule of FR 30. Demand fading in addition to differential reinforcement for appropriate responding was effective in decreasing aggression and increasing the amount of work.

More recently, Gerow et al. (2020) compared demand fading to a dense reinforcement schedule during FCT to determine if differential levels in task completion and rate of mands would occur across two participants. Although the rate of FCR varied between participants, the rate of task completion was higher for both participants during the demand fading condition relative to the dense schedule condition. This further supports the utility of demand fading as a schedule thinning procedure when using FCT as a treatment component.

24.3.4 Combining FCT with Additional Interventions

When implementing FCT, it is important to consider that the reinforcer for the FCR might not always be immediately available, if at all. Furthermore, it might not be feasible to deliver the reinforcer if it is available (e.g., if manding for unhealthy food). When delays or withholding reinforcement occurs, problem behavior might occur, and it might not be feasible or safe to implement extinction. Therefore, other strategies might be required as part of the schedule thinning process to ensure continued low levels of problem behavior (Fisher et al., 1993). For example, Wacker et al. (1990) evaluated various components of an FCT treatment and found that each part of the treatment was necessary for control over the behavior, and withdrawal of the treatment was not effective in maintaining reduced levels of problem behavior. The contingency for problem behavior was not enough to maintain the treatment effects. Hagopian et al. (1998) summarized 21 inpatient cases and found that additional treatment components, including extinction and punishment, were necessary to reduce problem behavior. That is, it might not be sufficient to include FCT as the sole treatment component.

These findings were later supported by Rooker et al. (2013) who found that FCT in combination with other treatment components such as alternative reinforcement, extinction, or punishment was necessary to produce at least a 90% reduction in almost 80% of applications.

24.4 Generalization

Generalization of the trained communication response is an indicator of success for the intervention. Although this is the goal, it is not always possible to see generalization effects. Schindler and Horner (2005) attempted to decrease problem behavior exhibited by three children with ASD. FCT was an effective intervention in the primary setting where initially implemented, but other intervention strategies were necessary once the children transitioned to new environments. The FCR occurred at low levels outside of the primary setting and problem behavior increased. Parents also provided a low rating for the time, effort, and materials needed to conduct the intervention.

Although potentially difficult, generalization across various domains is important when teaching an FCR. Clinicians develop interventions with the intent of the individual performing the skill across settings, stimuli, and trainers. Continued implementation of the FCR in generalized settings, with novel trainers, and across modalities is important to allow treatment effects to spread beyond the context in which the skill was taught.

In the case of FCT, research primarily focuses on the acquisition of the FCR, and less is reported on generalization (Berg et al., 2007; Macnaul & Neely, 2018; Wacker et al., 2005). Ghaemmaghami et al. (2021) found that the generality of treatment effects was only evaluated in 24% (181 out of 744) of the applications assessed. Although understudied, the generalization of treatment effects may allow for long-term suppression of problem behavior over time (Derby et al., 1997; Durand & Carr, 1991, 1992).

Stokes and Baer (1977) introduced generalization as an active technology that allows for the programming of relevant behavior under different, non-training conditions outside of the initial treatment setting. In this preliminary account, nine strategies were presented to promote generalization: (a) train and hope; (b) sequential modification; (c) introduce to natural maintaining contingencies; (d) train sufficient exemplars; (e) train loosely; (f) use indiscriminable contingencies; (g) program common stimuli; (h) mediate generalization; and (i) train "to generalize."

More recently, Tiger et al. (2008) recommended three of the nine techniques presented by Stokes and Baer (1977) to promote the generality of an FCR. The suggested techniques included training and incorporating multiple exemplars, sequentially introducing training in relevant contexts, and creating a similar training environment to that of the naturalistic environment by including like stimuli.

24.4.1 Training Multiple Exemplars

Training multiple (or sufficient) exemplars increases the likelihood of generalization by reducing control of extraneous stimuli by introducing training in a previously untrained setting and measuring responses across all settings (Diaz-Salvat et al., 2020; Kirby & Bickel, 1988). Durand and Carr (1991) used FCT to increase appropriate communication and decrease problem behavior across various trainers for three boys who displayed problem behavior maintained by negative reinforcement in the form of escape from demands. An appropriate FCR was taught across novel care providers, and the behavior was generalized and maintained across new tasks, environments, and untrained teachers. Wacker et al. (2005) programmed for generalization by conducting posttreatment stimulus condition probes using stimuli that were not included during the training phase for 12 children who exhibited problem behavior. They found that while generalization occurred across persons and settings, generalization was less likely to occur across tasks.

Berg et al. (2007) analyzed treatment effects across various stimulus dimensions and dependent variables. Results indicated a strong reduction in problem behavior following FCT along with increases in appropriate communicative responses. Generalization did not occur across all stimulus dimensions, but the most consistent generalization was seen for increased task completion for all participants. Few studies have evaluated generality in terms of task competition, and future research should analyze the generalization effects of FCT in this context. Although used similarly, training multiple exemplars is distinct from the generalization procedure in which FCT is sequentially introduced in relevant contexts. The primary distinction is that subsequent generalization training in various settings.

24.4.2 Sequentially Introduce Training in Relevant Contexts

Generalization across environments must occur in collaboration with training across personnel in the various contexts. An important aspect of generalization across people is to create opportunities for multiple interactions for the learner to encounter. Allowing novel trainers to teach the FCR will allow for greater generalization of the FCR across people and settings.

The FCR should come under the control of stimuli in various contexts to establish reinforcement in the naturalistic environment (Kuhn et al., 2010; Leon et al., 2010). Teachers and practitioners should plan opportunities to allow for the generalization of the FCR outside of the training environment. This technique of generalization may pose difficulties with time and resources.

When attempting to generalize treatment effects across trainers, it is important to evaluate the effects of FCT implemented by novel personnel with minimal involvement from the trained clinician (Durand & Kishi, 1987; Northup et al., 1994). Few studies have evaluated the impact of parent-implemented FCT and the sustained use of training over time for parents (Campos et al., 2020; Gerow, Hagan-Burke, et al., 2018). Even less research has evaluated the best method of training parents to implement FCT. Generalization may be more difficult to achieve when parents are not well trained in the implementation of a given intervention.

24.4.3 Include Like Stimuli

Another method to program generalization to novel settings is to make the training environment similar to the naturalistic environment (Tiger et al., 2008). Establishing antecedent-based procedures to incorporate familiar people and tasks into the training environment is useful for generality to other settings (Kemp & Carr, 1995). Few studies have evaluated the effects of FCT on behavior beyond the training context (Durand & Carr, 1991, 1992; Durand, 1999). Durand (1999) taught five children who engaged in problem behavior to use a voice-output device in school to mand for assistance, tangible items, or brief periods of attention. The results showed FCT was effective in reducing problem behavior while increasing appropriate communication using the voice-output device across children. These results generalized to various community settings, suggesting that the voice-output device may have functioned as a discriminative stimulus to promote generalization. Maximizing common stimuli will help to remove conditional control and allow for greater generalization across settings (Kirby & Bickel, 1988). Creating modifications to the training environment can be possible by adapting stimuli in the training environment to match those of the terminal setting.

Furthermore, previous research has shown that continued application of FCT may produce withstanding treatment effects. Wacker et al. (2011) evaluated the long-term effects of FCT and demonstrated quick reductions in inappropriate behavior and improvement in appropriate behavior. The persistence of these effects suggests that FCT may be a durable treatment for long-term suppression of problem behavior while decreasing the potential for resurgence.

24.5 Resurgence

Although a treatment might successfully generalize to other settings and individuals, there will inevitably be some level of treatment integrity failure, typically as omission and commission errors (St Peter Pipkin et al., 2010; Vollmer et al., 2008). Within FCT, we are primarily concerned with omission errors, which occur when a reinforcer is not delivered following the FCR. This could result in the resurgence of problem behavior, which is defined as an increase in a previously extinguished behavior (e.g., problem behavior) when a more recently reinforced alternative response (e.g., FCR) is not reinforced (e.g., low levels of treatment integrity; Greer & Shahan, 2019).

Greer et al. (2016) used multiple schedules and chained schedules to place the FCR on extinction and found that schedule thinning was effective at maintaining the effects of FCT. Although these findings support the use of FCT, they did not evaluate the possibility of resurgence during the schedule thinning procedures. Briggs et al. (2018) examined the data collected by Greer et al. and found rates of resurgence during applications of reinforcement schedule thinning. Results indicated that resurgence occurred during 19 of the 25 cases or 76% of the applications of schedule thinning.

Volkert et al. (2009) used FCT to treat problem behavior exhibited by five individuals diagnosed with ASD or developmental disabilities. They exposed the FCR to extinction and lean reinforcement schedules to evaluate extinction induced resurgence. They found that the resurgence of problem behavior occurred for all but one participant.

Muething et al. (2020) retrospectively analyzed problem behavior during thinning of multiple schedules of reinforcement following FCT for 32 patients enrolled in an intensive day treatment program. There were 239 thinning steps across participants (M = 7.5 steps), and experimenters only compared the rate of problem behavior during the last five sessions before the thinning step to the first three sessions after the schedule was thinned. Their results showed that resurgence was observed in almost 41% of the thinning steps and that the rate of problem behavior was seven times higher with the introduction of schedule thinning relative to the average five sessions before schedule thinning. Although they described resurgence as transient, it allows more opportunities to practice errors of commission (i.e., reinforcing problem behavior), which needs to be considered when training novel individuals (e.g., parents, teachers) in the implementation of the treatment.

Research has shown that one approach to mitigate resurgence is to use discriminative stimuli signaling the availability and unavailability of reinforcement. Fuhrman et al. (2016) compared resurgence of problem behavior during an extinction challenge for two children using a traditional FCT approach (i.e., no signal) and a multiple schedule arrangement. Results showed that the multiple schedule arrangement was more effective at mitigating resurgence of problem behavior relative to the traditional FCT approach.

Teaching the FCR in a context with little or no reinforcement history for problem behavior is another approach that could mitigate resurgence. Suess et al. (2020) used a telehealth model with four participants diagnosed with ASD. They were taught an FCR in three contexts with little or no history of reinforcement for problem behavior before conducting FCT. Overall, resurgence of problem behavior was low and occurred quickly, supporting previous findings that implementing FCT in contexts that are not correlated with problem behavior mitigates resurgence (Mace et al., 2010).

24.6 Feasibility of Extinction

Extinction might not be feasible when implementing FCT for a variety of reasons, including ethical and safety reasons and treatment integrity failures (Vollmer et al., 2020). For example, if a student engages in attention-maintained aggression, school staff may be obligated to provide some level of attention (e.g., redirecting) to ensure the safety of other students and staff (e.g., Newcomb et al., 2019). Another example might include a student who engages in attention-maintained inappropriate vocalizations. Although a teacher might be able to implement an intervention with 100% integrity, other students in the class may reinforce the behavior in the form of attention. Vollmer et al. (2020) suggested modifying the operational and procedural definition of differential reinforcement of alternative behavior procedures such that it did not include extinction.

Effecting behavior change without extinction may be possible by manipulating reinforcement parameters such as rate, magnitude, delay, quality, and duration. For example, Athens and Vollmer (2010) implemented FCT with six individuals diagnosed with developmental disabilities who engaged in socially mediated problem behavior. The experimenters manipulated single or combined dimensions of reinforcement such that reinforcement favored appropriate behavior while reinforcement was still available for problem behavior. Overall, appropriate behavior was sensitive to each dimension in isolation, but the most consistent behavior change was observed when multiple dimensions were combined (e.g., duration, quality, or delay). Despite these findings, clinicians and practitioners might be reluctant to evaluate sensitivity to these parameters as it requires problem behavior to be evoked.

Kunnavatana et al. (2018) extended Athens and Vollmer (2010) by using arbitrary responses to identify sensitivities to reinforcement parameters with three individuals diagnosed with developmental disabilities. Based on the results of the parameter sensitivity assessment, they developed a treatment evaluation that included DRA without extinction, specifically, differential magnitudes and quality of reinforcement for appropriate behavior relative to problem behavior.

These shifts in response allocation can be described by the matching law, which provides a quantitative description of response allocation to two or more behaviors that are concurrently available (Baum, 1974; Herrnstein, 1961). Within the context of interventions that preclude extinction, either due to safety or integrity concerns, individuals will allocate responding to the choice with a denser or richer reinforcement schedule. Therefore, best practice should always include maximizing reinforcement for appropriate behavior (e.g., high-quality attention, immediate reinforcer delivery) and minimizing reinforcement for problem behavior (e.g., little to no attention, delay reinforcement).

Although dense and rich reinforcement schedules will shift responding toward the appropriate response, these schedules are often not feasible as terminal goals and schedule thinning must be considered. For example, it might not be possible for a parent to provide their child with immediate, high-quality praise if the caregiver is on the phone or engaged in another activity. Therefore, it is important to consult with those involved (e.g., caregivers, teachers) and consider conducting descriptive analyses to identify what might be feasible to implement without sacrificing the integrity of the treatment. These components often include some combination of delay to reinforcement, chained schedules (or demand fading), and multiple schedules. In addition to FCT, other treatment components often include extinction (Hagopian et al., 1998). However, as previously described, extinction might not be feasible or safe to implement depending on the topography of the behavior or size of the individual. Therefore, many of the examples below will include research that evaluated DRA without extinction.

Delay to reinforcement increases the duration between an individual emitting a response and the delivery of the reinforcer. However, care must be taken in identifying when to thin the schedule to minimize the reemergence of problem behavior. One such example was described by Vollmer et al. (1999) who used FCT to teach two individuals diagnosed with developmental disabilities to appropriately mand for food. They then evaluated both individual's sensitivity to magnitude using a concurrent-schedules format, during which mands produced a larger reinforcer (e.g., three chips) while problem behavior produced a smaller reinforcer (e.g., one chip). Finally, they compared the presence and absence of a signal, a hand gesture for one participant, and a timer for the other participant, when a delay was introduced for mands. Although problem behavior continued to occur despite mands producing larger, delayed reinforcers, the addition of a signal was sufficient to shift responding toward the appropriate response (i.e., mands) even as the delay increased to a terminal goal of 10 min for one participant.

More recently, Boyle et al. (2020) used FCT, tolerance training, and reinforcement thinning (i.e., delay to reinforcement) with an 8-year-old boy diagnosed with ASD to reduce elopement maintained by access to stereotypy. After teaching an appropriate response ("Can I play with that door?") which produced access to stereotypy for 1 min, the experimenters introduced tolerance training during which engaging in an alternative appropriate response ("Okay") was immediately reinforced with access to stereotypy. Finally, reinforcement schedule thinning was implemented, during which the participant was told to wait before engaging in stereotypy. The results indicated that although there was an extinction burst during schedule thinning, the FCR was quickly acquired and elopement was eliminated, and treatment effects remained through tolerance training. It is important to note that differential access to stereotypy was in place throughout the experiment (i.e., 3-s access contingent on elopement relative to 1-min access contingent on the appropriate response).

24.7 Summary

FCT is one of the most common and effective treatments for problem behaviors exhibited by individuals with ASD. Practitioners and clinicians must consider many factors before implementing FCT, including the function of the behavior and an appropriate FCR. Once FCT has been demonstrated to be effective in reducing problem behavior, plans must be made to develop an effective and efficient method to thin the reinforcement schedule, program for generalization, and develop strategies to mitigate resurgence. When each of these factors is considered and accounted for, FCT can be an immensely effective intervention that can result in long-lasting behavioral change.

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25 Response Cost and Time-Out from Reinforcement

Ashley Bagwell, Monique Barnett, and Terry S. Falcomata

25.1 Response Cost and Time-Out from Reinforcement

Response cost and *time-out from reinforcement* (referred to as *time-out* for the remainder of the chapter) are behavior change tactics that have been applied widely as part of intervention efforts to reduce problem behaviors (e.g., aggression, self-injurious behavior [SIB], property destruction, noncompliance, disruptive behavior, tantrums, pica) demonstrated by individuals with autism spectrum disorder (ASD) and other developmental disorders (e.g., Conyers et al., 2004; Nolan & Filter, 2012; Watkins & Rapp, 2014). Both response cost and time-out procedures have been demonstrated to be effective in isolation as well as in combination with other behavior change tactics (e.g., noncontingent reinforcement [NCR], differential reinforcement of other behaviors [DRO], differential reinforcement of alternative behaviors [DRA], stimulus control procedures). In this chapter, we describe the principles from which response cost and time-out are derived, relevant basic findings that predated applications of the procedures, examples of the clinical application of the procedures, and considerations for their use including advantages, disadvantages, and ethical considerations.

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25.1.1 Principles and Concepts

Response cost entails the removal of earned reinforcing stimuli (e.g., tokens, time with preferred activities) contingent on a target behavior (Harris, 1985; Kazdin, 1972; Weiner, 1962). Similarly, time-out entails the removal of an individual's access to positive reinforcement along with the opportunity to obtain reinforcement (Harris, 1985; Leitenberg, 1965). Nonexclusionary time-out consists of the removal of reinforcing stimuli from the individual while the individual remains in their current environment. Exclusionary time-out consists of the removal of the individual from the environment in which the reinforcing stimuli are present (Harris, 1985; Wolf et al., 2006).

Any discussion of response cost and time-out procedures requires a clear definition of, and connection to, the principles from which the two procedures are derived. The process that is responsible for the effects of both response cost and time-out procedures is operant conditioning; and, more specifically, the principle on which both procedures are based is *negative punishment*. Operant conditioning (Skinner, 1953) is the process by which behaviors are affected by the consequences they produce such that the behaviors are either strengthened (i.e., reinforced) or suppressed (i.e., punished). When a consequence results in an increased likelihood that a response will happen in the future or an increase in response rate, *reinforcement* has occurred. The

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two types of consequences that strengthen behaviors are *positive reinforcement* (i.e., a stimulus is presented contingent on a behavior that strengthens the behavior) and *negative reinforcement* (i.e., a stimulus is removed contingent on a behavior that strengthens the behavior). When a consequence results in a decreased likelihood that a behavior will happen in the future or a decrease in response rate, *punishment* has occurred. The two types of consequences that suppress behaviors are *positive punishment* (i.e., a stimulus is presented contingent on a behavior that suppresses the behavior) and *negative punishment* (i.e., a stimulus is removed contingent on a behavior that suppresses the behavior).

25.1.1.1 Punishment

Punishment is a naturally occurring phenomenon that impacts the behavior of all organisms, including humans, on a relatively ongoing basis. Examples of the natural occurrence of punishment include instances in which behaviors come into contact with painful consequences such as touching hot stoves or drinking hot liquids. Further, the principle of punishment, both positive and negative, is applied throughout society even though those applications may not be formally conceptualized as such by the implementers. Examples of common general applications of punishment in society include fines for moving violations or loss of driving privileges, demotion for on-the-job performance, and suspension of posting privileges on social media platforms. Two types of punishment-producing consequences are primary and secondary. Primary punishers are associated with unlearned responses and include consequences such as pain. Secondary punishers are associated with learned behaviors that rely on previous pairings with primary punishers (Sigafoos et al., 2003).

25.1.1.2 Punishment-Based Procedures in the Treatment of Problem Behavior

The field of applied behavior analysis (ABA), as reflected by (a) position statements provided by the field's primary professional organization (Association for Behavior Analysis International [ABAI]; i.e., Van Houten et al., 1988; Vollmer et al., 2011) and (b) the ethical codes of the field's primary professional certification organization (Behavior Analysis Certification Board [BACB]; BACB, 2014), subscribes to several positions pertinent to the use of punishment-based procedures. First, individuals have the right to effective behavioral treatments (Van Houten et al., 1988; Vollmer et al., 2011). This principle dictates that even though a punishment-based procedure may not be the most desirable approach given its potential side effects (Baer, 1971; Iwata, 1988), when weighed against the continued occurrence of problem behavior (because of the lack of effects of alternative approaches including antecedent and/or reinforcement-based procedures) and its own negative side effects, it may be the most appropriate approach to treatment. Second, treatments should be utilized based on the principle of least restrictiveness (Vollmer et al., 2011). This principle does not presuppose that alternatives to punishment-based procedures will always entail the most "favorable risk-to-benefit ratio" (Vollmer et al., 2011, p. 104) which should be calculated based on multiple factors including the direct effects of behavior (e.g., tissue damage to self and others, competition with learning, social isolation), duration of intervention (e.g., DRA plus punishment-based procedure may significantly reduce the length of treatment vs. DRA alone), and likely success of intervention (e.g., DRA or NCR alone are not effective in the absence of punishment-based treatment components). Third, the welfare of the individual is prioritized, including ensuring their safety (Vollmer et al., 2011). Thus, should the clinical team deem it to be in the individual's best interest given the characteristics of the clinical case and best practices based on the research literature, punishment-based procedures can/should be utilized (i.e., the interests and welfare of the individual "must take precedence over the broader agendas of institutions or organizations that would prohibit certain procedures regardless of individual's needs;" Vollmer et al., 2011, p. 104). Last, it should also be noted that it is standard and recommended practice that when punishment-based procedures are utilized, they (a) be used after alternative approaches (e.g., antecedent-based procedures, reinforcement-based procedures, combination of antecedent and reinforcement-based procedures) are either demonstrated to be inadequately effective (see Baer, 1971 and Iwata, 1988 for further discussion) or unavailable given the characteristics and/or constraints of the clinical case and (b) be combined with reinforcement-based procedures to the extent possible (Vollmer et al., 2011).

Falcomata et al. (2007) provided an example in which the above-described principles were combined in a case in which non-punishment (i.e., reinforcement) procedures were not effective at reducing problem behavior exhibited by an individual with ASD. Specifically, Falcomata et al. initially implemented NCR in the form of enriched environment (EE) in an attempt to treat automatically maintained severe pica (Fig. 25.1 shows an X-ray of a safety pin lodged in the participant's throat prior to treatment) exhibited by a 12-year-old boy with ASD. After NCR/EE was demonstrated to be ineffective, Falcomata et al. incorporated a time-out procedure along with NCR/EE and a stimulus control procedure. The treatment package was effective at reducing the pica and clearly met the criteria for justifying the use of punishment (e.g., effective, evidence-based, favorable in terms of the risk-to-benefit ratio, the welfare of the client was clearly priori-

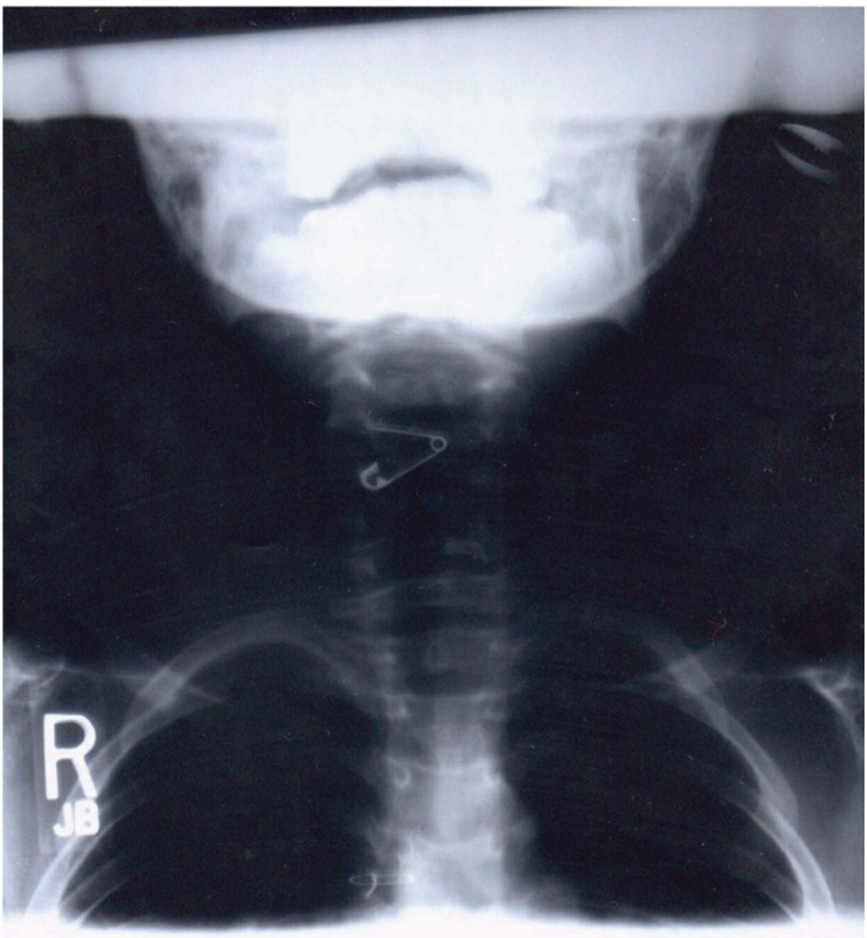

Fig. 25.1 X-ray showing physical evidence of the severity of participant's pica in Falcomata et al., (2007; Reprinted with permission from Roane et al. (2005)). The X-ray also appeared in Falcomata et al. (2007).

tized given these factors). Bagwell et al. (in preparation) provided an example of a situation in which typically recommended evidence-based procedures (i.e., blocking, high preferred item-based NCR) were not available. In this case, automatically maintained bruxism was exhibited by a 14-year-old girl with ASD, and blocking the behavior in combination with NCR was not possible. Further, only after NCR was demonstrated to be ineffective, Bagwell et al. implemented response cost which was effective at decreasing bruxism, albeit with significant side effects which were subsequently mitigated (i.e., engagement in high preferred activities was also suppressed; see below for further discussion of the study).

25.1.2 Early Basic Research on Response Cost and Time-Out

Numerous early basic and translational studies were conducted that investigated negative punishment in general, and response cost and time-out-based independent variables specifically. For example, the effects of response cost received a great deal of early attention in the basic literature, specifically, within human operant-based experimental preparations (Kazdin, 1972; e.g., Weiner, 1962). For example, Weiner (1962) studied the effects of response cost in the form of loss of points with typically developing human participants. Specifically, the participants' responding was reinforced with points via variable interval (VI; Experiment 1) and fixed interval (FI; Experiments 2 and 3) schedules of reinforcement and subsequently lost points for responding during a *cost condition* (Weiner, 1962). The results, across experiments, showed suppressing effects, including the elimination of scalloped responding with FI schedules, of the response cost procedures. Likewise, time-out also received a great deal of attention in early studies within basic research arrangements (Leitenberg, 1965; e.g., Ferster, 1958; Ferster, 1960). For example, Ferster and colleagues showed, in a series of experiments with chimpanzees and pigeons (i.e., Ferster, 1958, Experiment III; Ferster, 1960), that animal subjects terminated responding in the presence of stimuli that were paired with a time-out procedure that was contingent on responding. Ferster (1958, Experiment IV) and other researchers (e.g., Baer, 1960; Baron & Kaufman, 1966) also showed, in early basic and translational studies, that animals and humans would engage in responding that resulted in the avoidance of time-out periods.

25.2 Response Cost

25.2.1 Response Cost in Practice

It is recommended that response cost, like other punishment strategies, be used in combination with other procedures (e.g., DRO, DRA, NCR). However, a few studies exist in which response cost was the sole intervention strategy. For example, Woods (1982) implemented response cost to decrease the occurrence of severe SIB exhibited by an adolescent with ASD in the home setting. Tickets were provided at the start of each day, and engagement in any of the target problem behaviors (i.e., SIB or aggression) resulted in losing one ticket per occurrence. As the intervention progressed, the number of tickets allotted per day decreased such that fewer tickets were available to meet the criterion. Engagement in the target problem behaviors decreased to near zero levels, and a final criterion of providing only three tickets per day was met. Woods demonstrated that response cost can be used alone to reduce severe problem behaviors such as headbanging, biting, and aggression. Furthermore, the participants' family administered consequences in the home setting demonstrating that response cost can be implemented in natural environments. Bartlett et al. (2011) demonstrated a decrease in spitting for one child with ASD after reinforcement-based approaches proved ineffective. A high-preferred item (i.e., a radio) was removed contingent on spitting behavior for 10 s. After the 10 s elapsed, the radio was given back to the child. Bartlett et al. observed a decrease in spitting behaviors to near zero levels with findings that generalized and maintained up to 4 months following the intervention.

Response cost procedures have been found to be similar or more effective in comparison to other interventions. For example, Conyers et al. (2004) compared the effects of response cost to DRO on disruptive behaviors in a preschool classroom. Twenty-five students, all of whom exhibited disruptive behaviors such as screaming, crying, and throwing, participated in the study. During the response cost condition, 15 tokens were provided to each of the students via stars next to their names on a board. Contingent on disruptive behaviors, individual students lost one token. At the end of the 15-min period, the students exchanged tokens for access to preferred edibles. Engagement in disruptive behaviors decreased in both conditions, with a larger decrease observed in the response cost condition. Low rates of disruptive behavior continued to be observed when response cost intervals were increased (i.e., from 1 to 12 min). Further, Capriotti et al. (2012) compared the effects of a response cost analogue to DRO on tics exhibited by four children with Tourette's syndrome. Decreases in rates of tics were observed in both conditions with no differences observed between the effects of response cost and DRO.

Response cost can also be applied as a group contingency. For example, McGoey and DuPaul (2000) compared the effects of token reinforcement and response cost in a classroom with children with attention-deficit/hyperactivity disorder (ADHD) diagnoses. Reinforcement and response cost contingencies were implemented, respectively, for off-task behavior, disobeying rules, and tantrum behavior. During the token reinforcement intervention, the participants earned buttons that were placed on a chart contingent on appropriate behavior (i.e., following classroom rules). At the end of class, the participants were provided with reinforcers in exchange for earned buttons. During the response cost intervention, the token reinforcement system remained in place, but contingent on target problem behaviors, buttons were removed from the chart. Both token reinforcement and response cost were effective with little difference in the effects of the two interventions. McGoey and DuPaul also found that teachers considered response cost to be more acceptable than token reinforcement and continued using it after the study ended. Holland and McLaughlin (1982) evaluated the effects of response cost, public posting, and group contingencies on a variety of problem behaviors with 254 primary and secondary grade students across a school. Specifically, Holland and McLaughlin applied response cost procedures to a several behaviors (e.g., gum chewing, entering school without permission, fighting, running in hallways) by recording student's name as well as their teacher's name. Each occurrence resulted in a 1-point loss for the entire class in which the student resided; each class started each day with 10 points. At the end of the day, point totals were summed and publicly displayed outside the classroom. The results showed that the response cost procedures in combination with public posting and group contingencies were effective at decreasing problem behaviors across the school. Further, students and teachers reported that the intervention was useful and indicated that they were able to dedicate more time to learning.

Treatment packages that include response cost have been demonstrated to be effective in decreasing a variety of problem behaviors such as vocal stereotypy in the form of screaming (e.g., Shillingsburg et al., 2012), SIB (e.g., Capriotti et al., 2012), aggression (e.g., Nolan & Filter, 2012), and feeding issues (e.g., Buckley & Newchok, 2005). Shillingsburg et al. (2012) evaluated the effects of response cost on automatically maintained screaming behavior exhibited by a child with ASD. Initially, the authors provided the individual with access to a preferred activity (i.e., access to a computer). Contingent on the vocal stereotypy, the authors removed access to the computer for 20 s. Following a demonstration of the positive effects of response cost, Schillingsburg et al. incorporated demand fading to imbed instructional tasks during the procedure. After an increase in problem behavior during demand fading, the authors incorporated a DRO-based token economy along with instructions. Specifically, the authors provided tokens contingent on abstinence from vocal stereotypy and removed tokens contingent (i.e., response cost) on vocal stereotypy. Following predetermined intervals, the individual exchanged tokens for time with the computer. The combination of token economy, DRO, and response cost was effective at reducing vocal stereotypy when instructions were implemented and reinforcement was faded. Buckley and Newchok (2005) demonstrated the positive effects of response cost on packing exhibited by child with ASD during feeding. Response cost was first paired with differential reinforcement followed by the addition of simultaneous presentation of a highly preferred food. Specifically, the authors removed access to a preferred video contingent on packing and returned access following mouth cleans. Response cost plus differential reinforcement resulted in significant reductions in packing; the addition of simultaneous presentation of a preferred food further decreased packing behavior. Nipe et al. (2018) evaluated the effects of response cost, NCR, and blocking on compliance with hearing aids exhibited by a teenager with multiple developmental disabilities. The response cost component consisted of removal of preferred items for 15-s contingent on the individual attempting to remove the prostheses. After initial positive effects, the response cost and blocking components were systematically faded and compliance remained high and generalized to different settings.

25.2.2 Considerations

25.2.2.1 Advantages

Response cost can be easy to implement Response cost, especially when used in combination with reinforcement-based procedures, can take advantage of programmed reinforcers without requiring much adjustment to existing interventions. In some cases, response cost can even be self-administered by students in the classroom when class-wide rules are provided (e.g., Briesch et al., 2015). In fact, in a comparison of token economy and response cost alone and in combination, many teachers favored response cost for its specific ease of implementation (DeJager et al., 2020).

Response cost can be implemented in the natural environment The removal of access to highly preferred items (e.g., cell phones, video games, internet privileges) contingent on inappropriate behavior by parents is a common practice (e.g., Borrego et al., 2007). Likewise, the removal of a favorite toy by a parent when siblings are fighting over the toy is common (e.g., Richins & Chaplin, 2015). Removal of privileges (e.g., access to free time, recess, lunch with friends, tokens, points, or other privileges) for violation of classroom rules is common practice in educational settings (e.g., Long et al., 2019). State and local governments "remove" our money (i.e., fines) when we break traffic laws. Thus, response cost is a commonly occurring consequence in many settings for children and adults alike, in the home and at a societal level (CCBD, 1990). Response cost procedures are possible and conducive to use in natural contexts as individuals are typically accessing reinforcing stimuli on a relatively ongoing basis. Thus, from a practical perspective, reinforcing stimuli are typically available for removal contingent on undesirable behaviors.

Response cost is socially valid There have been many studies assessing the social validity of response cost. Specifically, response cost procedures are often the second highest rated form of behavioral intervention, ranking only behind reinforcement-based procedures by both teachers and parents (e.g., DRO, differential attention, social praise; Borrego et al., 2007, Curtis et al., 2006, Eid et al., 2019, Heffer & Kelley, 1987, Jones et al., 1998, Pisecco et al., 2001).

Response cost can be readily combined with reinforcement-based strategies When reinforcement-based procedures are not effective to a degree that is considered clinically significant, response cost may be introduced with relatively simple procedures in combination with reinforcement-based approaches. When reinforcement-based strategies are in place (with previously identified, programmed reinforcers and clearly identified target responses) incorporating a response cost component (when the reinforcement-based approach has been shown to be ineffective) can be relatively simple.

25.2.2.2 Disadvantages

Potential for misuse Potential for misuse exists when implementing response cost procedures. Without carefully programmed contingencies with clear operational definitions and staff training, there is a risk that response cost may be implemented incorrectly (e.g., misapplied to nontarget behaviors). Consider, for example, the implementation of response cost in conjunction with a token economy. Removing tokens based on behaviors other than the intended target behaviors, whether as a result of issues with treatment fidelity or for some other reason, might result in the "incorrect" removal of all available tokens, creating an establishing operation with regard to problem behavior (CCBD, 1990) or other complications.

Isolated use When used in isolation, response cost operates to decrease problem behavior in lieu of specific programming for increasing adaptive behavior. In instances in which the problem behavior is so severe as to pose a danger to the safety of the individual, direct care staff, or peers, a singular focus on decreasing the behavior as quickly as possible may be acceptable when considering the risk-to-benefit ratio (Vollmer et al., 2011). When the behavior has been reduced to acceptable levels, however, the focus should widen to include adaptive behaviors, and punishment procedures should no longer be used in isolation.

Undesirable side effects Undesirable side effects can occur as a result of the use of punishment (Hine et al., 2018). Interventions which are perceived by the individual to be aversive can result in an increase in the occurrence of escape and avoidance behaviors, though such effects have seldom been observed in the response cost literature (Kazdin, 1972; Walker, 1983). Another potential side effect of response cost is adventitious punishment. When Bagwell et al. (in preparation) implemented a response cost procedure for an individual who engaged in bruxism, item engagement decreased concomitantly with bruxism, suggesting that item engagement had been adventitiously punished. When response cost was used in combination with NCR with edible reinforcers, item engagement increased while bruxism remained low. Side effects associated with failures in treatment integrity can also result from the implementation of a response cost procedure. Both errors of omission (failure to reinforce appropriate alternative behaviors) and commission (failure to apply response cost to problem behavior) can result in suppressed appropriate responding and increased problem behavior responding (St. Peter et al., 2016).

Punishment and social stigma Although the colloquial understanding of punishment may not be consistent with the behavioral principle, it can impact how people outside of the field might perceive the term and its subsequent use. Thus, having the knowledge and expertise necessary to explain response cost and use it in a socially relevant and effective way may be considered a prerequisite to using response cost procedures in many settings.

25.2.2.3 Recommendations

Response cost, as a punishment procedure, should be used with caution. There are several issues to consider when response cost is implemented alone or within a treatment package.

Response cost should be applied consistently and immediately following the occurrence of the target behavior Applying response cast as closely in time with the problem behavior will ensure that the loss (e.g., removal of points) will be paired with the problem behavior. If the latency between the problem behavior and response cost is too large, the consequence may be associated with nontarget behaviors instead of the intended target behavior (Walker, 1983).

The penalty or cost should be appropriate and controlled When response cost is applied, the loss of tokens or reinforcing stimuli should match the severity or frequency of the behavior. Alternatively, if too few points are available for retention, the penalty may be considered too severe, and additional problem behaviors may emerge (DeJager et al., 2020).

Penalty arrangements resulting in negative values should be avoided When response cost is used, a maximum number of points should be preselected (e.g., 30) according to average baseline data (Walker, 1983). The implementer should avoid removal of more than the preselected number resulting in negative values. If an individual engages in more than the preselected number of points, an alternative consequence should be provided. The implementer should provide alternative ways to earn points or implement another consequence-based procedure until response cost can be readministered.

Applying response cost should be objective The removal or loss of points or access to preferred items should be contingent on engagement in the intended target response. This means that response cost procedures should be based on behavior rather than the preferences of the implementer. Walker (1983) noted that care provider frustration can emerge when addressing problem behaviors; however, frustrations should not bias how response cost is applied. Thus, it is important to remain objective and apply response cost only when target behaviors occur. Development of objective protocols, care provider training, and ongoing assessment of treatment integrity is recommended.

Response cost should only be used When reinforcement strategies are not available or have been shown to be ineffective As with any punishment procedure, response cost should be used only after other strategies have been proven ineffective, when the severity of the behavior warrants immediate and intensive intervention, or when the characteristics of the case create constraints that prevent the initial use of alternative strategies.

What is removed should be reinforcing The delivery of stimuli contingent on behavior that does not subsequently increase the likelihood of future instances of the behavior cannot be called a reinforcer. Likewise, if the removal of stimuli contingent on a target behavior does not reduce the likelihood of future occurrences of that target behavior, the response cost procedure is not functioning as negative punishment. Thus, preference and reinforcer assessments are vital in the implementation of a response cost procedure just as they are in the implementation of reinforcement-based procedures.

25.3 Time-Out

25.3.1 Inclusionary Time-Out

Inclusionary time-out involves removing the individual from the reinforcing activity or area without eliminating the ability of the individual to observe the time-in area (Harris, 1985; Wolf et al., 2006). Types of inclusionary time-out have been described as (a) contingent observation, (b) removal of stimulus conditions, and (c) ignoring. *Contingent observation* “refers to a procedure in which the individual is required to sit on the periphery of the ongoing activity and observe the appropriate behaviors of his or her peers for a brief period of time” (p.280, Harris, 1985). With contingent observation, the individual may sit adjacent to the reinforcing area and observe their peers engage in activities. *Removal of stimulus conditions* refers to the removal of reinforcing stimuli (e.g., preferred toys) contingent on engagement in a target behavior (Harris, 1985; Wolf et al., 2006). For example, if a child throws a toy at their peers, the toy can be removed from the child's possession. *Ignoring*, also known as planned ignoring, refers to the removal of social attention without removing the individual from the environment contingent on engagement in a target behavior (Harris, 1985; Nelson & Rutherford, 1983; Wolf et al., 2006). For example, if a child hits their peer with a toy, the teacher might prompt the peer to move away without engaging in conversation with the child. During the planned ignoring interval, the teacher and peers would ignore any attempts to interact by the other child. It has been demonstrated that for inclusionary time-out strategies to be used effectively, the implementer must ensure that all reinforcement is withheld (e.g., social interactions with others) and appropriate time-out behavior occurs such as sitting quietly or staying in the time-out environment (Nelson & Rutherford, 1983).

25.3.2 Exclusionary Time-Out

Exclusionary time-out is similar to inclusionary time-out in that the individual is removed from the reinforcing area. However, the individual is unable to observe others during exclusionary time-out. The individual may be required to sit facing the opposite direction of the activity, or a barrier (e.g., room divider, screen) is placed between the individual and the activity (Harris, 1985; Wolf et al., 2006). Similar to inclusionary time-out, it has been recommended that the implementer ensures that the individual does not contact reinforcement, appropriate behavior is maintained in the time-out setting, and the length of time is appropriate (Nelson & Rutherford, 1983). Ensuring that these aspects of the time-out are implemented requires the implementer to prepare the time-out setting prior to use. Thus, stimuli (e.g., toys, leisure items) are removed before the individual is placed in the time-out setting. A barrier or screen used to divide the time-in and time-out areas is typically used to prevent the individual from clearly viewing others in the time-in area.

25.3.3 Seclusion Time-Out

Seclusion time-out, also known as isolation, is the most intrusive form of time-out and is generally not recommended for use because of risk of injury and potential effects of isolation the individual may experience. However, in the interest of clarity and distinguishing the procedure from less intrusive forms of time-out and crisis management techniques, we discuss and provide a description of seclusion time-out. Seclusion time-out refers to the removal of an individual from the reinforcing area to a separate non-reinforcing environment (e.g., a separate room) with the express purpose of behavior reduction (Harris, 1985; Nelson & Rutherford, 1983; Wolf et al., 2006). Seclusion settings are typically bare and do not include any items or objects with which the individual can interact. The individual is transitioned to and placed in the separate setting alone without peers, care providers, or clinicians. An example of seclusion time-out would include placing an individual in a room without supervision for an extended period of time contingent on engagement in problem behavior. During the seclusion time-out interval, the unsupervised individual may engage in high-risk behaviors such as SIB or other destructive behaviors (Ryan et al., 2007).

A distinction should be made between seclusion time-out and crisis management, which is not a behavior reduction technique. If an individual poses a severe risk to those around them (e.g., peers, direct care staff, school-based educational personnel), crisis management procedures might include placement of the individual in a safe and secure environment, under constant and appropriate supervision (including blocking SIB if necessary), until predetermined safety criteria are met and the individual may be transitioned out of the crisis management protocol/area. The goal of this type of crisis management is to ensure the safety of the individual and others involved in an emergency situation; it is not intended as a treatment of the dangerous behavior.

25.3.4 Time-Out in Practice

Time-out has been used to address a variety of problem behaviors with considerable evidence demonstrating its effectiveness. Additionally, recent research has provided evidence that multiple variations of time-out can be used safely and effectively. For example, Donaldson and Vollmer (2011) compared two time-out procedures in terms of their effects on problem behavior (i.e., crying, aggression) exhibited by preschool-aged children. Three of four participants were diagnosed with autism or developmental delay, and the fourth participant had no diagnoses. An exclusionary time-out procedure was used such that participants were removed from the reinforcing environment contingent on engagement in problem behavior and observed by therapists during time-out periods. Within this context, Donaldson and Vollmer compared a fixed duration time-out procedure to a release contingency time-out procedure. The fixed duration time-out required participants to remain in the time-out area for 4 min. The release contingency time-out also required participants to remain in the time-out area for 4 min. However, the time-out duration increased by 30-s intervals if participants engaged in additional aggression or disruption. The results showed that both time-out strategies reduced problem behaviors and neither strategy was more effective than the other. The results of Donaldson and Vollmer suggested that using a time-out procedure with or without a release contingency can be useful in reducing problem behaviors in similar contexts.

Everett et al. (2007) evaluated the effects of parent-delivered time-out versus time-out plus escape extinction on escape-maintained noncompliance exhibited by four typically developing preschool-aged children. During both conditions, parents provided an instruction to their child. When time-out was used alone, participants were prompted to a time-out area contingent on noncompliance and were allowed to leave when appropriate behaviors were exhibited (i.e., release contingency time-out; Donaldson & Vollmer, 2011). After a release from time-out, parents presented a different instruction, and the same protocol was followed. The procedures for time-out plus escape extinction were similar; however, the parents presented the same instruction following the release from time-out. The results showed that time-out alone and time-out plus escape extinction produced increases in compliance. However, the procedure that included escape extinction was more effective than the alternative procedure.

Recent evaluations of time-out have also examined the long-term effects of time-out procedures. For example, Iwata et al. (2009) conducted an evaluation of a phased time-out procedure with individuals at a community-based residential program. The study sought to identify if time-out procedures were needed for 34 residents. Participants were diagnosed with developmental or intellectual disabilities (e.g., Prader-Willi syndrome, cerebral palsy, ADHD) and had histories of engagement in some form of problem behavior (e.g., aggression, property destruction). Exclusionary and seclusion time-out procedures were utilized contingent on target behaviors and were faded over a 1-year period. Iwata et al. successfully faded the time-out procedures for 92% of the participants; in some cases, alternative strategies were implemented. As time-out was faded, a decrease in problem behaviors was observed across participants. These results indicated that time-out does not have to be used indefinitely to produce lasting effects. Also, in some cases, time-out alone was sufficient to decrease problem behaviors.

Other recent studies of time-out procedures have evaluated other procedure-specific variations and parameters. For example, Slocum et al. (2019) evaluated the effects of delaying the implementation of time-out procedures following target problem behaviors exhibited by four preschool-aged children (two of whom had been identified as developmentally delayed; two of whom had no diagnoses). The authors first demonstrated that time-out was effective when implemented immediately following occurrences of problem behavior. Next, Slocum et al. implemented a series of conditions in which they delayed the implementation of time-out (i.e., 5 s, 10 s, 60 s, 120 s) with three of four participants. Problem behavior remained low when time-out was delayed up to 90 and 120 s. Their results suggested that time-out procedures can be effective even when the procedures are not immediately implemented following target problem behaviors. Donaldson et al. (2013) also examined procedure-specific parameters by evaluating the effects of reducing durations of time-out intervals contingent on compliance with time-out instructions. After showing the standard time-out procedures were effective at reducing problem behavior with six of six participants, Donaldson et al. found that reducing durations of time-out intervals was effective at maintaining low rates of problem behavior with four of six participants.

25.3.5 Considerations

25.3.5.1 Advantages

Social validity Studies assessing the social validity of different behavioral interventions have shown time-out to be generally acceptable. While time-out is typically rated by care providers below reinforcement-based interventions and response cost, time-out is consistently ranked above overcorrection, medication, and spanking (Blampied & Kahan, 1992; Miller & Kelley, 1992; Miltenberger et al., 1989; Plessy et al., 2018). Global efforts to eliminate the use of corporal punishment in family homes have led experts and advocates to recommend the use of time-out procedures (Warzak et al., 2012). Decisions regarding whether or not to incorporate time-out in a treatment package should be made on a case-by-case basis with support from stakeholders.

Time-out takes advantage of existing reinforcers Time-out from reinforcement necessitates the presence of reinforcement prior to the removal of either the reinforcing stimuli (inclusion) or the individual (exclusion). If reinforcement-based procedures have been attempted in isolation, adding a time-out component to the treatment package may allow the care provider to take advantage of previously programmed reinforcers.

Time-out can be quick and effective The effects of time-out procedures can be quick and considerable when they are implemented consistently and for appropriate durations. In a review of time-out parameters, Corralejo et al. (2018) found that a duration of 5 min or less was indicated based on findings regarding the effects of duration on time-out periods. Additionally, there was no benefit to time-out periods lasting as long as 10 min relative to shorter durations. It should be noted that although the required time for effects may be short for some individuals and their behavior, more time may be required for others. Thus, the time parameters of the procedures should always be individualized to the individual case. However, as long as the time-out procedures are implemented consistently and appropriately, little time may be needed to be spent in the time-out setting to produce significant reductions in problem behavior.

The individual can stay in the learning/therapeutic environment When implementing inclusionary time-out procedures, the individual does not need to leave the physical setting where the behavior occurred. For example, under some time-out arrangements (e.g., loss of access to preferred stimuli during task demands), loss of instructional time would not be a requirement during the procedure. Exclusion from time with family would not be a requirement of the procedures with individuals in home setting. Last, termination of time in the therapeutic environment would not be a requirement of the procedures with individuals receiving behavioral or other supports.

25.3.5.2 Disadvantages

Potential for misuse Potential for misuse exists when time-out is not implemented based on evidence-based recommendations. If the care provider's implementation of the time-out procedures is reinforced by escape from having to manage problem behavior (i.e., negative reinforcement), misapplication of the procedure and/or in appropriate extension of the duration of time-out can occur.

Potential loss of instructional time Potential loss of instructional time is one of the primary concerns with time-out in educational settings (Zirpoli, 2012). Extended periods of time outside the classroom can impact students' academic success as well as their relationships with peers. If time-out is being used repeatedly with an individual student at high rates and durations, it is possible that the intervention is ineffective (i.e., response cost is not functioning as a punisher, might be reinforcing the behavior) and would warrant reevaluation. Results of previous reviews of time-out usage in school settings have suggested that implementation of time-out was low relative to lost instructional time resulting from absences, suspensions, and truancies (Skiba & Raison, 1990); though updated assessment of these effects may be warranted.

Negative side effects Negative side effects commonly associated with negative punishment are possible when time-out procedures are implemented. However, reviews of time-out studies have failed to note any evidence of side effects unique or more pronounced in the context of time-out procedures (Corralejo et al., 2018; Warzak et al., 2012).

Misapplications of the procedure Misapplication of time-out procedures can occur when the function of the target behavior is not addressed or has not been correctly identified. If the target behavior is maintained by escape from demands, removing the individual from the environment (and the demand) can reinforce the problem behavior (Taylor & Miller, 1997). If a child in a classroom engages in behavior maintained by peer attention, inclusionary time-out may not remove the relevant reinforcer (Turner & Watson, 1999). Similarly, the amount of attention required to implement time-out may reinforce attention-maintained behavior, especially if physical guidance is implemented.

25.3.5.3 Recommendations

Time-in must be reinforcing As the full term (i.e., *time-out from reinforcement*) implies, time-in should be a reinforcing environment and stimuli targeted for removal should be reinforcing. If the individual is removed from a setting or if stimuli are removed that are not reinforcing, negative punishment will likely not have occurred as intended (Turner & Watson, 1999). This could, in some scenarios, overlap with escape or avoidance-maintained problem behavior in which the time-out setting might function as reinforcement.

Time-out cannot be reinforcing To be effective as a form of punishment, the time-out environment cannot contain stimuli which function as reinforcers (Turner & Watson, 1999). An alternative source of reinforcement could compete with the reinforcement that has been removed, lessening the efficacy of time-out as a punishment procedure and potentially establishing a functional relation between the problem behavior and the time-out setting.

Reinforcement based procedures should be used first Time-out should be used when reinforcement-based alternatives are not available or have been attempted and shown to be ineffective. In the event that an individual engages in severe, problem behavior which poses a risk to themselves or those around them, reinforcement and punishment-based procedures might be used in combination from the beginning of intervention, to achieve a swift reduction in problem behavior.

25.4 Response Cost and Time-Out: Acceptability

Regarding the implementation of punishment procedures generally, there are several issues relating to acceptability that merit additional consideration. A considerable body of literature and diversity of opinions has been generated around the topic of social acceptability. There are many stakeholders involved in the assessment and treatment of problem behavior. Acceptability of different behavioral interventions has been assessed from many perspectives including professional organizations (e.g., ABAI), organizations representing individuals with specific disabilities, parents, and teachers. In this section, official statements from organizations as well as studies related to social acceptability will be reviewed and discussed, along with a variety of cultural and demographic variables that have been studied with regard to the acceptability of different behavioral interventions.

25.4.1 Professional Associations and Disability-Specific Organizations

Many position statements released by organizations related to the representation of individuals with disabilities and by professional organizations (e.g., ABAI) have not specifically addressed the use of response cost or time-out, with the notable exception of exclusionary time-out. However, many organizations have officially stated positions on the use of aversive stimuli or aversive interventions, generally. While response cost and time-out procedures may be considered to be aversive in some capacity, these procedures do not fall under the scope of procedures most often identified in such position statements.

The American Association on Intellectual and Developmental Disabilities (AAIDD;, 2020) called for the elimination of aversive procedures characterized by one or more of (a) obvious signs of physical pain experienced by the individual; (b) potential or actual physical side effects, including tissue damage, physical illness, severe stress, and/or death; and (c) dehumanization of the individual, through means such as social degradation, social isolation, verbal abuse, techniques inappropriate for the individual's age, and treatment out of proportion to the target behavior. Such dehumanization is equally unacceptable whether or not an individual has a disability (AAIDD, 2020). AAIDD's positions are consistent with the recommendations for implementation identified in the current chapter more broadly in the behavioral literature.

In a position paper released by the Council for Children with Behavioral Disorders (CCBD;, 1990), the authors identified response cost as a procedure used frequently in natural settings including the classroom, the home, and in society broadly. They noted that response cost appears to be most effective when used in combination with a reinforcement-based procedure and recommend against using response cost in isolation. In a more recent position paper, CCBD (2009) drew a clear distinction between the use of time-out procedures and "seclusion," stating that the two concepts are often confounded. The authors acknowledged time-out as a behavior reduction technique and identified three forms of time-out procedures including (a) inclusionary, (b) exclusionary, and (b) seclusionary. Regarding restrictive forms of time-out, they cautioned, "regardless of the name or the purpose, if a student is alone and prevented from leaving, this setting constitutes seclusion" (CCBD, 2009, p. 3).

As discussed earlier, ABAI (i.e., Vollmer et al., 2011) provided a position statement in which the issues of restraint and seclusion were addressed. Specifically, the authors stated that they supported the use of planned time-out but that it must "(a) be derived from a behavioral assessment, (b) incorporate reinforcement strategies for appropriate behavior, (c) be of brief duration, (d) be evaluated by objective outcome data, and (e) be consistent with the scientific literature and current best practices" (Vollmer et al., 2011, pp. 105–106). Across all of the position papers detailed above, views on the use of time-out procedures are consistent. Response cost is rarely specifically addressed but also does not appear to meet the provided definitions of aversive interventions.

25.4.2 Teachers and Parents

Many studies have compared different behavioral interventions in terms of teacher and parent acceptability and preference. For example, a survey of 1005 elementary school teachers across the United States found that an intervention consisting of praise and planned ignoring was rated similarly acceptable and feasible to an intervention consisting of self-managed response cost (Briesch et al., 2015). In addition, Pisecco et al. (2001) used the Behavioral Intervention Rating Scale (BIRS; Elliot & Von Brock Treuting, 1991) to assess the acceptability ratings of 159 elementary school teachers specific to ADHD. Interventions included parent feedback/goal setting, response cost, medication, and a group contingency. Response cost and feedback/goal setting interventions were deemed comparably acceptable, and significantly more acceptable than medication.

Blampied and Kahan (1992) assessed social acceptability of punishment procedures specifically, including parent views. No significant differences were found based on respondents' demographic variables, including parental status. The interventions included were rated on a 5-point scale in terms of acceptability in different settings and different child genders. Response cost procedures and social reprimands were more preferred than time-out and overcorrection, which were rated significantly higher than physical punishment. Overall, punishment procedures were deemed to be more acceptable in the home than school.

It should be noted that many studies assessing parent perceptions of behavioral interventions have not specifically recruited parents of children who have specific diagnoses; instead, they have utilized community samples. The degree to which being a parent of a child with a history of engagement in severe problem behavior might impact one's knowledge and acceptance of various behavioral interventions has not been clearly established. One exception, Jones et al. (1998), assessed acceptability of different behavioral interventions by mothers of children with Oppositional Defiant Disorder or Conduct Disorder. Positive reinforcement was the highest rated intervention with response cost second; however, response cost was not rated significantly higher than time-out, differential attention, and overcorrection. A more recent study (i.e., Stary et al., 2016) included different diagnoses (i.e., ADHD, ASD, no diagnosis) in the vignettes used to present different behavioral interventions to parents via a community sample. As can be seen in Table 25.1 from Stary et al. (2016), positive reinforcement and response cost were rated as the most acceptable interventions regardless of diagnosis. Time-out was rated as significantly more acceptable than spanking regardless of diagnosis. However, no studies have assessed the impact of having a child with unique behavioral challenges on parent perceptions of various behavioral interventions.

25.4.3 Cultural and Demographic Variables

Some studies have assessed the potential influence of different cultural and demographic variables on social acceptability of different behavioral interventions, including response cost and time-out (e.g., Borrego et al., 2007; Eid et al., 2019; Heffer & Kelley, 1987; Mah & Johnston, 2012). Borrego et al. (2007) found that response cost procedures were rated significantly more acceptable by Mexican-American parents than any other treatment; and time-out, overcorrection, and token economy were rated as significantly more acceptable than differential attention, spanking, and medication. No differences related to response cost and time-out procedures were found when controlling for acculturation. Mah and Johnston (2012) compared perspectives of Euro-Canadian and Chinese-immigrant mothers. Techniques were grouped into three categories including (a) reward (praise and token economy), (b) withdrawal (response cost and time-out), and (c) punishment (overcorrection and spanking).

Table 25.1 Descriptive statistics for acceptability ratings of techniques and diagnostic status

Technique/diagnosis	Mean	SD	% with positive reaction
Timeout			
ADHD	13.26	4.43	60.2
Autistic disorder	13.54	3.33	61.4
No diagnosis	13.75	3.97	58.7
All groups	13.53	3.96	60.0
Response cost			
ADHD	14.87	4.03	73.6
Autistic disorder	14.42	3.18	68.4
No diagnosis	15.01	3.60	70.6
All groups	14.80	3.63	71.0
Positive reinforcement			
ADHD	15.82	3.45	70.6
Autistic disorder	15.37	4.02	73.7
No diagnosis	14.99	3.91	74.6
All groups	15.38	3.79	73.0
Spanking			
ADHD	8.78	4.60	19.1
Autistic disorder	8.86	4.66	19.3
No diagnosis	9.53	4.46	17.4
All groups	9.09	4.55	18.5

Reprinted with permission from Stary et al. (2016)

No differences were found between reward and withdrawal techniques in terms of acceptability within or between the two groups of mothers. A similar study was recently conducted with parents of children with ASD in Saudi Arabia (Eid et al., 2019). Eid et al.'s findings were consistent with studies published with American parents, with the relative acceptability of interventions placing reinforcement-based interventions first, response cost second, and time-out third and ahead of medication and spanking.

25.4.4 Summary

Response cost and *time-out* are two operant-based interventions that have been shown to be effective at the reduction problem behaviors exhibited by individuals with ASD and other developmental disorders. Both procedures are derived from basic principles pertaining to negative punishment and have wide evidentiary support in both the basic and applied research areas. Although both procedures have a great deal of support in terms of clinical application, they should both be recommended and used with caution given some associated disadvantages and ethical considerations. However, given their advantages, both procedures are viable, and valuable options in situations in which (a) non-punishment-based approaches have been exhausted or demonstrated to be ineffective, (b) when the severity of the behavior warrants immediate and intensive behavior-reductive interventions, and/or (c) when treatment constraints are present that prevent the use of alternative strategies.

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26 The Token Economy

Patrick M. Ghezzi and Ainsley B. Lewon

26.1 Introduction

We begin this chapter where papers on the token economy often end, with ethics. The decision to implement a token economy, as we shall emphasize, is always informed by the relevant coursework, training, and supervised experience in the applied analysis of behavior (ABA). If this appears obvious, it is because of the agonizing lessons learned in the early days of "behavior modification." We open a window on those days in order to comment on ethical matters pertaining to ABA in general and to the token economy in particular.

We turn next to a list of nine key elements in a token economy. We emphasize "key elements" for good reason. The trove of scientific research and systematic replication on the token economy today is sufficiently rich and informative to say with confidence that certain elements had better be in place in order for the intervention to qualify as ABA as here conceived. Putting these keys elements in motion does not guarantee a successful outcome, but it does increase the chances of one when the elements are in place. Successful behavioral interventions with high scores on measures of intervention integrity (a.k.a. procedural fidelity) consistently produce the best outcomes, as expected (Reed & Codding, 2011).

Our chapter is written for credentialed applied behavior analysts who work in the field with youthful clients and professional co-workers and who supervise aspiring applied behavior analysts. We take for granted a working knowledge of functional behavior assessment and interventions, and we naturally assume an unwavering commitment to manage the token economy according to the principles of behavior and the best practices of ABA.

The bulk of our own applied experience is early intensive behavior intervention (EIBI) and early childhood autism (e.g., Lovaas, 1987; Lewon & Ghezzi, 2020). This background does not commit us to writing a chapter on autism and early intervention per se, and besides, it would be a mistake to assume that a token economy is restricted to a particular person, age, setting, or circumstance. We take this opportunity instead to discuss broader matters, beginning with events over 50 years ago that shaped the future of ABA.

26.2 Ethics and the Token Economy

Workers in the field of applied behavior analysis might recall reading about the scandal at Sunland Miami Training Center in Jon Bailey and Mary Burch's book, *Ethics for Behavior Analysts*

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(2016; see also Curry, 2013; McAllister, 1972: NARC, 1972). Following an investigation of the residential treatment facility by Florida state officials in 1972, the superintendent and several senior staff members faced civil and criminal charges of cruel and unusual treatment of several youngsters with developmental disabilities living there at the time. The incident shocked the nation.

To make matters worse, the superintendent characterized the Sunland Miami facility as a "superb behavior modification program" (Bailey & Burch, 2016, p. 7). Florida state officials strongly disagreed, writing that the program, which included random beatings, public nudity and humiliation, physical restraint, and solitary confinement, was a "bizarre, abusive, and ineffective system of punishment (p. 2)."

The Sunland Miami program had no credible basis in ABA, concluded the authorities, and yet reports began to surface from prisons, psychiatric hospitals, and residential care and treatment facilities across the nation accusing "behavior modifiers" of exploiting convicts, demeaning psychiatric patients, mistreating elderly persons, and abusing people with disabilities (Moya & Achtenberg, 1974). Lawyers were prosecuting federal and state governments for civil rights violations, and the courts began scrutinizing therapeutic practices in prisons, psychiatric hospitals, and other "total" institutions (Wexler, 1973).

On top of that, the mainstream media was vilifying behavior modification as dystopic (Skinner's Utopia, 1971), and the motion picture industry was animating the script with a deeply disturbing parody of classical conditioning in Stanley Kubrick's *A Clockwork Orange*. To top it all off, Vice President Agnew warned in a speech in 1972 that behavior modification "poses a dire threat to traditional American values." For a young science striving to gain a toehold in human services, things could get no worse.

Against this backdrop, the American Psychological Association (APA), led by Albert Bandura, intervened by forming a Commission on Behavior Modification in 1974. "The Commission will focus on the area of applied behavior analysis in research and practice," read the mission statement, "in order to recommend effective courses of action to deal with the legal, ethical, and professional issues raised by these behavior-influencing procedures" (Stolz, 1978, p. xiv). As luck would have it, the most prominent "behavior-influencing procedure" at the time was the token economy, the ugly centerpiece of the "superb behavior modification program" at the Sunland Miami Training Center.

The APA Commission, chaired by Sidney Bijou, published a final report in 1978 that paid special attention to the ethics of large-scale applications of the token economy (Stolz, 1978). The authors of the report referred to "thousands" of undocumented token economies that surfaced in the wake of Ayllon and Azrin's legendary token economy at Anna State Hospital in the 1960s and feared that most of the programs were operating in state hospitals, nursing homes, detention centers, prisons, and schools for students with disabilities. The committee understood that the most vulnerable people in society populate these places, many too young or too old or weak to speak for themselves, many silenced by virtue of their incarceration or involuntary commitment, and each one unable to exert counter-control over a powerful and potentially coercive and oppressive system such as a token economy.

Fortunately, a token economy is like a magnet for exposing this type of trouble. As with most monetary economic systems, a token economy limits or restricts a person's access to the things and events the tokens can buy. Known technically as a "motivational operation," it is possible to take matters to extreme and even inhumane and deadly lengths, for example, by restricting an inmate's access to food, water, shelter, sleep, hygiene, social contact, and so on. The effects are conspicuous.

This, however, is not the only source of trouble that a token economy attracts. The inmate earns tokens for performing certain tasks in the prison and exchanges the tokens for the things and events the inmate can afford to buy. The relationship between tasks and tokens is laden with potential for gross inequities in workload and earnings, and the relationship between earnings and the price of the things and events that tokens can buy is equally susceptible to gross inequities.

Suppose the price for a hot dinner in the prison commissary is 30 tokens. The inmate works in the prison laundromat 8 hours a day for a maximum of 10 tokens a day, 5 days a week. The inmate might earn less than 10 tokens a day and might even lose tokens already earned during the day, for instance, for failing to meet the standards set for properly folded clothes. A guard inspects the inmate's work periodically in this scenario and dispenses tokens based ostensibly on the quality of the inmate's performance. It is safe to say that under these conditions, the inmate would be eating many cold dinners.

It is easy to imagine far greater injustices than a cold dinner. A token economy is actually susceptible to unspeakable abuse; to inconsistent, haphazard, and arbitrary use; and for use as a cudgel for punishment, retribution, and revenge. A token economy, under these circumstances, not only spells trouble but can also breed cruelty, contempt, and corruption.

It is reasonable to suppose, then, that a large number of early token economies failed on moral and legal grounds, as in the Sunland Miami case. It is also reasonable, furthermore, to suppose that many of them failed on technical and conceptual grounds, which was also the case at Sunland Miami. It turns out that Florida state officials found that the token economy at Sunland was in disarray, that staff training was nonexistent, and that the people in charge of the facility simply did not know how to manage behavior within the confines of token economy (McAllister, 1972). It seems safe to conclude that the abusive practices at Sunland grew from this inadequacy.

Fortunately, a token economy is like a magnet for this type of trouble, too. An inherent feature of the token economy is that it has many "moving parts" that require constant attention to keep the system running smoothly and in tune with the objectives set for a given individual. When the parts fail, the intervention fails, and when it fails, it is likely that the demands of the token economy exceeded the behavioral skills and abilities of the people responsible for managing the intervention. "Winging it" seems to capture these moments concisely.

Design flaws, technical errors, conceptual shortcomings, and so forth are clear sources of trouble for a token economy. Less apparent but just as troublesome is the potential for harm created by making the mistake to introduce a token economy in the first place.

We suspect that many token economies in the 1970s were adopted prematurely and probably unnecessarily, given the success of Ayllon and Azrin's token economy at Anna State Hospital in the 1960s. The trouble with introducing a token economy needlessly or too soon is that it departs from the common practice in ABA to manage an individual's behavior as naturally and unobtrusively as possible. A token economy receives poor marks on these two dimensions, bringing it closer to a "last resort" than to a "first resort" intervention on the continuum of behavior management interventions (BACB, 2020)

The upshot of poor marks on the natural and unobtrusive dimensions is another common practice in ABA; if a less contrived and less intrusive intervention fails to change behavior, then move up to an intervention with a comparably higher level of contrivance and intrusiveness. A decision to move up this scale sets the occasion for yet another common practice in ABA, which is to choose a course of action in the presence of data showing little or no change in a target behavior over the course of a deliberate and systematic progression from the least-to-most intrusive and contrived interventions.

In hindsight, it seems inevitable that many token economies would fail for technical and conceptual reasons. There were, after all, very few colleges and universities with graduate training programs in behavior analysis at the time and in the era of the Sunland Miami scandal. There was no code of ethics, no regulatory controls, and no professional organizations in behavior analysts to support the education and training of future applied behavior analysts.

In an effort to protect highly vulnerable people from harm by behavioral interventions such as a token economy, the APA Commission strongly recommended that behavior analysts adhere to the 1977 edition of APA's *Ethical Standards of Psychologists*. The recommendation provided protections not only for the civil rights of persons subject to behavioral interventions and research, but it also gave the ABA community the cover it needed to begin solving the legal, ethical, and professional problems that scandals such as the Sunland Miami affair exposed and that the commission brought to light in its report. These problems, in a nutshell, boiled down to poor academic preparation in the principles of behavior, poor training in applying the principles of behavior, poor supervision over the practice of applying the principles of behavior, and poor regulatory control over the behavior of applied behavior analysts (Johnstone et al., 2017).

How the behavior analysis community responded to these problems is beyond the scope of this chapter. It suffices to say that the group came together in the 1970s and began building the culture and infrastructure necessary for behavior analysis to succeed as a scientific discipline, as a legitimate profession, and as a leader in the human services community. The permanent products of this continuing pursuit include the Association for Behavior Analysis International (ABAI) and the Behavior Analyst Certification Board (BACB). ABAI has been accrediting graduate training programs in behavior analysis since 1993, and the BACB has been credentialing behavior analysts since 1998. A license to practice ABA, furthermore, is now required in most states and provinces, and many licensed behavior analysts working today maintain Professional Liability (Malpractice) Insurance for protection against complaints, claims, and lawsuits (BACB, 2021).

Our motive in beginning this chapter with ethical matters is to be clear from the start that implementing a token economy, or for that matter, *any* ABA intervention without the proper education, training, supervised experience, commitment, and in most states and providences, a license to practice as an applied behavior analyst, is plainly unethical and rightly so.

26.2.1 Star Charts, Point Systems, and the Token Economy

Star charts and point systems can be confused with a token economy and mistaken for ABA. The confusion over these types of systems and a token economy is understandable, given the similarities they share. Mistaking star charts and point systems for ABA is a different matter, and understanding the difference both clarifies the meaning of a token economy in the context of ABA and underlines the importance of maintaining a distinction between a token economy and systems that resemble a token economy.

A token economy is a behavior management intervention based on decades of experimental research and field studies in the analysis of behavior. A properly credentialed behavior analyst (1) selects the intervention for a given individual based on a comprehensive functional analytic assessment of the individual's behavior and current circumstances, (2) manages the intervention with the competence and commitment to follow the basic principles and best practices of ABA for the duration of the intervention, and (3) monitors and evaluates the effects of the intervention regularly according to directly measurable changes in personally and socially meaningful target behavior(s) in the intervention setting(s) and, to the maximum extent appropriate, in the individual's natural environment. A star chart or point system has none of these characteristics, obviously.

While this clearly disqualifies these systems as a token economy or ABA, it does not diminish the experience shared by millions of parents and teachers that a star chart or point system can be an effective way to promote desirable behavior at home and in the classroom with children and youth. The key to this success is the same key to a successful token economy: Maintain a contingent relation between responses and reinforcements.

Consider the child who earns points for feeding the family dog. The youngster enjoys a family picnic at the neighborhood park and feeds the dog regularly to earn enough points to exchange for the activity. The points by themselves are initially neutral, but they acquire and maintain a reinforcing function by virtue of their contingent relation to the things and events they buy, in this instance, a picnic with the family at the park.

Assuming the youngster's parents invest in the success of the system, they must commit themselves to maintaining the contingency they created for their child. This means that feeding the dog earns the child points toward a family picnic at the park, but only so long as the child earns enough points to exchange for the activity. It means that the child does not go to the park for a family picnic noncontingently, that is, without earning the correct number of points, and it also means that the points themselves are not given away freely or noncontingently, but are awarded instead just for feeding the dog in this scenario.

A token economy, as with star charts and point systems, takes advantage of a basic learning process in nature, operant reinforcement. The similarity ends there, however. The parent who awards a point on a ledger contingent on their child feeding the family dog is taking advantage of operant reinforcement, but is not thereby practicing ABA or implementing a token economy per se. For the same reason, the parent who puts a bandage over a small cut on their child's finger is taking advantage of the healing process but is neither practicing medicine nor implementing a medical procedure per se.

We hasten to add that we have absolutely no antipathy toward star charts and point systems, only toward mistaking these systems as ABA and confusing them with a token economy. Indeed, we agree with the legions of pediatricians, educators, and child psychologists that star charts and point systems can promote good behavior at home, in the classroom, and in the community.

In our work with young children and families, we sometimes encourage parents to implement a simple star or sticker chart at home. We exercise considerable caution in these cases, however. We understand that parents tend to want to introduce these systems needlessly, that the systems are susceptible to inconsistent and haphazard use, and that they are vulnerable to abuse by strict disciplinarians as an instrument of punishment. We view these as warnings and urge practitioners to keep the early history of ABA and the token economy in mind when it comes not only to selecting a token economy as a behavior management intervention but also to encouraging parents to adopt a star or sticker chart.

We turn next to a discussion of nine key elements in a token economy. Our purpose is not to review or critique the vast literature on the token economy, but instead to cite a few, mostly current studies in support of a key element, and add our own practical experience now and then to augment the scientific support. Keep in mind that we discourage people from implementing a token economy on any scale, large or small, without the proper coursework, training, experience, and credential(s) in ABA and that we encourage a functional analytic assessment of the person(s) involved in the token economy before deciding to build and manage one for them.

26.2.2 Key Elements in a Token Economy

A list of the key elements in a token economy appears in Table 26.1. We discuss each element in turn, offering suggestions along the way on how to develop, maintain, troubleshoot, and fade a token economy. To reiterate a previous point, we are more concerned with the token economy itself rather than with applications of the intervention to certain populations, ages, settings, and so on.

Table 26.1 Key elements in a token economy

Develop objectives and select relevant target responses with clarity and precision	
Measure the target behavior repeatedly, accurately, and reliably	
Choose when, where, and with whom the token economy will operate	
Pick out tokens	
Stockpile backup reinforcers	
Establish tokens as generalized conditioned reinforcers	
Specify the schedule of reinforcement	
	Token production schedule
	Token exchange schedule
	Exchange-production schedule
Decide when to exchange tokens	
Phase out the token economy	

26.2.3 Develop Objectives and Select Relevant Target Responses with Clarity and Precision

We distinguish between an intervention (or treatment) objective and the response(s) that will lead to achieving the objective for a given person. An objective for a youngster in a token economy, for example, is to be ready for school each morning. The responses that serve or accomplish this objective might include awaking earlier, grooming faster, or dressing quicker.

Developing objectives and selecting responses relevant to accomplishing the objective is an individualized, ongoing process guided by an overriding concern for a person's health, welfare, and happiness. This concern translates into objectives and responses that (1) maximize a person's access to contingencies of positive reinforcement and minimize exposure to aversive stimuli, (2) promote independence and autonomy over the course of the intervention, (3) open new and previously unavailable or restricted contingencies of positive reinforcement, and (4) establish appropriate replacements for dangerous and undesirable behaviors.

Engage the person from the start, if possible, in the process of developing objectives and selecting responses with developmentally (and culturally) appropriate methods and materials, as needed. Be mindful of the truism that learning goals linked to personally important and socially meaningful objectives keeps the "applied" and "analytic" dimensions of ABA in balance throughout the intervention (Baer et al., 1968; Common & Lane, 2017; Leaf et al., 2016).

An important first step in creating important and meaningful behavior change is to begin identifying instances of the responses that will accomplish an objective. Some or all of these responses will constitute the "targets" of the intervention. The challenge is to develop a class of target responses that is not only commensurate with a given objective but also populated with a sufficient number of instances to which positive reinforcement can be applied once the intervention begins in earnest.

A clear, concise, and easy-to-follow description of the target response(s) is essential to the success of any ABA intervention, including a token economy. A useful description includes verbs and phrases that depict a person's actions in real time. Given a learning goal to wake up in the morning at 6:30, actually waking up and getting out of bed at the appointed time is useful in that it describes the target behavior (awaking, getting out of bed) in clear and unmistakable action terms. Indeed, the whole point of describing behavior as action is to obtain an objective, unvarnished description of the behavior, one that anyone would be able to identify with perfect accuracy, at least in theory. Relying upon ambiguous or vague terms defeats this ideal and undermines the efficacy of the token economy (Moore et al., 2001).

Giving clear examples and non-examples of the response(s), describing the full range of topographies included in the class, and delineating strict rules for recording instances and/or non-instances of the response(s) in the class accomplish the task. Keep in mind that classes that are defined too broadly may fail to capture a fine-grained but clinically significant change over time and that classes that are defined too narrowly may fail to capture instances of behavior that relate to accomplishing an objective, thereby providing an incomplete picture of change over time (Johnston et al., 2020).

26.2.4 Measure the Target Behavior(s) Repeatedly, Accurately, and Reliably

It is one thing simply to observe a response and another thing to observe, record, and measure the response repeatedly with a high degree of accuracy and reliability over extended periods. The outcome of the process is a measurement system that both compliments an intervention objective and captures the responses essential to accomplishing the objective.

Obtaining a measure of inter-observer agreement (IOA) with respect to the occurrence and non-occurrence of a given target response is a long-standing practice in ABA (e.g., Johnston et al., 2020; Page & Iwata, 1986). Bear in mind that the practice of working toward and obtaining a high degree of IOA is not limited to research in ABA, but it also provides practitioners with accurate and reliable information that is necessary to assessing the impact of an intervention over time. It serves as the basis for modifying the parameters of the token economy, it tracks maintenance and generalization of behavior change in different settings and circumstances, and it is indispensable when phasing-out a token economy and moving toward less contrived and intrusive contingencies. Measuring behavior often and monitoring progress frequently have an additional benefit of keeping the behavior analyst accountable to the stakeholders and clients they serve (Hawkins & Mathews, 1999).

Behavior data collection systems are based on directly observable and objectively defined dimensions of the target behavior, facilitate data collection with high IOA, and specify how often data are graphically depicted, reviewed, and evaluated. Behavior analysts design these systems with accuracy, reliability, and validity in mind, as even the most diligently designed and monitored systems are subject to measurement error (Johnston et al., 2020).

Continuous data collection methods (e.g., frequency, duration; see Table 4.1 in Cooper et al., 2020) that capture all occurrences of the target behavior constitute the gold standard in this regard (Johnston et al., 2020). Interval recording and other discontinuous data collection methods fail to capture all instances of behavior during an observation period and therefore provide a rough estimate of the dimensions of the target behavior. The data collected using discontinuous methods are interpreted with caution given the well-documented variation and measurement error inherent in these systems (Fiske & Delmolino, 2012; Meany-Daboul et al., 2007).

Subjective or retrospective measures, such as questionnaires where stakeholders report on their perceptions of acceptability and efficacy of the token economy, may be helpful in assessing the social validity of the intervention (Common & Lane, 2017). Research has shown, however, that these indirect measures are susceptible to observer bias and may under- or overestimate the magnitude of the treatment effects. Thus, these measures supplement, not supplant, objective and direct measures of behavior (Cosper & Erickson, 1984; Reitman et al., 2004).

26.2.5 Choose When, Where, and with Whom the Token Economy Will Operate

A person's behavior is always a matter of time and place. It is critical, therefore, to be explicit regarding when, where, and with whom the token economy will and will not operate. In some cases, it might operate during all waking hours across all persons and environments. In others, it may be restricted to specific parts of the day or week (e.g., morning, weekends), to certain activities (e.g., evening routine, household chores), to certain environments (e.g., stores, parks), or to certain people (e.g., parents, teachers) who deliver and/or exchange tokens. These factors are individualized in a token economy and tailored to the objective(s) set for a given person. We might add that all stakeholders, including the person(s) for whom the token economy operates, receive instructions concerning the times, settings, and circumstances under which the economy is operational.

26.2.6 Pick Out Tokens

The "tokens" in a token economy are construed as conditioned reinforcers in behavior theory, but in practice, they function more like generalized conditioned reinforcers (Hackenberg, 2009, 2018). We shall return to the distinction in a moment, but for now, the point is simply that a token is like a coin in a traditional currency economy, something that someone earns and then exchanges at a certain time and place for things and events such as a new toy, a favorite snack, a special outing, and so forth.

A conventional token is a physical possession, light and durable, inexpensive, easy to handle and store, hard to deface or forge, and difficult to steal. Take steps, as needed, to reduce the potential for stigma by making tokens as inconspicuous as possible and by incorporating a person's preferences in the selection of the physical features of the token(s).

Research indicates that the physical features of the token itself can interact with its functional properties. Studies conducted with children diagnosed with ASD, for example, show that incorporating a child's "perseverative interests" (e.g., cartoon figures) into a token's design can augment the reinforcing effects of the token (Carnett et al., 2014; Charlop-Christy & Haymes, 1998). Visually stimulating tokens, according to Hineline (2005), may have the added benefit of strengthening the social validity of the intervention.

Research conducted in educational environments suggests that digital tokens delivered over online school communication platforms may offer an effective alternative to physical tokens (Horner et al., 2018; Robacker et al., 2016; Williamson & McFadzen, 2020). This feature is available on smartphones and tablets and could become an attractive option in future applications of token reinforcement systems. Bear in mind, however, that designing a collection of visually stimulating tokens is no replacement for well-researched procedures that establish a stimulus as a conditioned or generalized conditioned reinforcer.

26.2.7 Stockpile Backup Reinforcements

Backup reinforcements or simply "backups" are the preferred toys, items, activities, treats, privileges, and so on that a person can buy in exchange for the tokens in a token economy. The reinforcing value of a token, in the technical sense of actually strengthening the behavior on which it is contingent, is proportional to the value of the backup(s) with which the token is correlated (Moher et al., 2008). Selecting well-established, ethically responsible backups and managing their availability according to the supplies and demands of the token economy, therefore, are vital to achieving the objective(s) set for the intervention.

There are several well-documented assessments available to identify preferred stimuli with reinforcement potential in a contingent relation. Individuals with sufficient language abilities can provide input on likely backups, but bear in mind that self-reported preferences do not always correspond to actual preferences for children and adults (e.g., Northup et al., 1996). More formalized stimulus preference assessments and/or caregiver interviews may be required if a person has difficulty verbally communicating their preferences (Piazza et al., 2011).

Preference assessments do not guarantee that a given thing or event will serve a reinforcing function, but instead identifies and reveals potential reinforcements. Multiple stimulus without replacement (MSWO) preference assessments (DeLeon & Iwata, 1996) receives high marks in regard to selecting stimuli that are most likely to function as reinforcers (Kang et al., 2013).

The value of a backup changes as a function of several well-researched variables. They include (1) the level of deprivation or restriction of the backup (Ivy et al., 2015; Roane et al., 2005), (2) the effort required to obtain the backup (Reed et al., 2013), (3) the availability of other backups (Foster & Hackenberg, 2004), and (4) the magnitude, quality, and delay to the backup (Mace et al., 1994; Neef et al., 1994). Evaluate preferences often, according to this extensive literature, stay alert to the changing preferences of individual(s), keep a fresh menu of backups handy, and remember that the value of a token is proportionate to the value of the backup(s) in a token economy.

26.2.8 Establish Tokens as Generalized Conditioned Reinforcers

A token in a token economy is defined in behavior analysis as a conditioned reinforcer, one that has acquired the capacity to reinforce "due to its contingent relation to another reinforcer"

(Catania, 1998, p. 391). The function of a token is seldom restricted to a single reinforcer in practice, however, but instead is related to multiple reinforcers. "Generalized conditioned reinforcement" is the term given to "a conditioned reinforcer that is backed-up by many other sources of reinforcement" (Pierce & Cheney, 2017, p. 513). These sources, in a token economy, are the backups, as previously discussed.

The main advantage of establishing a token as a generalized conditioned reinforcer is that it augments the value of the token, thereby creating a stimulus that is capable of reinforcing countless responses so long as the contingent relations remain in effect between backups, responses, and tokens (Defulio et al., 2014; Russell et al., 2018; Sran & Borrero, 2010). In a word, a generalized conditioned reinforcer is a versatile stimulus, one that can transcend most motivational operations, settings, objectives, and individual circumstances.

Two methods for establishing a token as a conditioned reinforcer have emerged in practice guidelines (Ivy et al., 2017; Hackenberg, 2009, 2018). The most common method of the two involves a written or spoken description of the value of the token with respect to the prevailing schedule of token reinforcement, e.g., "When you earn three points, you can chose to play a video game" (Ivy et al., 2017). Incorporating this type of rule appears sufficient to establish a conditioned reinforcer for language-able people; however, the process is not well understood at this time (Moher et al., 2008; see also Hackenberg, 2009, 2018; Harte & Barnes-Holmes, 2021).

The second method is "stimulus pairing" whereby a token is closely associated in time and space with a backup. Fashioned after the traditional "S-S" procedure for establishing a conditioned reinforcer (Hendry, 1969), the protocol involves repeatedly delivering a token and a backup contiguously with, and contingent on, an appropriate, low-effort, and highly probable response. Once the response(s) is occurring at an acceptable level, delays to the time between earning a token and exchanging it for a backup are systematically added until the desired delay is achieved. Incorporating a response whereby the individual exchanges a token for a backup appears to accelerate the process of establishing the token as conditioned generalized reinforcer (Hackenberg, 2009, 2018).

26.2.9 Specify the Schedules of Reinforcement

A token economy is composed of three interrelated schedules of reinforcement. The three schedules specify (1) the response requirement and conditions under which tokens are delivered, called the *token production schedule*; (2) the exchange rate, or the number of tokens needed to trade for backups, called the *token exchange schedule*; and (3) the conditions under which an opportunity to exchange tokens for backups is available, called the *exchange-production schedule* (Hackenberg, 2009, 2018). We turn first to the token production schedule, then to the exchange-production schedule in the section developing exchange rates, and finally to the token exchange schedule.

The token production schedule specifies the contingency between tokens and responses. There are numerous options in this regard, including awarding a token after a fixed or variable number of responses (i.e., ratio schedules) or after the first response following a fixed or variable amount of time (i.e., interval schedules; see Cooper et al., 2020). The token production schedule also specifies the contingency between responses and the number of tokens earned, which can range from small to large depending upon the criteria set for responses and reinforcer amounts. On that point, target responses that occur infrequently, that require considerable time and effort, or that impact an objective in powerful and consequential ways are reinforced most frequently and most often with a large number of tokens relative to target responses without these exceptional qualities (Ghezzi et al., 2008; Miltenberger, 2016).

A great deal is known about schedules of reinforcement and how different schedules affect the rate, pattern, and other characteristics of responding (Ferster & Skinner, 1957; Hackenberg, 2009, 2018). Variable-ratio (VR) schedules often produce higher response rates than fixed-ratio (FR) schedules, fixed-interval (FI) schedules, and variable-interval (VI) schedules (de Luca & Holburn, 1990, 1992; Mazur, 1983), and individuals tend to show a preference for VR over FR and VI over FI schedules (Mazur, 2004; Repp & Deitz, 1975). Responses maintained by a relatively "lean" schedule typically show greater resistance to extinction compared to a denser schedule (Ferster & Skinner, 1957; Kazdin & Polster, 1973), and a strong preference is usually seen for immediate over delayed reinforcers (Romani et al., 2017). These are just a few of the many characteristics of token production schedules, each one offering a great deal of flexibility in terms of achieving a combination of responses and reinforcers that compliments the objective(s) set for a given person.

Managing the number of tokens in circulation is an important consideration when determining how the token production schedule interacts with the token exchange and the exchange-production schedules. Too many tokens can lead to accumulation or "saving," which can decrease the motivation to earn more (Winkler, 1972). Too few tokens in circulation can limit the number of opportunities to exchange tokens for backup reinforcers, thereby reducing the conditioned reinforcing value of the tokens themselves. The most effective token systems allow many opportunities to earn and exchange tokens but arrange the contingencies to keep savings low or nonexistent (Hackenberg, 2009, 2018; Winkler, 1971). Resolving the issue of too many or too few tokens in circulation may require adjustments to the token production schedule, or it may involve making modifications to the token exchange and exchange-production schedules, described below.

26.2.10 Decide When to Exchange Tokens

The exchange-production schedule specifies the conditions under which tokens are exchanged for backups. One option is a response-based schedule, which stipulates that a person can exchange tokens at any time, and a second option is a time-based schedule, which restricts exchanging to certain days or times regardless of the number of tokens an individual earns (Ivy et al., 2017).

A meaningful difference between the two options is the time delay between awarding tokens and exchanging tokens for backups. Response-based exchanges grant access to the backup(s) the moment a person meets the response requirement, while time-based exchanges add a delay to the backup(s). It is most helpful to know that a response-based schedule with a short delay to exchange is most appropriate for young children with and without disabilities and for persons with limited language (e.g., Hendy et al., 2005; Klimas & McLaughlin, 2007). Long delays to exchange can be difficult even for older children and adults and can weaken the positive effects of a token economy (Field et al., 2004; Moore et al., 2001). Indeed, research suggests that the frequency of exchanges is as vital to the success of a token economy as the frequency of awarding tokens (Bullock & Hackenberg, 2006; Webbe & Malagodi, 1978).

26.2.11 Select Exchange Rates

The exchange-production schedule specifies the cost in tokens of the backup(s) and functions in tandem with the token production and exchange-production schedules as a significant factor in determining response requirements in a token economy (Bullock & Hackenberg, 2006; Hackenberg, 2009, 2018). A combination of a thin token production schedule and relatively expensive backups, for example, can limit opportunities to exchange tokens for backups. A dense token production schedule together with relatively inexpensive backups, in contrast, can lead to excessive exchanges that may lower the value of the backup(s) and the tokens (Tarbox et al., 2006; Ward-Horner et al., 2017).

Several exchange-production configurations are available for use. These include (1) a fixed schedule, whereby a person exchanges their tokens after earning a given number of tokens; (2) a variable schedule, whereby a person exchanges their tokens after earning a variable number of tokens; and (3) a "menu" system, whereby an assortment of concurrently available backups can be purchased in different amounts for different sums of tokens (Ivy et al., 2017). A token economy appears to operate most effectively when variables as opposed to fixed earning requirements are used and when the magnitude and quality of the backup(s) vary in cost (Becraft & Rolider, 2015; Cihon et al., 2019; Madden et al., 2000; Sran & Borrero, 2010; Whitney et al., 2018).

Incorporating a written or pictorial "menu" of backup reinforcers may be helpful when multiple backups are available or when managing the behavior of a person with a language delay (Cooper et al., 2020; Daley, 1969). A visual reminder of the cost of each backup is particularly important when the cost of the backups range from "most expensive" to "least expensive" (Cooper et al., 2020; Ghezzi et al., 2008).

26.2.12 Phase Out the Token Economy

The key elements in a token economy have little in common with the naturally occurring contingencies of reinforcement in the everyday environment, as we said before. The demand to transition from the conditions and contingencies that manage the relevant target responses in a token economy to those that manage the individuals' behavior under more natural and less contrived circumstances is greater in a token economy compared to other ABA behavior management interventions, as we also said before. A plan to phase out the token economy, then, is on a par with the decision to develop and manage a token economy to begin with.

It may come as a surprise to discover that the scientific literature on ending a token economy is sparse compared to the vast amount of information on starting a token economy. What is available instead are well-worn recommendations on a range of topics, from promoting stimulus generalization to increasing resistance to extinction (e.g., Ghezzi & Bishop, 2008; Ghezzi & Rogers, 2011).

Consider schedule thinning, which is regarded in ABA as an essential step toward maintaining the gains made during an intervention after the intervention is over (Cooper et al., 2020). Thinning a schedule of reinforcement in a token economy is complicated by the fact that there are three schedules to consider, the token production schedule, the token exchange schedule, and the exchange-production schedule, as previously described (see also Petursdottir & Ragnarsdottir, 2019). Changes to the token production schedule are possible by systematically increasing the response requirement for token delivery and/or incorporating an intermittent schedule of token delivery (e.g., Christensen et al., 2004; LeBlanc et al., 2000). The token exchange schedule is modified by gradually increasing the cost of backups, particularly for those that are highly preferred and those with no functional equivalent in the natural environment (e.g., Tarbox et al., 2006). The exchange-production schedule is thinned slowly reducing the number of times tokens are exchanged for backups (Kazdin, 1977).

While not specific to phasing out a token economy, there are several procedures available that we consider good candidates for this purpose. They include (1) incorporating a "level system" in the token economy wherein a person passes through a hierarchy of tiered levels which culminate in the termination of contrived contingencies (e.g., Paul & Lentz, 1977; Pritchard et al., 2018), (2) reducing the number and type of backups specific to the token economy and replacing them with reinforcers available in the natural environment, and (3) establishing a self-monitoring repertoire (McLaughlin & Malaby, 1975).

26.3 Conclusion

Kazdin (1978) credits Joseph Lancaster (1778–1838) with developing the prototype of Ayllon and Azrin's renowned token economy. A talented promoter and successful businessperson, Lancaster designed his "monitorial" system to meet the demand in the nineteenth-century England to educate the growing population of poor children and youth at a time when teachers were in short supply. The solution was simple: The older children (the "monitors") would teach the younger children in small groups under the direction of an adult "master teacher." The young monitors in Lancaster's classroom earned merit badges (tokens) for their performance as teachers and disciplinarians and could exchange their tokens (badges) for prizes such as a new toy, game, book, writing materials, and the like.

Lancaster advertised the monitorial system in mostly commercial terms as an "economy of expense, efficiency of instruction, discipline by routine, motivation by competition, and neutrality of religion" (Kaestle, 1973). Ayllon and Azrin, in stark contrast, viewed the token economy in scientific terms as a "motivating environment based upon reinforcement theory, specifically operant reinforcement theory" (1968, p. 4). This change in purpose, from commercial success to applied behavior science, is a major turning point in the history of ABA. The token economy played the leading role, either as the hero or as the villain, depending on your point of view. As the hero, the token economy exposed the incompetence and systemic malfeasance to many total institutions in the USA and abroad in the 1960s; as the villain, it provided the means and pretext for unscrupulous people to violate the civil rights of persons living in total institutions at the time.

The token economy is understood in ABA today as one of many behavior management interventions. It is a demanding intervention, one that requires a great deal of preparation, planning, and daily management, as our nine key elements show, and one that can be difficult to fade without a plan in place from the start. These features of a token economy leads practitioners to evaluate less intrusive and more natural procedures before turning to the intervention to accomplish a given objective for a given person. It is a course of action in which "minimally invasive" interventions are favored over interventions such as a token economy that require not only a significant amount of time and effort but also experience, knowledge, and commitment of a veteran applied behavior analyst.

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27 Activity Schedules and Script-Fading Procedures: Key Curricula for Teaching People with Autism Independence and Social Interaction Skills

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27.1 Activity Schedules

According to McClannahan and Krantz (1999, 2010), an activity schedule is a set of pictures or words that cue someone to engage in a sequence of activities. A more extended definition was provided by Hugh et al. (2018), when they described visual activity schedules (VAS) as "an evidence-based type of visual support that provide sequential organization of the steps for an activity or skill" (p. 4). Although the use of visual cues/activity schedules to evoke sustained engagement and the completion of target response chains has a long-standing and well-established place in the applied behavior analysis literature (Bryan & Gast, 2000; Horton & Taylor, 1989; MacDuff et al., 1993; Massey & Wheeler, 2000; Pierce et al., 2013), what is considered the best practice?

A primary function of activity schedules is to increase the levels of independence/unprompted behavior (Johnson et al., 2016). In this respect, multiple authors have posited that the presence of visual cues displayed within an activity schedule has reduced learners' reliance on caregivers, increased the number of tasks completed without prompts, and increased the levels of sustained engagement or on-task behavior (Duttlinger et al., 2013; Kelley et al., 2013; Mechling et al., 2010; Purrazzella & Mechling, 2013). In fact, in a review of 28 research articles that used activity schedules, Koyoma and Wang (2011) stated that an increase in engagement or on-task behavior was the most frequently cited outcome from studies investigating the effects of activity schedules. Other outcomes posited by these authors related to an increase in the levels of independence included improvements in self-scheduling and task initiation following instruction in the use of activity schedules.

With the ongoing use of activity schedules as a means of promoting the acquisition and generalization of a wide array of target responses, several comprehensive reviews of the effects of activity schedules have been published. Some reviews have focused on the evolution of schedule formats from notebooks containing photographs to technological devices (e.g., iPad, iPhone, smart phone, Samsung Galaxy Tab), while others have analyzed the effectiveness of activity schedules as a means of teaching social skills, increasing on-task and on-schedule behavior, and promoting higher levels of independence. For example, in a 2006 review of the activity schedule literature, Stromer and colleagues reported that activity schedules could be used to

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teach generative and functional skills (e.g., social initiations, independent play, and academic skills such as reading, spelling, and math). They concluded that a combination of computer-based and notebook schedules provided an appropriate framework for the acquisition of social, play, and communication skills for children with autism spectrum disorder (ASD).

Still, other researchers have examined the effects of activity schedules on the reduction of problem behavior. Banda and Grimmett (2008) reviewed 13 studies that investigated the use of activity schedules as a means of enhancing social behavior and decreasing occurrences of problem behavior. A total of 28 children and 3 adults with autism served as participants in the reviewed publications, and the format of the schedules varied (e.g., photographic, video models, textual). The authors reported that, regardless of the format of the activity schedule, all 31 participants showed improvement in the dependent variables measured (e.g., social interactions, transitions, on-task behavior, decreased occurrences of problem behavior) following the introduction of activity schedules.

In an additional summary of the literature pertaining to the effects of activity schedules on challenging behavior, Lequia and colleagues (2011) analyzed 18 studies that included the use of activity schedules. Although they concluded that the acquisition of schedule-following behavior resulted in a reduction in problem behavior, they suggested that other variables such as severity of diagnosis, communication skills, and setting were also likely to have influenced the extent of the reduction.

In 2018, Koos and MacDuff reviewed 34 published studies that met the definition of activity schedules as posited by McClannahan and Krantz (2010). Unlike previous reviews that summarized the literature over more limited time spans, these authors examined the literature on activity schedules and other visual cues over a 40 year period (i.e., the earliest paper included was published in 1977). Most studies (i.e., 76%) examined the use of activity schedules with children—the majority of whom were diagnosed with ASD (i.e., 53%). The remaining participants were diagnosed with other developmental disorders including severe intellectual disabilities and pervasive developmental disorders. These authors also reported that 88% of the studies reviewed reported the use of photographs or video-enhanced activity schedules and 12% described written activity schedules—72% of the investigations that used photographs presented these materials in a book format. In contrast, 18% of activity schedules were presented in technological formats including, but not limited to, Dell and Microsoft PowerPoint, a Windows touch-screen computer, and an iPod Touch.

27.1.1 Mode of Presentation

Activity schedules consisting of photographs, line drawings, and/or words have all been found to be effective in increasing the levels of engagement and promoting the independent completion of tasks and activities (Knight et al., 2015; Lequia et al., 2012). Kimball et al. (2004) noted that "activity schedules have evolved in terms of (a) the ever more sophisticated media for their delivery and (b) the ever-broadening range of independent skills they may support" (p. 283). Whereas activity schedules were originally designed to cue learners to execute previously acquired skills (Stromer et al., 2006) over time, activity schedules have, in some instances, become more technologically elaborate and have evolved as a means of expanding the existing repertoires of children and adults with developmental disabilities across an array of response classes. For example, in an effort to present an activity schedule in a more socially acceptable format, Carlile et al. (2013) presented activity schedules on an iPod to teach four 8- to 12-year-old boys with autism to engage in age-appropriate leisure skills. In addition to enhancing the boys' levels of engagement, acquired skills generalized to novel settings and novel activity schedules and maintained over time after instruction had ceased.

Cihak (2011) compared the effects of *static-picture schedules* (i.e., digital photographs of participants engaging in activities) and video clips that showed learners engaged in activities and independently moving from one task to another (i.e., video models) on the number of independent transitions that were completed by four pre-teens with autism. Results showed that two of four participants emitted more independent transitions using video schedules, one participant performed better using the static-picture schedule, and the final participant's performance was equivalent across the two formats. Cihak stated that some participants "demonstrated a preference (via better performance) with one particular intervention over another" (p. 439). According to the author, the results obtained from this study "should heighten educator's awareness of the need to be flexible and to incorporate a range of research-based practices to address individual problems" (Cihak, 2011, p. 439).

Does the literature suggest a particular activity schedule format as the best practice or as demonstrating an advantage over other formats? Reinert et al. (2020) acknowledged the outcomes produced by photographic schedules (e.g., increased levels of engagement) but proposed that book-formatted activity schedules may be cumbersome to manipulate and socially stigmatizing. In citing potential advantages of digital activity schedules, the authors included that technology-based schedules (a) can be shared across devices, (b) reduce potential stigmatization because tablet computers are pervasive in most settings, and (c) lend themselves to the re-sequencing of tasks within the schedule. However, these researchers cautioned that when selecting a schedule modality, instructors and caregivers must also realize that technology-based activity schedules use equipment that is more expensive than the materials used in traditional activity schedules and that these systems require some level of technological expertise to design, use, and modify.

In a comparative study, Giles and Markham (2017) compared acquisition rates when participants used book- and tablet-based activity schedules and assessed which of the modalities participants preferred to use. Three preschool boys with ASD served as participants. During instruction, two participants showed a gradual increase in the percentage of schedule components completed without assistance using both book- and tablet-based activity schedules—the third participant required additional training sessions to reach a criterion level of performance across the two modalities. According to the authors, there was no functional difference in the rate of acquisition across the two modalities.

Giles and Markham (2017) also used a concurrent-chains preference assessment to determine each child's preferred activity schedule modality. Although it was not uncommon for participants to fluctuate in their choice of modalities, two participants selected the tablet-based schedule more often, and the remaining participant the book-based schedule. Importantly, according to the authors, the modality preferred by a given participant did not necessarily match the modality that produced more rapidly acquisition for that participant.

Although some researchers have posited the possibility of social stigmatization and lack of mobility as potential deficits of book-based activity schedules (Carlile et al., 2013; Stromer et al., 2006), both traditional book-based and technology-based activity schedules have been effective in promoting the acquisition of schedule-following skills and an increase in the levels of engagement (Cihak, 2011; Goldsmith & Le Blanc, 2004; Moore & Calvert, 2000; Williams et al., 2002).

In 2004, Rehfeldt and colleagues stated "A proficient schedule user is an individual whose completion of, and transition between activities is occasioned by the visual cues presented in his or her schedule" (p. 115) and advocated that learners who are new to activity schedules might benefit from instruction using a "standard notebook schedule" (p. 116) before proceeding to a computer-based activity schedule. With these recommendations in mind, because both book- and technology-based activity schedules have been demonstrated to produce desired outcomes, perhaps the "best practice" for selecting the most appropriate modality for activity schedules should include exposure to both standard notebook schedules and technology-based schedules so that learners' levels of on-task and acquisition of on-schedule behavior can be used to determine which type of format represents the best practice for each individual.

27.1.2 Prerequisite Skills

Rehfeldt's (2002) review of McClannahan and Krantz's (1999) book, *Activity Schedules for Children with Autism: Teaching Independent Behavior*, identified figure-background discrimination, identity matching, and matching three-dimensional objects to their two-dimensional representations as prerequisites to learners beginning the use of and/or benefiting from an activity schedule. Rehfeldt went on to suggest that compliance with adult instructions and attending behavior (e.g., visually attending to the task at hand) was also an important prerequisite to the acquisition of schedule-following behavior. Interestingly, in their review of the literature, Koos and MacDuff (2018) reported that of 34 reviewed studies, only 10 (29%) explicitly stated that picture-object correspondence or other prerequisite skills had been established prior to the introduction of an activity schedule.

Accepting manual guidance was also considered prerequisite to the acquisition of schedule-following skills by McClannahan and Krantz (1999, 2010) who stated, "The procedures we use to teach children to follow activity schedules emphasize manual guidance. If we are to accomplish this teaching, children must permit us to touch their hands, arms, and shoulders, and must allow us to guide them" (p. 17).

27.1.3 Implementation of an Activity Schedule

Spriggs et al. (2015) stated, "Consistency in schedule implementation is critical for the schedule to work in increasing desired behaviors as well as decreasing undesired behaviors" (p. 30). According to this publication, the most important factors related to the successful implementation of an activity schedule is to establish a routine based on (a) the type of schedule selected, (b) the environments where the schedule will be used, (c) and practical aspects of the schedule such as how learners will manipulate schedule materials to indicate that a task or component of a task has been completed (e.g., turn the page, mark a box). Similarly, Kimball et al. (2004) linked the successful acquisition of schedule-following behavior to (a) the selection of tasks that children could competently complete, (b) the consistent implementation of graduated guidance, and (c) an ample schedule of reinforcement for schedule completion.

When instructors/caregivers are ready to begin teaching, McClannahan and Krantz (2010) suggested the use of an initial instruction that is general in nature to evoke schedule-following behavior (e.g., "Time for chores," "Go play," "Please find something to do"). Following the initial instruction, McClannahan and Krantz suggested that graduated guidance be used to evoke schedule-following behavior and task completion and that further verbal instructions, gestural prompts, and models be avoided. In their book, *Activity Schedules for Children with Autism: Teaching Independent Behavior*, McClannahan and Krantz (1999) also advocated the use of graduated guidance and advised against the use of least-to-most prompt hierarchies when teaching children with autism to complete activity schedules "because it permits them to make many errors. After errors occur, they are likely to be repeated" (p. 38).

27.1.4 Selection of Prompt and Prompt-Fading Strategies

Several researchers (Betz et al., 2008; Bryan & Gast, 2000; MacDuff et al., 1993; McClannahan & Krantz, 1999; Spriggs et al., 2007; Torres et al., 2018) advocated the use of or used graduated guidance to teach schedule-following behavior and encouraged that these prompts be delivered from behind participants to decrease the salience of the instructor and to promote the activity schedule as a discriminative stimulus.

Interestingly, numerous other researchers have selected prompt and prompt-fading strategies other than graduated guidance to promote acquisition of targeted dependent variables and schedule-following behavior. For example, Whatley et al. (2009) successfully increased the number of independent transitions completed by four students with moderate autism using a least-to-most hierarchy of prompts. In another experiment, Carlile et al. (2013) used a progressive time-delay prompt procedure to teach participants to complete leisure tasks using an iPod Touch. They reported that the time-delay procedure used resulted in the rapid fading of prompts and allowed the instructor to successfully fade their proximity to participants until they were no longer present.

In another example, Massey and Wheeler (2000) used gestural prompts in addition to verbal and manual prompts to promote engagement in an inclusive preschool setting. As the authors reported, the number of gestures required to produce the expected levels of on-task behavior showed a pronounced decrease over time. Spriggs et al. (2016) suggested that instructors "reflect on the specific response prompting strategy that would be most successful with their students" (p. 11). Perhaps the success of the studies that did not use graduated guidance exclusively owes their success to the fact that the selected prompt and prompt-fading procedures represented the intervention variables that were most beneficial to those individual participants.

Although certain authors have advocated the use of particular prompt and prompt-fading procedures (McClannahan & Krantz, 1999, 2010), the literature suggests that the specific prompt type or fading strategy selected may be less critical than the systematic removal of prompts. Cuvo and Davis (1983) proposed that programming the transfer of stimulus control "be an integral aspect of any behavioral intervention" (p. 378). The application of a more diverse number of prompt-fading strategies in the activity schedule literature has expanded the possibilities for the successful transfer of stimulus control and allowed a greater level of individualization when designing intervention packages for learners.

27.1.5 The Presence of the Instructor as a Prompt

Although MacDuff et al. (2001) did not include the presence of the instructor in their taxonomy of prompts, the influence of supervision and its effect on learner's engagement is well documented. Dunlap and Plienis (1988) stated that while many individuals with developmental disabilities have learned to remain engaged and complete tasks in the presence of supervisory staff and "clear contingencies of reinforcement" (p. 121), levels of engagement decrease markedly when supervision is absent. Decreased levels of engagement in the absence of supervision are not unique to individuals with developmental disabilities. For example, Sariscany et al. (1995) examined the effects of three supervision strategies when providing physical education to three junior high school males. Three conditions, (a) close supervision with feedback, (b) distant supervision with feedback, and (c) distant supervision without feedback, were applied. In feedback conditions, these adolescents received 0.5 feedback statements per min. Sariscany and colleagues reported that two of three participants showed significantly higher levels of engagement when they received active supervision.

In their review of procedures designed to increase independence, Hume et al. (2009) emphasized the importance of identifying instructional strategies that result in a shift in stimulus control from continuous adult management to an alternate stimulus. An activity schedule could serve such a stimulus if the presence of the instructor can ultimately be faded. Several studies investigating the effects of activity schedules described successfully fading the proximity and/or presence of the instructor. In 1997, Steed and Lutzker used activity schedules to teach an adult with developmental disabilities to independently complete vocational activities. In the third phase of teaching, the instructor's presence was gradually faded until the participant completed tasks independent of supervision. Steed and Lutzker noted that their findings showed that picture prompts facilitated the increase and maintenance of the participant's task completion behavior and represented an alternative to direct, ongoing supervision.

Pelios et al. (2003) examined the effects of a treatment package that included the systematic fading of the instructor's presence on the promotion of independent work skills. Fading occurred via shadowing the participant and then gradually increasing the physical distance between the student and instructor until the instructor was no longer present in the room. The description of the fading process was well defined across ten steps. As stated, the initial fading steps were designed to decrease the instructor's proximity to the learner. The first component of fading was characterized by the instructor shadowing the movements of the student at a distance of 5 or 6 inches. This distance was increased to 12 and then 24 in., and finally the instructor moved to and stood in the doorway to the classroom for the duration of the session. When the proximity of the instructor had been faded to this level, the remaining fading steps were dedicated to making supervision noncontinuous and less predictable. At this point, the instructor exited the room and closed the door after instructing the child to begin their activity schedule but returned every minute on the minute mark. At the next two levels of fading, the length of time the instructor was absent was increased, and they returned every 2 min and then every 3 min. Two schedules of random supervision were then introduced in succession with the instructor returning every 2–5 min and then every 3–5 min. The final level of fading was achieved by having the instructor return once during the 15 min session at a randomly selected time. Throughout the fading process, the instructor remained in the room for approximately 3 s each time they returned. This level of systematic fading resulted in high levels of on-task and on-schedule behavior for each of the boys with a supervising adult present for only brief and intermittent periods of time.

27.1.6 The Influence of Prompts Following Errors

Although several prompt-fading procedures have been posited as "errorless," few studies have evaluated the function of prompts that follow errors. Magee and Ellis (2006) assessed the function of errors with undergraduate students learning to receptively identify Japanese words and phrases. When feedback was contingent on an incorrect response, incorrect responses predominated. Similarly, when the error-correction consequence followed nonresponding, this behavior prevailed. The authors reported that students mastered the target task in fewer trials with the above-mentioned error-correction strategies than they did in a no prompt and/or trial-and-error condition but noted that the acquired skill showed better retention in a 1-week follow-up for participants exposed to trial-and-error procedures. These results caused the authors to suggest that the corrective procedure (i.e., feedback) may have functioned as a reinforcer.

In a study conducted by Shreiber and colleagues (n.d.), the authors noted that prompts that followed errors functioned as reinforcers for many of their more challenged students. Using a staff training protocol that included modeling and feedback, the authors successfully decreased the number of prompts teachers provided that followed student errors and increased instructor's delivery of tokens. These changes in teacher behavior resulted in a marked change in the mean levels of engagement displayed by adult learners—30% in baseline and 90% following intervention.

Touchette and Howard (1984) suggested that unlike trial-and-error procedures, intervention procedures that produced a low level of errors also evoked greater attention to discriminative stimuli. They also stated that transfer of stimulus control was accelerated when the probability of reinforcement favored unprompted responding. Both observations would appear relevant to teaching learners with disabilities to complete activity schedules in which a goal would be to have the schedule function as a discriminative stimulus.

Although the most-to-least prompt sequence described by McClannahan and Krantz (1999, 2010) is designed to prevent errors, they acknowledged that all individuals will make errors when learning to follow activity schedules. They posited further that when an error occurs that the instructor returns to the previous level of prompting that had produced successful schedule-following behavior—if the instructor was prompting at the learner's shoulder, they would return to prompt at the forearm or wrist. They specified that this level of prompting should continue to be provided until the learner has made one or more correct schedule-following responses. For example, if the learner does not point to the textual or photographic stimuli in the schedule return to the previous prompting procedure until they have correctly pointed to one or two consecutive stimuli, then resume prompt-fading.

27.1.7 Activity Schedules and Reinforcement

Although "independence" has been identified as a desired outcome produced via the acquisition of schedule-following skills, the *New Webster Encyclopedic Dictionary of the English Language* defines "independent" as behavior that is not subject to the control of others or that does not rely on others. In many activity schedule publications (Bryan & Gast, 2000; Massey & Wheeler, 2000; Pelios et al., 2003; Steed & Lutzker, 1997), the emphasis of teaching schedule-following skills appears to be on increasing participants' levels of unprompted behavior (i.e., addressing, treating, and/or minimizing the level of prompt dependence exhibited by participants).

As Cameron et al. (1992) stated, sometimes prompting procedures cause people with autism to "attend to the teacher's prompt and learn nothing about the task" (p. 329). MacDuff et al. (2001) defined prompt dependence as behavior that is under the stimulus control of irrelevant aspects of the learner's environment. They repeatedly described how prompts (paired with the delivery of rewards) presented by supervising adults and/or the presence of the supervising adult often come to control target responses versus having these responses of interest come under the stimulus control of aspects of the environment that evoke these same behaviors in nondisabled individuals. Similar definitions of prompt dependence have been posited by Clark and Green (2004). Dependency was characterized by the learner's response being dependent on the controlling prompt of the therapist with little progress made in fading the prompt. Comparably, Oppenheimer et al. (1993) stated that it is not uncommon for participants to wait to engage in a response until a prompt is provided, despite having learned the skill.

A stimulus acquires control over a response only when the response emitted in the presence of that stimulus produces reinforcement (Tarbox & Tarbox, 2017). To ensure that target responses come under stimulus control of relevant aspects of the environment, it would appear prudent to select teaching strategies that emphasize environmental stimuli that will continue to be present when instruction and prompt-fading have been completed.

Stimuli are described as criterion related when they cue participants to attend to the dimensions of the stimulus complex that are relevant to making a criterion discrimination (Etzel et al., 1981; Horner & Billingsley, 1988; Smeets et al., 1990). Zane et al. (1984) stated that "the success of any method designed to facilitate performance is dependent upon the degree to which it maximizes attention to the critical dimensions of either the target (correct) and/or comparison stimuli" (p. 368). When teaching schedule-following behavior, instructors endeavor to establish the activity schedule as a relevant or criterion-related aspect of the learning environment (i.e., discriminative stimuli). The success of establishing the activity schedule as a discriminative stimulus (S^D) or series of S^Ds is dependent on fading prompts and minimizing pairing of the instructor and the motivational system used to reinforce schedule-following behavior. In their development of a practice guide for the design and implementation of visual activity schedules, Hugh et al. (2018) emphasized the importance of individualizing reinforcement systems that are used in conjunction with activity schedules.

A number of authors suggest frequently delivering reinforcers for new schedule followers and ensuring that reinforcers are delivered from behind the participant to avoid pairing the presence of the instructor with reinforcement (Doenyas, 2014; McClannahan & Krantz, 1999, 2010). Dunlap and Plienis (1988) stated that all stimuli associated with contingencies of reinforcement are likely to acquire discriminative properties. In addition these authors noted that the continual pairing of instructors with the delivery of rewards is a key variable that results in differences noted in a learner's performance when the instructor is present versus absent. Interestingly, in their review of the literature, Koos and MacDuff (2018) reported only 13 of the 34 studies reviewed (38%) described how or when reinforcement was managed within the intervention packages used by researchers to teach schedule-following behavior.

27.1.8 Socially Mediated Motivational Systems

Reinforcement is a key variable in the acquisition and maintenance of schedule-following behavior and in establishing the activity schedule as a discriminative stimulus (Kimball et al., 2004). How reinforcers are presented and managed has differed across studies. Some of the earliest studies investigating the effects of visual cues on the levels of engagement and task completion used teacher-managed rewards systems. For example, Johnson and Cuvo (1981) taught adults with mental retardation to cook using visual cues and instructor-delivered stars. Participants received a star on a bar graph for each day's performance that showed improvement over the previous data point. In another study, Thinesen and Bryan (1981) stated that instructors delivered edible reinforcers to participants for correctly completing grooming responses. These authors also described the systematic thinning of edible rewards until all edible reinforcers had been faded. As the activity schedule literature has progressed, so has the manner in which researchers have endeavored to provide appropriate levels of reinforcement for task completion, engagement, and on-schedule behavior.

Spriggs et al. (2007) increased the level of on-task and on-schedule behavior displayed by four students with moderate intellectual disabilities during centers activities that included familiar tasks such as math worksheets, computer programs, and books using picture activity schedules and an instructor-managed motivational system. "Students earned the same token during the study that they earned during their routine school day" (Spriggs et al., 2013, p. 213). Tokens were delivered at the conclusion of each 40-min session and were based on the amount of work completed. Token exchanges were also delayed; participants exchanged tokens for backup reinforcers twice each week. Similarly, Carson et al. (2008) used a delayed but socially mediated reinforcement system in combination with a photographic activity schedule to increase task completion and independent movement between tasks for three participants with mild to moderate intellectual disabilities. Prior to the 65-min sessions, participants selected a snack from a reinforcer preference menu. They gained access to this reinforcer if they completed four of five changes in task without assistance. Although Carson et al. noted that the proximity of the instructor may have influenced participants' work behavior, they made no mention of how the use of delayed reinforcers may have impacted their performance.

MacDuff et al. (1993) taught four boys with autism to complete hour-long photographic activity schedules consisting of leisure, recreation, and academic activities. Perhaps one of the most important, yet overlooked, aspects of this study was the authors' decision to embed reinforcing activities (i.e., snacks) into the activity schedule to avoid repeated pairing of the instructor with the delivery of potential reinforcers. The speed with which the presence of the instructor was faded in this study may be attributed to the fact that they were never paired with the delivery of reinforcement and, therefore, their presence and/or absence did not influence the boys' schedule-following behavior. For the four boys in this study, it is likely that prohibiting the instructor from delivering rewards and praise statements at any time not only decreased the salience of the instructor's presence but also helped establish the activity schedule as a discriminative stimulus.

Similarly, Pierce and Schreibman (1994) used photographic activity schedules with three boys with autism to evoke the independent completion of daily living skills such as making a bed, setting a table, and getting dressed. Smiley faces were placed on the last page of each activity schedule to evoke the self-delivery of reinforcers. The authors reported that the use of the activity schedule and self-management systems was taught using praise, verbal prompts, and modeling. The authors specified that behavior shaping was used to promote the "transfer of stimulus control from prompt to task-related stimuli" (Pierce & Schreibman, 1994, p. 474).

Embedded rewards might also encompass activity schedules that produce and/or provide access to potential reinforcers. For example, Mechling and colleagues (2009) taught three high school males with ASD to successfully prepare a series of recipes using a personal digital assistant (PDA) as a "self-prompting" device. Their description of the motivational system used in conjunction with the PDA included verbal praise for unprompted and correct prompted responses on a variable-ratio (VR) three schedule of reinforcement and the opportunity to consume the food they had prepared. Spriggs et al. (2014) used visual activity schedules with embedded video models to assess the acquisition and generalization of novel tasks such as check writing, table setting, and paragraph writing as well as independent movement between activities by four high school students with ASD. Spriggs et al. (2014) specified that "no tangible reinforcement was given" (p. 3852), but each session was followed by a preferred activity that was a component of students' daily schedules.

In a study designed to teach adults with mental retardation to complete self-care, housekeeping, and leisure activities, Anderson et al. (1997) used pictures and line drawings to design individualized activity schedules. For one of the three participants, the target activities were presented in a book format with tokens attached to the schedule pages. The learner removed the tokens as they completed each activity. Another participant in this study selected a "favorite activity" from an array of possibilities and placed the picture of that activity below the other activity schedule pictures placed in a column on their bulletin board. The authors noted that although this participant could complete these tasks in any order, they typically saved the favored activity until the others had been completed. The final participant also displayed their activity schedule stimuli on a bulletin board. Although the authors did not explicitly describe the motivational system for this individual, their activity schedules were brief and consisted of only a few activities—when they completed their scheduled activities, the authors stated that they would engage in routine activities that they had previously completed without assistance. Perhaps the opportunity to engage in their daily routine had reinforcement value.

In a study designed to teach a child with autism "generative sociodramatic play" skills, Dauphin et al. (2004) used a teaching package that combined video-based matrix training and notebook activity schedules. The authors embedded breaks in both types of activity schedules. In the video-based activity schedule, slides that played auditory praise and signaled the availability of a break were included. When the participant earned a break, they gained access to preferred activities and snack. Similarly, a token was mounted on each page of a book-based activity schedule that the student manipulated when they completed an activity. The last picture in the schedule depicted the icon for a break.

In their development of a practice guide for the design and implementation of visual activity schedules, Hugh et al. (2018) suggested that the schedule of reinforcement required by learners is likely idiosyncratic and therefore requires that the motivational system associated with the activity schedule be individualized. That said, if a goal of instruction is to ultimately fade the presence of the instructor, motivational systems that rely on socially mediated access to tokens and other conditioned reinforcers would appear detrimental because they cannot be implemented in the absence of the instructor and result in a condition in which previously reinforced behaviors (e.g., task completion and schedule-following behavior) are placed on extinction. Therefore, systems that included embedded reinforcers and that promote self-management of reinforcement systems including gaining access to materials or activities acquired through token exchange may be of value particularly for older learners and adults.

27.1.9 Self-Management Systems

Neizel and Busick (2009) posited that self-management meets criteria as an evidence-based intervention strategy that has been used to reduce inappropriate behavior (Coyle & Cole, 2004) and increase adaptive responses such as giving compliments (Lowy Apple et al., 2005), on-task behavior (Axelrod et al., 2019; Callahan & Rademacher, 1999), play skills (Lee et al., 2007; Newman et al., 2000), and increasing levels of independent behavior (Reinecke et al., 2016). Although the conceptualization and use of "self-reinforcement" have been debated within our field for decades (Golddiamond, 1976; Hayes et al., 1985), a few studies from more recent times were identified that taught participants to self-manage rewards/reinforcers. One example of an early study found that college students who self-reinforced significantly increased the duration of their study time, while undergraduates who did not self-manage rewards did not (Tichenor, 1977).

Agran et al. (2001) taught six males with varying disabilities (e.g., learning disabilities, visual impairments, intellectual disabilities) and self-regulatory behavior that included self-monitoring, self-evaluation, and self-delivery of rewards. The authors specified that the acquisition of the targeted self-management responses was likely to promote greater levels of independence, competence, and acceptance for the participants. In their effort to teach the participants to self-reinforce, Agran and colleagues taught the boys to praise their own behavior whenever they attained a level of performance that met or exceeded pre-established goals. When participants achieved weekly goals, they selected a preferred activity or snack. For example, one participant was interested in the Titanic. As a component of their self-evaluation and self-managed motivational system, they added a letter to their daily self-evaluation card whenever their daily performance reached the predetermined goal. Access to the weekly reward was contingent on spelling the word "Titanic."

In another study (i.e., Stevenson & Fantuzzo, 1984) involving "self-management," an under-achieving student was taught to use self-monitoring, self-evaluation, and self-delivery of rewards to address goals for the accurate completion of math problems—the participant self-administered a gold star each time they achieved or exceeded their goal. Later, they exchanged accumulated stars for items depicted on a self-determined menu.

Although self-management of reinforcers would appear to lend itself to use with activity schedules, only one published study was identified that examined the effects of this strategy. In a 2017 publication, Beaver and colleagues compared the levels of on-task behavior and task completion produced by teacher-delivered and self-delivered motivational systems for adolescents with autism. Participants used text-based activity schedules presented on an iPod to complete vocational, functional living, and leisure activities. Prior to intervention participants were taught to use a golf counter for the self-delivery of reinforcers. During the teacher-delivered condition, the instructor delivered reinforcers via clicks on the golf counter beginning with an FR2 schedule of reinforcement. When on-task behavior and task completion increased, the schedule of reinforcement was gradually thinned—when thinning was completed, participants performed using a FR28 schedule of reinforcement. In the *self-reinforcement* condition, pictures of the golf counter were embedded within the activity schedule—participants advanced the counter each time the picture appeared. The proximity of the instructor was faded under both reinforcement conditions. The authors reported high levels of on-task behavior and task completion under both reinforcement conditions and that the proximity of the instructor was successfully faded in approximately the same number of sessions. The authors concluded that although both systems for reinforcer delivery were equally effective, the self-managed system may have been superior because it permitted the presence of the instructor to be completely faded, while the teacher-managed system required the instructor to be present, at least, occasionally.

27.1.10 Summary

Applied behavior analytic research on intervention with people with developmental disabilities may be viewed as an effort to identify and assess procedures that, it is hoped, will bring target responses under the control of relevant, naturally occurring discriminative stimuli. Activity schedules can come to function as discriminative stimuli and continue to be one of the most effective evidence-based interventions available that reliably increases levels of engagement, task completion, and movement from one task to another. The research literature also suggests that with systematic fading of prompts and embedded or self-managed reinforcement systems, activity schedules can be completed at a criterion level in the absence of or with limited supervision.

27.2 Scripts and Script-Fading Procedures

A script is an audiotaped or written word, phrase, or sentence that enables people with autism to start or continue conversation (McClannahan & Krantz, 2005). Scripts can be used to teach students with limited vocal repertoires as well as students with rather complex vocal repertoires. The general goal of script-fading is to reduce students' dependency upon verbal prompts so that they spontaneously engage in social interactions.

27.2.1 Selecting the Type of Script To Be Used

Scripts may be presented via an audio recording or textual stimuli. In a seminal study by Krantz and McClannahan (1993), scripts were presented using textual stimuli to teach students to interact with one another during an art activity. Stevenson et al. (2000) adapted this procedure to incorporate the use of auditory scripts to teach non-readers to initiate interactions. Scripts were presented via a magnetic card reader, and faded one word at a time, from end to beginning, until only photographs of activities remained.

In a review of the script-fading literature conducted by Akers et al. (2016), visual (i.e., textual) scripts were deemed to be slightly more effective for individuals with autism. The authors hypothesized that because visual scripts provide two modes of presentation, in that they provide a visual support and oral response via the verbal prompt, there may be more enhanced responding.

Researchers have provided limited rationales for selecting the use of an auditory or written script. Primarily, researchers have identified the use of textual scripts for participants that displayed prerequisite reading skills. For example, Argott et al. (2008) indicated that all participants could read and therefore selected the use of written scripts to teach three individuals with autism to respond to affective stimuli with an empathetic statement. This procedure was effective for two of three participants. However, for the third participant, reading the prompt and emitting the appropriate empathetic response proved challenging, despite their success in reading the textual stimuli. When auditory scripts were presented and slight procedural modifications were made, they began to respond to the affective stimuli with appropriate empathetic statements. This led the authors to suggest that the method of presenting scripts should be individualized.

27.2.1.1 Factors That Influence the Selection of Scripts

While further research is needed to compare the effectiveness of textual versus auditory scripts, some potential factors to consider should include the student's particular strengths related to verbal imitation and reading. Students who do not display prerequisite reading skills will require the use of auditory scripts. Some students who have acquired prerequisite reading skills struggle with quickly referencing the textual stimuli and orienting toward the interaction partner. Additional teaching in which the student reads a phrase and orients to an interaction partner may be necessary.

Other factors to consider when selecting the type of script to be used pertain to the specific skill being taught. Auditory scripts may have the distinct advantage of modeling aspects of vocal behavior, such as intonation, volume, and inflection. If teaching a student to display an empathetic response, as Argott et al. (2008) did, this may be of particular importance. Similarly, when teaching students to ask questions, an auditory model of change in inflection may be valuable. Written scripts, however, can be more easily attached to items in the environment and are more discreet and portable. Brown et al. (2008) used written scripts to teach students to engage in interactions while shopping in a mock store and ultimately in community settings. A student learning to order from a menu may have written scripts available in their wallet to reference as they order. Students learning to complete worksheets or other written tasks may have scripts incorporated on those pages. Written scripts can also be faded in a more gradual manner, such as by removing one letter at a time or even by cutting a letter in half.

Some students may be more likely to omit words presented via an auditory script due to the fleeting nature of auditory stimuli. These students may instead benefit from the visual support of a written script. Additionally, when using scripts with multiple students, peers may attend to the recording rather than the individual repeating the script. In this format, such as when teaching children to interact with one another during play, the use of textual scripts may be beneficial. Alternatively, for students with articulation challenges, it may be advantageous for peers to hear the recording as it may serve to supplement the child's vocal speech.

It is often helpful to teach students to imitate the audio-recording or read the written script prior to the onset of instruction. At times, even students who display proficiency in vocal imitation struggle with imitating from a recorder and require supplemental instruction. For children who approximate vocal models, such as by saying "buh" for "ball," the recorder may include that single sound, in an effort to evoke this verbal response.

Students who have acquired early vocal imitation responses, such as imitating single sounds or short words, should immediately begin learning to imitate these same sounds or short words from an audio-recording. This has two benefits. First, it prepares the student for the use of script-fading procedures. Second, it teaches the student to imitate vocalizations without the added prompt of observing instructors' lip movements. Instructors may do this by alternating opportunities to imitate in vivo vocal responses and responses presented on recording devices.

For students who do not display prerequisite skills related to receptive labeling, photographs should be included on scripts. For example, if a student learns to approach an adult with a recorder and imitate "play tag" but then does not attempt to engage in that activity, attaching a photograph of them running may be useful to associate meaning to the script. For some students, this strategy may be sufficient in teaching picture-object correspondence. For other students, direct teaching of picture-object correspondence will be necessary. Stevenson et al. (2000) attached photographs to auditory scripts and faded these photographs over the course of the study.

Textual and auditory scripts may also be introduced and faded using smart phones and tablets. This has been done at the Princeton Child Development Institute (PCDI) by using a variety of applications and embedding text or voice recordings within activity schedules or photographs presented on the device. For example, a young adult may learn to swipe through the photographs on their smart phone to talk about recent events with peers. Scripts are recorded within the photographs and ultimately faded. These technological advancements, in addition to the recent popularity of smart watches, have the potential to increase portability of scripts and provide additional strategies for fading scripts, such as by fading the volume of the auditory model.

	Auditory scripts	Textual scripts
Format	Voice recorders Smart phones Smart watches Tablets	Cards, worksheets, written cues Smart phones Smart watches Tablets

Advantages	Models various aspects of vocal behavior Does not compete with visual attending	Child can repeatedly reference the script Portable and discreet
Disadvantages	Auditory stimuli are fleeting	May compete with visual attending

Clinicians are encouraged to evaluate each of these factors prior to determining whether to use auditory or written scripts. Further research is needed to determine how auditory and written scripts compare in the acquisition of scripts and the success of script-fading. Additionally, researchers should evaluate the impact of ancillary aspects of vocal behavior, such as appropriate intonation and inflexion.

27.2.2 Selecting the Content of the Script

In addition to determining the type of script to be used, instructors must carefully select the content of that script. For very early learners, scripts may be introduced without a vocal response. A young child may be taught to obtain a script, such as a card featuring a photograph of a toy. The child approach an interaction partner and activate the recorder that says "Look" while orienting to the adult to garner their attention. This allows the child to come into contact with social attention and to engage in early reciprocal interactions, prior to learning to emit vocal responses.

In order for students to come into contact with reinforcement for social interaction, vocal responses must be socially competent. Creating scripts that are age-inappropriate or include atypical use of language has the potential to socially stigmatize students. Scripts that might be taught at a young age should be modified as needed to increase socially acceptability. Perhaps a 2-year-old is taught to say "potty" prior to using the bathroom. As they age, scripts may be reintroduced to teach them to say, "May I use the bathroom," and as they enter adulthood, it may be more appropriate for them to say, "Excuse me, I'll be right back."

27.2.2.1 Incorporating Content Developed by Peers

Observing similarly aged peers of typical development can be enormously helpful in generating normative samples of rates of interactions and content of interactions. Garcia-Albea et al. (2014) observed preschool and kindergarten students of typical development playing with toys that were similar to those introduced during script-fading sessions. Three categories of scripts were created (i.e., identification of the toy, description of the toy, function of the toy) based on the results of this observation. Similarly, Gomes et al. (2020) conducted a 30-min observation of five children of typical development exposed to stimuli used to evoke a joint attention response during the course of the study. Scripts generated were identical or highly similar to those emitted during the observation. In many cases a normative sample may produce language that exceeds that child's expressive and receptive repertoire. Scripts will require modification to ensure that the student with autism can imitate the script fluently and is understandable if there are articulation challenges.

Researchers have yet to evaluate the influence of the content of scripts and how this relates to ongoing social interaction following the fading of scripts. Anecdotally, during clinical observations there appears to be a correlation between a students' understanding of the content of a script and the generality and maintenance of that response. If a student learns to say, "My brother plays lacrosse," without having a referent for the word "lacrosse," it is unlikely that the student will initiate this interaction in relevant contexts. Future research should more carefully assess participants' understanding of content presented via scripts to determine how this influences effectiveness and to identify whether students acquire new vocabulary during the script-fading process.

27.2.2.2 Teaching Students to Write Scripts

As students become more proficient in their use of scripts and respond to script-fading procedures, alternate stimuli may be used to evoke social interactions. For example, students may learn to generate conversational exchanges when given only a topic or may learn to write their own scripts (McClannahan & Krantz, 2005). While research has not yet been conducted in this area, clinically, we have used these strategies at PCDI over the years. It is very common for PCDI students to learn to prepare for lunch by obtaining a worksheet, selecting topics to discuss with friends, and writing scripts to bring to lunch. This allows the student to be an active participant in choosing topics of conversation. For example, perhaps a child is given several categories, such as recent events at school, an upcoming holiday, or a favorite movie. The student may look through those options and choose to talk about his favorite movie. Differential reinforcement is used to teach students to select topics that are novel, accurate, and interesting to others. Instructors may remind students that they have already spoken about a topic or include visual supports, such as having a student cross items off a topic list after discussing them. For some students additional fading steps are introduced so that the scripts are not present during lunch. Instead, generating and reviewing scripts beforehand is sufficient in maintaining social interactions.

27.2.3 Identifying a Teaching Strategy

Prior to implementing script-fading procedures, clinicians should plan for the use of prompts, error correction, and reinforcement. One of the goals of script-fading is to prevent students from becoming reliant upon instructor prompts to interact. Specifically, this strategy reduces the need for verbal prompts, which can be more difficult to fade. Thus, it is critical that prompting strategies be selected on the basis that they will be successfully faded. McClannahan and Krantz (2005) indicate that physical prompts should be used to prevent the occurrence of errors. But, when errors occur, prompting should resume, and a behavioral rehearsal should be completed. The use of physical prompting strategies has been most commonly used in the literature (Garcia-Albea et al., 2014; Krantz & McClannahan, 1993; Stevenson et al., 2000; Wichnick-Gillis et al., 2019). Gomes et al. (2020) also used physical prompts during teaching and incorporated the use of behavioral rehearsals if a participant did not initiate a bid for joint attention.

If a child does not have a history of approaching adults, a second person is helpful during early teaching sessions (McClannahan & Krantz, 2005). The instructor stands behind the student and provides physical prompts for the student to obtain the script, approach the interaction partner, and initiate the script. Students who demonstrate prerequisite skills in emitting vocal responses and approaching an interaction partner can begin learning to use scripts to engage in vocal exchanges. McClannahan and Krantz (2005) recommend beginning by observing a child's preferences and identifying toys, foods, or activities that he or she especially enjoys. If these preferences are not obvious, a preference assessment may be valuable. Ideally, early scripts would result in immediate access to those items.

The early script-fading literature did not include delivery of reinforcement by the instructor (e.g., Krantz & McClannahan, 1993, 1998). Since then, many studies have followed suit (Groskreutz et al., 2015; Pollard et al., 2012; Stevenson et al., 2000; Woods & Poulson, 2006). Some studies incorporated the use of materials that may have reduced the need for instructor-delivered reinforcement. For example, Akers et al. (2018) and Reagon and Higbee (2009) taught interactions about play materials that may have functioned as a reinforcer throughout teaching. Similarly, in a study by Sarokoff et al. (2001), participants had access to snacks and video games following initiations in which textual stimuli were embedded on those items. Other studies have incorporated the use of additional reinforcers, such as snacks (Garcia-Albea et al., 2014; MacDuff et al., 2007) or tokens (Argott et al., 2008; Brown et al., 2008; Dotto-Fojut et al., 2011; Wichnick, Vener, Keating et al., 2010; Wichnick, Vener, Pyrtek et al., 2010; Wichnick-Gillis et al., 2016; Wichnick-Gillis et al., 2019). Both Garcia-Albea et al. (2014) and MacDuff et al. (2007) thinned the schedules of reinforcement during the course of the intervention until instructor-delivered prompts were no longer used.

Prior to determining whether to incorporate the use of instructor-delivered reinforcement, Gomes et al. (2020) conducted a social consequence reinforcer assessment to determine the reinforcing value of adult social responses (modified from Isaksen & Holth, 2009). Based on the results of this assessment, social reinforcement was used for two participants, and an additional reinforcer (i.e., edibles) was added for two participants but thinned out throughout the course of the study. This is the first study to provide such clear rationales pertaining to the introduction of tangible reinforcers to establish adult-delivered social consequences as conditioned reinforcers.

The determination of the use of tangible reinforcers should be individualized based upon the student's responsiveness to social reinforcers and the task being targeted. It is likely that the content of the script will impact whether additional reinforcers are needed. For those responses that require ongoing programmed reinforcement, self-monitoring might be an effective strategy. Krantz and McClannahan (1993) had participants use check marks to indicate the use of a script. It is possible that checking off each script functioned as a reinforcer to maintain this response and in some ways served as a form of self-monitoring. Similarly, Parker and Kamps (2011) taught two students with autism to interact during social activities, games, and cooking activities. Scripts were embedded within task analyses, and participants were taught to self-monitor social initiations.

27.2.4 Script-Fading

Initially, for students first learning to use scripts, fading may occur one word at a time or one letter at a time, when using written scripts. For example, the script "I like basketball" may be faded to "I like ____," "I ____," and "____." Additional fading steps are then required to remove the recording device or the card that displayed the text. As students become more fluent in their use of scripts, it is possible to fade more rapidly, perhaps by removing multiple words at once. The introduction of other modalities in presenting auditory scripts may also provide alternate opportunities to fade scripts. For example, presenting scripts via a tablet allows for the opportunity to fade scripts by gradually decreasing the volume of the auditory model.

For students with more advanced vocal repertoires, gradual fading may not be necessary at all. Yamamoto and Isawa (2020) evaluated the effects of scripts on social interactions. The authors demonstrated that even when scripts were fully removed without the use of a gradual script-fading procedure, all participants continued to emit scripted, unscripted, and novel initiations. This study provides preliminary evidence of the potential effectiveness of script removal in maintaining interactions.

Determining the potential steps for script-fading should occur very early on in the process. Even when first developing scripts, the fading process must be a consideration, as this should influence the type of script selected and the content of the script. For example, if scripts all begin with the same word, this may impact the script-fading process. A student presented with the scripts "I like to play outside," "I like to play tag," and "I like to play soccer" may struggle in identifying which script to emit when the last word is faded.

Planning for script-fading must include considerations regarding what should ultimately evoke the target response. Several researchers have attempted to transfer stimulus control to natural stimuli in the environment. Sarokoff et al. (2001) used scripts with embedded textual stimuli, via product labels on food and video packaging, to interact with peers (e.g., "Gummi Savers" on the package began the sentence "Gummi Savers are my favorite"). Groskreutz et al. (2015) embedded scripts on sets of toys. Similarly, Brown et al. (2008) carefully selected stimuli present at a video-tape rental store, convenience store, and sporting goods store to ultimately evoke conversational initiations in those settings. The use of these items served as a common stimulus to promote generalization from the "mock" store used for teaching to community settings. Wichnick-Gillis et al. (2016) replicated this procedure by superimposing scripts on leisure activities (e.g., movies, coloring books, toys, puzzles). Similarly, Wichnick-Gillis et al. (2019) placed textual scripts on a laptop, Lego pieces, and lunch materials to teach students to initiate interaction during these activities.

Researchers have attempted to shift stimulus control to the natural environment by manipulating the location of scripts. Gallant et al. (2017) more closely examined this variable by comparing the placement of scripts on target stimuli to holding a script behind the participant's head to activate it. The authors assessed the effects of these differences on acquisition and maintenance of initiations. After the script-fading process was completed, the frequency of initiations emitted was greater for two participants when the device was visible, greater for another participant when the device was not visible, and for the fourth participant, no difference was observed as a function of the auditory script location. This suggests that perhaps the location of the script is less relevant than initially suspected or varies based upon the individual characteristics of the student.

Additional research may be useful in determining whether the location of the script impacts other variables, such as by more carefully analyzing the stimuli in the environment that ultimately evoke social interactions. Materials alone should not serve as a discriminative stimulus for social interaction. Instead, the presence and behavior of a recipient should signal the availability of reinforcement for social interactions, perhaps in conjunction with the presence of particular stimuli in the environment. At PCDI it is common for auditory scripts to be affixed to doorways to teach students to initiate greetings upon entering the building. For many students, this strategy is successful, but for some, the doorway acquires faulty stimulus control in which students emit a greeting upon seeing a doorway, regardless of whether or not a person is there to greet. Future researchers should more closely evaluate whether the location of a script influences participants' attentiveness to the interaction partner.

Several researchers have more carefully examined the role of the establishing operation in the use of social initiations acquired via script-fading procedures. For example, Dotto-Fojut et al. (2011) taught participants to request assistance when completing a vocational task. The authors also probed scenarios in which the participant did not require assistance. Howlett et al. (2011) used script-fading strategies to teach students with autism to mand for information by asking "Where's [object]" when a high-preference item was not in its typical location. The authors incorporated an abolishing operation (AO) condition in which the item was present to evaluate that this mand for information was emitted only when an establishing operation (EO) was in effect. These strategies should be more consistently incorporated into script-fading procedures to ensure that manding does not inadvertently come under stimulus control, rather than evocative control.

The use of language is a complex discrimination, and additional teaching may be necessary to help students identify not only when to initiate but also when it is inappropriate to initiate. Eventually, students must learn to determine who is available to interact and when it is appropriate to interact.

27.2.5 Importance of Conversation Partner

McClannahan and Krantz (2005) identified strategies for conversation partners to provide appropriate models and reinforce attempts at social interaction. These strategies are outlined in Table 27.1. Additional research is needed to determine how these variables impact acquisition and maintenance of interaction skills.

Krantz and McClannahan (1998) taught students to initiate interactions with adults by saying "Look" or "Watch me" before engaging in an activity included within an activity schedule. The conversational recipient was instructed to respond to interactions with phrases or short sentences relevant to the activity. If a child showed the recipient a recently colored picture of Big Bird and said "Look," the recipient might respond "It's Big Bird." The authors anecdotally reported that the unscripted statements emitted were modeled by the recipient in prior conversations (e.g., "Look, it's Big Bird").

Pollard et al. (2012) more carefully evaluated the effects of varied adult responses on the production of unscripted statements. In an initial teaching condition, adults provided a single comment in response to bids for joint attention ("Yes, that's right"). In a subsequent teaching condition, adults varied the statement to include one of three statements about feature, function, or class of the stimulus. While unscripted interactions increased for two of three participants in the varied adult response condition, it is difficult to determine if this relationship is causal.

Garcia-Albea et al. (2014) directly evaluated the influence of vocal models on interactions. The authors measured scripted and unscripted statements modeled after the conversation partner's responses. Increases in social initiations were observed using scripts; this same effect did not occur in regard to participants' use of the instructor's models, despite delivery of reinforcement following in vivo interactions. Because teaching occurred with initiations about play materials, it is possible that participants were less attentive to the instructor's vocal models due to their access to toys following an initial initiation.

Table 27.1 Role of conversation partner (McClannahan & Krantz, 2005, p. 29)

1. Invite interaction by looking at and smiling at the child
2. Respond enthusiastically to the youngster's attempts at conversation
3. Ensure a language environment that is representative of the youngster's language level—use words that are likely to be understood
4. Make conversation as "natural" as possible
5. Make interesting comments
6. Model appropriate voice volume and intonation
7. Model gestures—for example, pointing when making a statement such as "I like *that* one" or using expansive hand movements when commenting about big objects
8. Provide powerful rewards for social interaction by delivering the preferred activities, toys, or snacks that were the topic of the child's initiation

Differences to consider across these studies include the vocal repertoire of the participants and the content of the models presented. For example, Krantz and McClannahan (1998) provided very brief statements following an initial interaction. Pollard et al. (2012) and Garcia-Albea et al. (2014) included far more variability within the models presented. Script-fading procedures are often developed for students who display profound deficits in making vocal initiations. It can be assumed that these students are exposed to vocal models on a regular basis—yet this has not been sufficient in teaching this repertoire. It is possible that script-fading procedures, as intended, are more effective models for social interaction. Perhaps this is in part due to the high amount of variability in in vivo language models and students' particular learning history with responding to those models. Scripts may provide a more static model that more consistently signals the availability of reinforcement following imitation of the stimulus. Subsequent research should more carefully compare acquisition of social initiations when presented with textual scripts, auditory scripts, in vivo models, and alternate models, such as those presented via video.

27.2.6 How to Measure and Graph

Data collection is critical in assessing the effectiveness of script-fading strategies. The student's existing vocal repertoire and history with script-fading procedures should dictate the goal of instruction. McClannahan and Krantz (2005) specify that for students first learning to approach an interaction partner, data collection should indicate whether the student obtained the script, approached the interaction partner, oriented to the interaction partner, and imitated the script (if applicable).

When students begin to imitate scripts, it is important that data collection be focused on the correct use of scripts. As scripts are faded, data collection continues to be important in ensuring that the use of the scripts maintains, as well as the occurrence of unscripted interactions. McClannahan and Krantz (2005) specify that data should be collected per opportunity when measuring the use of scripts and that a frequency measure be used to collect data on the frequency of unscripted initiations. It may also be useful to record students' interactions verbatim. This will allow the instructor to subsequently determine whether the student is recombining scripts or incorporating language models presented by the instructor.

Early research done by Krantz and McClannahan (1993) defined scripted interactions as those that matched the script and defined unscripted interactions as those that differed from the script or occurred after script-fading was complete. Thus, scripted interactions were no longer scored following the script-fading process. Stevenson et al. (2000) altered that definition to include a second measure of scripted responses to account for the use of scripts outside of immediate repetition of the script. Wichnick, Vener, Keating, et al. (2010) incorporated a definition for novel initiations, defined as initiations never uttered during the course of the study. These data were graphed as the cumulative number of novel unscripted initiations.

Akers et al. (2016) reviewed script-fading procedures and called for future researchers to address the lack of agreement in the definition of unscripted initiations and recommended that responses be defined in a manner that allows researchers to determine if participants engage in not only scripted responses but also novel responses, following teaching. Garcia-Albea et al. (2014) further refined these definitions by categorizing responses as scripted, unscripted, and novel and differentiating those acquired via in vivo models.

While these areas are important in refining the script-fading literature, in clinical practice the measurement procedure selected must correspond to the goal set forth for the student. As students become more proficient in their use of scripts, the response requirements should be altered. For younger students, any and all interactions should be scored. As students acquire more advanced vocal repertoires, this may be refined to only include interactions that are on-topic, and socially competent, with the eventual goal of producing novel initiations.

27.2.7 Programming for Generalization

Stimulus control and generalization occur on a spectrum. While it is important to ensure that vocal interactions come under relevant stimulus control, it is equally important to ensure that these interactions generalize across untaught conditions or result in interactions that have not been directly taught. The script-fading literature includes many examples of stimulus generalization. Woods and Poulson (2006) taught three children with developmental disabilities to initiate social interactions about recently completed and future activities to typically developing peers using scripts. Teaching occurred during an art activity. When probe data were collected during a novel activity (i.e., lunch), in a novel setting, without scripts, initiations increased across all participants.

Similarly, Wichnick-Gillis et al. (2019) used a script-fading package to teach children with autism to initiate social interaction with peers while playing games on a laptop, building with Legos, and eating lunch. When generalization was assessed in the home setting with a sibling, using the same activities, social initiations systematically increased. Gomes et al. (2020) assessed generalization with untaught categories of stimuli when teaching students to initiate joint attention responses and assessed generalization in a novel setting prior to and following intervention. There may be several potential explanations for the success of script-fading in producing these generalized responses. First, some studies incorporate the use of common stimuli to promote generalization. For example, Wichnick-Gillis et al. (2019) used the same materials in the home setting to assess generalization across settings and recipients. The use of natural maintaining contingencies may also promote generalization, as social initiations produce access to social attention and at times items in the environment.

Recent research has focused on producing response generalization, in which participants emit vocal responses that vary from those directly taught. Not only does this improve social competence, but it also may ensure that social initiations are less sensitive to extinction. Wichnick et al. (2010) demonstrated the effectiveness of script-fading procedures in increasing the production of novel utterances emitted by people with autism. The authors defined novel utterances as those that were never before emitted during the course of the study. Garcia-Albea et al. (2014) used a more conservative measure of novel initiations, requiring that they not contain any words from the scripts besides conjunctions, articles, prepositions, pronouns, or the toys' name. The authors observed the production of novel utterances in some, but not all, participants. Gomes et al. (2020) used a similar definition and observed an increase in unscripted initiations, defined as recombinations of words from the original scripts, but did not observe a marked increase in novel bids for joint attention, defined as the participant emitting a contextual vocal response that did not contain any words from the original scripts except for conjunctions, articles, prepositions, pronouns, or the object's name.

The differences in the definitions of unscripted and novel interactions across these studies make it difficult to ascertain the relevant variables that influence the production of responses that vary from scripts. Future studies should more closely examine variables that impact the success of scripts and script-fading procedures on producing response generalization. For example, providing more specific participant information that perhaps includes an assessment of overall rigidity across a variety of areas may be helpful. Perhaps students who are more likely to engage in more varied responding across a wide array of areas are also more likely to emit more variable vocal responses. Additionally, more information should be provided to ascertain the extent to which vocal initiations vary from the original scripts.

27.2.8 Social Validity of Script-Fading Procedures

Teaching individuals with autism to emit appropriate social interactions has the potential to improve upon social competence. One assessment of this critical area pertains to the social validity of script-fading procedures. Woods and Poulson (2006) used the Lower Elementary Level Acceptance Scale (A-Scale) to assess the attitudes of typically developing peers toward the students with disabilities (Voeltz, 1980). This was administered prior to and after introducing script-fading procedures to increase peer interactions. Sample questions included "I could be friends with a kid who can't talk yet," "I like to play with special needs kids," and "I am sometimes mean to other kids." The changes in acceptance scores were positive for every typically developing peer included in the study, suggesting that it is possible that the intervention may have contributed to increased acceptance of children with disabilities by their typically developing peers. The authors noted anecdotal observations of other improvements, such as a peer initiating play dates with a student from the self-contained class.

Garcia-Albea et al. (2014) and Gomes et al. (2020) both incorporated social validity measures related to the acceptability of the script-fading procedure and outcomes. Garcia-Albea et al. had adults view video from baseline and maintenance sessions and rated the appropriateness of participant's initiations. Eighty-six percent of raters scored maintenance sessions as including more appropriate initiations. Gomes et al. used a similar assessment; raters indicated that 0% of baseline clips and 100% of post-intervention clips included a bid for joint attention. The use of rating scales in both studies also indicated that instructors found the procedures acceptable for use.

While acceptance by peers and teachers is an important variable to measure, perhaps the most critical assessment of acceptability would be to directly measure responses to initiations taught via scripts. It is likely that the maintenance of initiations taught via scripts and script-fading procedures would be dependent upon positive responses that follow those initiations. If a student is taught to ask a peer to play, and the peer does not positively respond, these initiations may be extinguished over time. Thus, an area of future research might include measures of the responsiveness of adults and peers to scripted statements and an assessment of the variables that impact this. For example, it is possible that teaching students to engage in more variable responding or to emit interactions that require a response, such as mands for information, may be more likely to produce positive responses and therefore maintain.

27.2.9 Instructional Targets Acquired via Script-Fading

As students learn to respond to the use of scripts, subsequent teaching can more narrowly focus on teaching specific target responses. For example, several studies have employed script-fading to teaching the use of varied mand frames (Betz et al., 2011; Brodhead et al., 2016; Sellers et al., 2016), mands for information (Howlett et al., 2011), and mands for assistance (Dotto-Fojut et al., 2011). Additional social responses have been targeted, such as the use of empathetic statements when instructors demonstrated a nonverbal change in affect (Argott et al., 2008), and joint attention (Gomes et al., 2020; MacDuff et al., 2007; Pollard et al., 2012). Script-fading has also been used to teach initiations during play with siblings (Akers et al., 2018), peers (Wichnick, Vener, Pyrtek, et al., 2010), and parents (Reagon & Higbee, 2009).

The effectiveness of this teaching strategy across so many broad areas indicates that script-fading can likely be adapted to many other areas. Some areas that have not yet been formally evaluated but have been used clinically at PCDI include teaching specific grammatical responses (e.g., pronouns, prepositions, adjectives), incorporating listener responses (e.g., using scripts to ask follow-up questions, engage in reciprocal interactions, and demonstrate response variability when answering questions), engaging in peer tutoring, offering assistance, initiating greetings, recalling information about the school day and transmitting this to home, joining a conversation, sustaining a conversation, retelling a storybook, and interacting with others about photographs.

Teaching students to engage in appropriate initiations may also be used to provide differential reinforcement for alternative responses to responses that may be socially stigmatizing, such as perseverative language, and socially incompetent interactions. Yamamoto and Isawa (2020) targeted social initiations during play and assessed its effectiveness on reducing inappropriate responses as well. While a more thorough research design was required, this serves as preliminary evidence in the effectiveness of using script-fading strategies to increase one repertoire while simultaneously decreasing another. For students who display problem behavior that is hypothesized to be maintained by attention, the introduction of scripts that result in attention (e.g., joke telling, giving complements, requesting positive physical contact) can be successful in providing a rich schedule of reinforcement for those appropriate responses and can serve as an AO for problem behavior.

There may also be benefits to teaching script-fading procedures in conjunction with related social skills. For example, MacDuff et al. (2007) taught a pointing response while teaching students to initiate joint attention responses. There are many other ancillary responses that might co-occur with social initiations, such as the use of gestures, appropriate facial expressions, or intonation that corresponds to the script. Additional research should explore strategies that target alternate pro-social behaviors to enhance the social validity of initiations.

27.2.10 Incorporating Scripts and Script-Fading Procedures Within Activity Schedules

McClannahan and Krantz (2005) discuss the value of embedding scripts within activity schedules. Both procedures are designed to teach students to engage in more spontaneous responding, whether it be social interactions or the completion of complex response chains. In their 1998 study, Krantz and McClannahan embedded social interactions within activity schedules. Woods and Poulson (2006) later incorporated a similar strategy in teaching social children with developmental disabilities to interact with typically developing peers. Incorporating scripts within activity schedules has several advantages. For many individuals with autism, engaging in social interactions is challenging; interspersing these interactions with independent and highly preferred activities may be advantageous. Social initiations can also be linked to activities in such a way to create a sharing of experiences that replicates many of the social interactions of typically developing children. A child may learn to complete a puzzle and then initiate an interaction with a peer or adult to garner positive attention. Embedding scripts within schedules also has the benefit of providing visual support long after adult supervision is faded, ensuring maintenance of both skills.

27.2.11 Conclusion

Activity schedules and script-fading procedures take advantage of visual discrimination and imitation skills that often serve as areas of strength for individuals with autism. These procedures are highly effective in promoting the use of spontaneous language and task completion (Brodhead et al., 2016). Without specifically programming for the spontaneous occurrence of these responses, even students who have received effective behavior analytic services may fail to initiate activities, including social interactions.

The National Standards Report (NAC, 2009) identified schedules as an "established" evidence-based intervention for individuals with autism. At that time, they identified scripts and script-fading procedures as an "emerging" evidence-based practice, indicating that more high-quality research was necessary to support this treatment. In their updated 2015 review, script-fading procedures were reclassified as 1 of 14 "established" evidence-based interventions used to provide a child/adolescent with language to successfully complete an activity or interaction (NAC, 2015).

The repeated replication of research on the use of script-fading procedures and activity schedules demonstrates their utility in teaching individuals with autism to initiate activities and initiate and sustain conversations and other vocal interactions. Incorporating these procedures into behavior-analytic instruction may facilitate maintenance and more independent initiations of skills taught in isolation.

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28 Extinction and Differential Reinforcement

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28.1 Introduction

In this chapter we describe extinction and differential reinforcement, primarily as elements of behavioral interventions for behavior disorders. In the first section, we will describe extinction as an isolated procedure. However, a central theme of this chapter is that extinction should rarely be used in isolation. Among many reasons for this theme include the following: (a) extinction in isolation has potential side effects, (b) pure extinction is often difficult or even impossible to implement with fidelity, and (c) sometimes extinction does not address a primary variable associated with occurrence of the behavior (such as when a medical or physical problem increases the likelihood of escape behavior). When extinction is not implemented with fidelity, problem behavior is intermittently reinforced, making it more resistant to change than ever. That leads to the second main section of the chapter, on differential reinforcement. Another central theme of this chapter is that differential reinforcement is a more logical behavioral intervention in comparison to extinction in isolation. We describe variants of differential reinforcement in the latter section of the paper. A general premise, based on empirical evidence, is to maximize reinforcement in such a way to favor appropriate alternative behavior while minimizing reinforcement for dangerous or destructive behavior, even when it is not technically placed on extinction (Vollmer et al., 2020).

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28.2 Extinction

28.2.1 Overview

For the purposes of this chapter, extinction is defined as the withholding of a reinforcer that was previously presented contingent on a response, such that there is a decreased probability of that response (Catania, 2013; Cooper et al., 2020). In the context of behavioral interventions, extinction usually involves withholding the reinforcer(s) for problem behavior that has (have) been identified via functional analysis (e.g., Iwata, Dorsey, et al., 1994), which subsequently results in a decrease and (ideally) elimination of the problem behavior. Contrary to common usage, extinction is not just "ignoring" problem behavior, it is the withholding of the maintaining reinforcer for problem behavior. Because the maintaining reinforcer can take many forms (Kuhn et al., 1999; Richman et al., 1998), simply "ignoring" could be incidental to the functional properties of behavior.

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The two main components of the extinction definition highlight that extinction is both a treatment procedure and a behavioral process (Iwata, Pace, et al., 1994). Procedural extinction is the withholding of reinforcement previously presented contingent on a response. An example of procedural extinction is continuing to present an instruction (i.e., not allowing escape) when escape-maintained problem behavior occurs. However, if problem behavior does not decrease (and is not eventually eliminated), then the behavioral process of extinction did not occur. An outcome is required to meet the full definition of extinction.

28.2.2 Functional Variations of Extinction

One important feature of extinction as treatment for problem behavior is that it requires knowledge of the reinforcer maintaining the problem behavior. As decades of functional analysis research has shown, the same topography of problem behavior could be reinforced by (say) attention for one individual but reinforced by (say) escape for another individual. The implications for interventions are significant (Iwata, Pace, et al., 1994), because interventions based on extinction cannot be developed by merely observing the behavioral topography.

28.2.2.1 Socially Mediated Positive Reinforcement

Extinction of behavior maintained by socially mediated positive reinforcement involves withholding a positive reinforcer that was previously presented contingent on a response, such that withholding it decreases the probability of the response. One example of this is extinction of behavior maintained by attention (e.g., Fisher et al., 2004). Attention that reinforces problem behavior can take many forms, such as soothing statements from a caregiver (Iwata, Dorsey, et al., 1994), reprimands from a teacher (Iwata, Dorsey, et al., 1994), peer attention (Northup et al., 1995), or even eye contact from a therapist (Kodak et al., 2007). Extinction, in such cases, would involve withholding the particular form of attention. For example, if problem behavior is maintained by reprimands, the behavior change agent would withhold reprimands if problem behavior occurred.

As implied in the definition section, we recommend that the term "ignore" should not be used in the context of assessment and treatment of problem behavior, as it may imply to a lay audience that the behavior analyst is suggesting that the behavior should not be monitored. To the contrary, all individuals responsible for implementing an intervention involving extinction should carefully monitor a client who is engaging in problem behavior, to ensure that everyone in the environment is safe (including the person engaging in problem behavior). A more appropriate characterization would be to provide *minimal differential consequences* for the individual's behavior. *Minimal differential consequences* means that the problem behavior produces no (or as little as possible) change in the therapist's behavior while maintaining safety. For example, if a care provider is attending to a household task when a child throws a toy (suppose that toy throwing is maintained by reprimands), the care provider would continue to engage in the household task and would not provide any differential consequences (i.e., reprimands) for the disruption. There may be times when the behavior requires some sort of physical intervention to ensure the safety of the individual or others in the environment. However, the reaction to attention-maintained behavior should be minimized as much as possible.

Another variant of problem behavior maintained by socially mediated positive reinforcement is when behavior is reinforced by access to tangibles such as toys, snacks, or activities (Beavers et al., 2013). In these cases, extinction involves withholding the tangible item(s) that was (or were) previously delivered contingent on problem behavior. For example, if a child displays problem behavior maintained by access to an electronic tablet, one would withhold access to the tablet that was previously given contingent upon problem behavior, which will result in a decrease in that response (note that emotional side effects can be expected to occur, and this will be discussed shortly).

28.2.2.2 Socially Mediated Negative Reinforcement

Extinction for negatively reinforced problem behavior, often called escape extinction, involves continuing to present the activity or requirement from which escape was previously delivered contingent on problem behavior (Cooper et al., 2020). For example, if a student displays problem behavior maintained by escape from math instructions, math instructions would continue when instances of the problem behavior occur. This can be applied to a variety of contexts that may be functionally aversive, such as academic (instructional) demands, loud noises, or even the physical presence of certain individuals. However, usage of escape extinction requires very careful ethical consideration. For example, if a student is engaging in escape behavior in the presence of instructional demands, a behavior analyst should evaluate possible reasons that the instructional demands are aversive (Carr & Smith, 1995; Kennedy & Meyer, 1996; Smith et al., 1995). It is possible the individual does not have the skill in their repertoire, in which case continued presentation of the demand does not make sense from an ethical or clinical standpoint, unless the skill is being taught in some other way. Similarly, a loud ambient noise may be distracting or even painful to a particular individual. Keeping the person in the environment for the purposes of extinction, then, may not address the ultimate cause of the behavior (such as an auditory sensitivity).

A notable example of the effectiveness of escape extinction is in the treatment of pediatric feeding disorders, specifically food refusal. Escape extinction, or non-removal of the spoon, has been shown to produce increases in bite acceptance (e.g., Ahearn et al., 1996; Peterson et al., 2016; Piazza et al., 2003). It is noteworthy that successful escape extinction procedures for pediatric feeding disorders are an outcome of an exploratory process wherein potential physical or medical impediments are addressed first or in conjunction with extinction (Ibañez et al., 2020).

At times, instructional activity, self-care activity, medical activity, and so on are aversive if it is presented too frequently, for too long a duration, or when the individual does not have a proper skill set for compliance (Smith et al., 1995). One approach to address this phenomenon is to implement escape extinction along with instructional/demand fading (e.g., Zarcone et al., 1993), wherein the aversive event is presented gradually while extinction of escape behavior is in place. Often, a gradual presentation of the functionally aversive stimulation is combined with positive reinforcement, such as in the case of necessary medical procedures that cannot be avoided (e.g., Shabani & Fisher, 2006).

28.2.2.3 Automatic Reinforcement

Extinction can also be used in the treatment of automatically reinforced problem behavior. Automatically reinforced behavior produces its own source of reinforcement, independent of the social environment (Vollmer, 1994). Extinction in this case involves either altering the properties of the response so that they no longer produce the reinforcer or blocking the stimulation produced by the behavior (e.g., Rincover et al., 1979). For example, if disruption in the form of toy throwing is maintained by the sound that the toys make when they hit the wall, one could alter the wall by covering it with a pad so that the toys no longer make the noise when thrown. Extinction of automatically reinforced behavior is sometimes more difficult to implement than extinction of socially reinforced behavior. This difficulty arises from the fact that, by definition, automatically reinforced behavior produces its own source of reinforcement. Thus, the specific stimulus features of the reinforcer(s) may not be detectible or otherwise controlled.

28.2.3 Limitations and Special Considerations

Extinction should rarely if ever be presented in isolation, without the use of differential reinforcement, environmental enrichment, or noncontingent reinforcement. Extinction is limited as an isolated procedure because it can produce side effects that are attenuated when combined with these other (reinforcement-based) procedures (Lerman & Iwata, 1995). Further, in some circumstances, extinction is difficult if not impossible to implement with fidelity, which creates a host of problems, not the least of which is continued (possibly intermittent) reinforcement of the problem behavior (Vollmer et al., 2020). Also, if extinction is implemented without consideration of other contributing variables, the procedure can be unethical. For example, if someone is required to take a bite of food, but they do not have the skill to swallow the food, procedural extinction would be ineffective at the least and harmful in many cases (Ibañez et al., 2020). We describe these general limitations and considerations next.

28.2.3.1 Side Effects

One of the common side effects of extinction has been referred to as an extinction burst (Lerman et al., 1999; Lerman & Iwata, 1995). An extinction burst is an increase in the frequency, duration, or intensity of behavior that has been placed on extinction (Lerman & Iwata, 1995). In some cases, the burst can be relatively minor, but in other cases, problem behavior can rise to dangerously high levels. Although the extinction burst is usually temporary and decreases over time as the behavior continues to encounter extinction, the initially increased frequency or intensity can put the client or therapist at significant risk. Extinction bursts can be difficult or even unacceptable depending on the resources of the environment, especially if the burst is prolonged.

Related to extinction bursts, extinction can also induce other types of responses. These other responses can be desirable (e.g., novel communication responses) or undesirable (e.g., other topographies of problem behavior). One can use the desirable effects to advantage when shaping new responses and extinguishing previously reinforced approximations. However, in cases when undesirable responses are induced, problems can arise. It might be the case that new problem behavior occurs that is more intense than the behavior that is placed on extinction and, thus, must be reinforced because it is too dangerous. This is an example of inadvertent shaping of problem behavior intensity; the intense problem behavior that contacted reinforcement will be more likely to occur in the future (Fahmie et al., 2017). A common example of extinction-induced problem behavior is aggression, often toward the person implementing extinction. Withholding reinforcement can be an aversive event, so it is not surprising that aggression occurs toward the individual who withheld the reinforcement (Lerman et al., 1999). In fact, basic research on aggression has shown that both presentation of aversive stimulation (as seen in escape extinction) and reinforcer loss/withholding (as seen in extinction of positively reinforced behavior) can induce aggressive behavior, including but not limited to biting of the self or others (Hutchinson, 1977).

Extinction can also produce emotional responding (Lerman & Iwata, 1996b). Individuals may cry, scream, or say unkind things to the therapist or caregiver. Induced emotional responding poses additional challenges, and collectively the potential side effects of extinction make extinction difficult to implement without other treatment components in place. Further, some potential implementers of extinction may find it unacceptable (Ducharme & Van Houten, 1994), and such unacceptability equates to poor social validity (Wolf, 1978). The side effects of extinction can be attenuated by combining the procedure with reinforcement-based procedures (Lerman & Iwata, 1996b), which will be discussed shortly.

28.2.3.2 Feasibility

There are several reasons that pure extinction in isolation may not be practical or feasible, and when the procedure is not practical or feasible, implementers make mistakes and sometimes continue to reinforce problem behavior. As a result, a schedule intended as extinction may actually be an intermittent schedule of reinforcement for the problem behavior. Some of the reasons that pure extinction may not be feasible include (but are not limited to) the following:

1. The client may be too large and strong, such that physical guidance is not possible or potentially dangerous.
2. The client may be elusive, such that physical guidance is not possible.
3. It may be too dangerous to withhold response blocking (such as for some SIB, elopement, or aggression) even when it is known that physical contact is a reinforcer for a given client's SIB or aggression.
4. There may be laws or guidelines against the use of physical guidance during escape extinction.
5. There may be laws or guidelines requiring response blocking for SIB.
6. Even if there are no specific laws, ethical guidelines or personal ethics may lead practitioners to opt against physical guidance or to protect the individual through response blocking.
7. The outcome of some behavior (such as observable injury or even unobservable injury) may require medical consultation, which is not available in all settings.
8. If the behavior is automatically reinforced, the specific form of the reinforcer may not be known or if known may not be easily controlled.
9. Even if primary care providers are expertly coached to implement extinction, the individual is likely to encounter many other people who are not, and therefore the behavior is accidentally reinforced (e.g., by grandparents, siblings, family friends, school personnel). Further, even expertly coached care providers will make at least some integrity errors (Marcus et al., 2001).

Combining extinction with differential reinforcement can reduce some of the above problems, because research on concurrent schedules shows that weighting reinforcement to favor appropriate behavior versus problem behavior will shift allocation toward appropriate behavior, even if problem behavior is still reinforced (Athens & Vollmer, 2010; Vollmer et al., 2020). The key strategy is to ensure that appropriate behavior produces greater reinforcement along at least one dimension such as higher rate of reinforcement, shorter delay to reinforcement, greater quality of reinforcement, higher quality of reinforcement, and greater magnitude of reinforcement (e.g., Athens & Vollmer, 2010).

28.2.3.3 Root Cause

It is critical to identify the operant contingencies of reinforcement maintaining problem behavior in order to implement extinction. However, it is not enough to simply identify those contingencies when addressing severe behavior disorders. Medical and physical variables can interact with operant contingencies in such a way that problem behavior is exacerbated. For example, if a child has difficulty swallowing, they may develop escape behavior in the context of mealtime or food presentation (Ibañez et al., 2020). Similarly, there is some evidence that physiological factors such as allergies (Kennedy & Meyer, 1996), fatigue (Smith et al., 2016), menstrual cycle (Carr et al., 2003), and illness (Carr & Owen-DeSchryver, 2007) could exacerbate dangerous behavior of the sort that is commonly maintained by operant contingencies. Withholding the source of reinforcement without addressing the medical or physical problem has serious ethical implications (Behavior Analyst Certification Board, 2014). Consider an extreme example: a client displays escape behavior in the context of instructions to put on their socks and shoes and to begin walking. Suppose that, unbeknownst to the therapist, the client has a badly bruised (or possibly broken) toe. If a therapist moves directly to extinction and persists with extinction, the actual reason for escape behavior is not addressed: putting on footwear and walking are aversive because there is an underlying medical problem.

At times this "root cause" issue is more subtle. For example, a student may find reading aloud in a classroom to be aversive (Hofstadter-Duke & Daly, 2011) and therefore displays severe escape behavior, reinforced by being sent out of the classroom. If a functional analysis shows that the severe behavior is maintained by escape, a literal interpretation of extinction would involve continuing to require the student to read aloud in the classroom. However, it is possible that the student does not know how to read or is several grade levels behind other students. The persistent requirement to read aloud does not address the core of the problem, which would require individualized instruction on reading, and probably reflects an ethical shortcoming in application (consider, for example, the humiliation the student might experience).

28.2.4 Using Extinction in Practice

Extinction can be an effective and useful tool to decrease problem behavior. Extinction can make some treatments more effective and can also decrease problem behavior when other treatments have not worked (Rooker et al., 2013). Extinction has also produced impactful effects on the field in some critical areas such as pediatric feeding disorders (e.g., Peterson et al., 2016). Despite its apparent effectiveness as a treatment for problem behavior, as we have discussed, extinction is very rarely used in isolation. Extinction has been used in the context of noncontingent reinforcement (Fisher et al., 2004; Reed et al., 2004; Saini et al., 2017), instructional fading (Zarcone et al., 1993), and differential reinforcement of alternative behavior (DRA; Piazza et al., 2003), among other procedures. Extinction is almost always used in combination with another procedure because of the importance of skill acquisition in the context of behavior reduction, the side effects associated with extinction, and the practical limitations of applying extinction procedures (and resulting problems associated with extinction failures).

We have suggested that when treating problem behavior for individuals diagnosed with autism spectrum disorder (ASD)/intellectually and developmental disabilities (IDD), it may be useful to provide *minimized differential consequences* for problem behavior. As previously described, *minimized differential consequences* means that the problem behavior produces no change in the therapist's behavior (other than what is necessary to protect the individual, others in the environment, or property). To the best of the therapist's ability (and safety permitting), the therapist should minimize environmental changes when problem behavior occurs. However, this intervention alone is unlikely to produce a complete reduction in problem behavior, especially in the absence of skill acquisition procedures designed to increase the client's adaptive repertoire.

Relating to escape extinction, we have emphasized the importance of careful exploration of why a certain event or set of events functions as aversive stimuli. Blanket usage of escape extinction without detailed exploration and analysis at multiple levels has serious ethical implications. It is critical to understand *why* the event or events are aversive. Some examples of such considerations are listed here, but this list is by no means exhaustive: (a) the activity produces some sort of pain state for the individual, (b) the individual does not have the necessary skills in their repertoire, or (c) the individual is experiencing physical limitations (such as difficulty swallowing or grasping).

In short, due to potential side effects, extinction should be combined with procedures involving reinforcement. Relatedly, due to feasibility concerns wherein it is difficult and sometimes impossible to implement extinction perfectly (and, hence, an intermittent schedule of reinforcement for problem behavior is in place), it is important to minimize reinforcement for problem behavior while maximizing reinforcement for alternative behavior along as many dimensions of reinforcement as possible (e.g., rate, duration, immediacy, quality). Further, extinction should only be considered after other contributing variables have been identified, not only the maintaining reinforcers. A functional analysis is a first step, but an evaluation of medical variables, instructional context, and skill level is equally critical.

28.3 Differential Reinforcement

28.3.1 Overview and Forms of Differential Reinforcement

Differential reinforcement is one of the most commonly used behavior change procedures (MacNaul & Neely, 2018; Petscher et al., 2009;

Vollmer et al., 1999; Weston et al., 2018). Differential reinforcement is typically defined as reinforcing some response(s) and not reinforcing other responses (Catania, 2013; Cooper et al., 2020; DeLeon et al., 2013; Vollmer & Iwata, 1992). When defined in this way, however, differential reinforcement is procedurally constrained to the use of reinforcement and extinction. Although extinction is a common component when implementing differential reinforcement procedures, many successful applications have occurred without pure extinction (review Trump et al., 2019). Implementing differential reinforcement can be viewed as a concurrent-operant arrangement that involves applying different schedules of reinforcement to two or more responses (Fisher & Mazur, 1997). In other words, it is accurate to view differential reinforcement as any procedure that involves two or more schedules of reinforcement that vary along some dimension (e.g., reinforcer duration, reinforcer quality, delay to reinforcement) across different responses, whereby response allocation favors the programmed schedules of reinforcement (Athens & Vollmer, 2010). Several procedural variations of differential reinforcement exist; however, the most common differential reinforcement procedures are *differential reinforcement of alternative behavior*, *differential reinforcement of other behavior*, and *differential reinforcement of low rate behavior* (Cooper et al., 2020; Vollmer & Iwata, 1992).

28.3.1.1 Differential Reinforcement of Alternative Behavior

DRA is the most commonly used differential reinforcement procedure (Petscher et al., 2009). Traditionally, as it relates to treating problem behavior, DRA has been described as reinforcing some specific alternative behavior, while placing problem behavior on extinction (Vollmer & Iwata, 1992). A more recent definition, which takes into account the problems associated with implementing pure extinction, describes DRA as "providing greater reinforcement, along at least one dimension, contingent on the occurrence of one form or type of behavior, while minimizing reinforcement for another form or type of behavior" (Vollmer et al., 2020, p. 1300). Thus, DRA involves modifying parameters of reinforcement such that the alternative response receives greater reinforcement than another response (for the purposes of this discussion, problem behavior). In other words, DRA need not be constrained to explicit reinforcement of a target response and extinction for the problem behavior (as previously defined by Vollmer & Iwata, 1992). When DRA is implemented, even without perfect extinction, robust effects can still be obtained when treatment integrity failures occur because the schedule of reinforcement favors appropriate behavior (e.g., Athens & Vollmer, 2010; Brand et al., 2019).

Sometimes DRA procedures are labeled based on the type of alternative behavior that is reinforced. One such example is *differential reinforcement of incompatible behavior* (DRI). DRI involves selecting an alternative response that is physically *incompatible* with the target behavior selected for decrease (e.g., Young & Wincze, 1974). Another procedural variant is functional communication training (FCT), wherein the alternative response is always some form of communication (e.g., Carr & Durand, 1985).

The DRA approach is also a key component for establishing new skills in an individual's repertoire. DRA plays an essential role in *shaping* new responses or differentially reinforcing successive approximations to a terminal response. For example, a therapist might reinforce successive approximations to the word "tunes" as a mand for music (e.g., Bourret et al., 2004). The vocal utterance "t-" is followed by a positive reinforcer, but then placed on extinction once a closer approximation "tu-" contacts reinforcement. This process would continue until the terminal goal of "tunes" is achieved.

28.3.1.2 Differential Reinforcement of Other Behavior

Differential reinforcement of other behavior (DRO) involves delivering a reinforcer when a target response does not occur during a specified observation period (Catania, 2013; Reynolds, 1961). DRO is sometimes referred to as *omission training* (Uhl & Garcia, 1969) or *differential reinforcement of no responding* (e.g., Poling & Ryan, 1982). The contingencies of a DRO may involve a *reset* (i.e., timer restart) or *no reset* (i.e., no timer restart) of the interval when the target response occurs. If a reinforcer unrelated to the function of behavior is used, the implementation of DRO involves a procedural extinction component (i.e., withholding a positive reinforcer unrelated to the function of problem behavior). If the reinforcer maintaining problem behavior is used, the implementation of DRO involves functional extinction (i.e., withholding the reinforcer identified to maintain problem behavior).

At least four potential underlying mechanisms for the effectiveness of DRO have been proposed: (1) repeated delivery of the reinforcer may serve as an abolishing operation that momentarily suppresses the target response, (2) extinction, (3) negative punishment (because scheduled reinforcers are, in a sense, "lost" contingent on the occurrence of behavior), and (4) the strengthening of alternative responses due to adventitious reinforcement (Jessel & Ingvarsson, 2016; Poling & Ryan, 1982). A DRO contingency indicates when reinforcement is delivered based on the interresponse times (IRTs) that are either equal to or greater than the specified interval length (as described by Lindberg, Iwata, Kahng, 1999; Lindberg, Iwata, Kahng, & DeLeon, 1999). Commonly, DRO interval lengths are determined by calculating the mean IRT for a specified number of sessions (Poling & Ryan, 1982) to systematically establish and then to thin the reinforcement schedule. There are two primary procedural variations of DRO: *interval DRO* and *momentary DRO*.

For both procedural variations of DRO, there is a specified interval that requires either continuous (interval) or discontinuous (momentary) observation; a reinforcer is delivered contingent on the absence of the target response. *Interval DRO* involves continuous observation of the target response during a specified interval (which can remain constant, vary, or progressively increase) and then delivering the reinforcer if the target response does not occur at any point during the interval. *Momentary DRO* involves delivering a reinforcer if the target response does not occur at the end of the interval (or the exact "moment" of observation). Lindberg et al. (Lindberg, Iwata, Kahng, 1999, Lindberg, Iwata, Kahng, & DeLeon, 1999) described and compared the effects of fixed interval, variable interval, and variable-momentary DRO on rates of self-injury. *Fixed interval DRO* involves a constant interval duration. Lindberg et al. withheld functional reinforcers when self-injury occurred and provided functional reinforcers when self-injury did not occur during a constant time interval specified for each session. For example, if self-injury (the target response) did not occur during a 10 s interval, then an edible (positive reinforcer) was delivered; if self-injury occurred during the interval, then no reinforcer was delivered. *Variable interval DRO* has varied interval durations, based on an average value. Lindberg et al. administered the same procedures as described in the fixed interval DRO condition, except the interval lengths varied. For the variable-momentary DRO condition, Lindberg et al. withheld the functional reinforcer only if self-injury occurred at the end of a specified interval. Thus, the functional reinforcer was delivered if self-injury was not occurring at the end of the interval (i.e., self-injury could occur at other times during the interval). All three variations of DRO (fixed interval, variable interval, and variable-momentary) were equally effective in reducing self-injury maintained by social-positive reinforcement.

28.3.1.3 Differential Reinforcement of Low Rate Responding

Differential reinforcement of low rate responding (DRL) involves delivering a reinforcer for low rates of behavior, rather than total response suppression (Ferster & Skinner, 1957). Sometimes the goal is to maintain the behavior at low rates or slowly decrease the response criterion, rather than the total elimination of the response. Thus, this procedure is particularly useful when targeting behavior that should be maintained but is perhaps occurring too frequently or rapidly. Similar to DRO, IRT is a relevant measure when implementing DRL (as described below). The three primary procedural variations of DRL include *full session*, *interval*, and *spaced responding* (Becraft et al., 2017; Deitz, 1977).

For all the procedural variations of DRL, there is a specified observation period during which a predetermined criterion of (low) responding must be met for a reinforcer to be delivered. *Full-session DRL* involves delivering a reinforcer following a full session (e.g., treatment session, appointment, observation window) during which the target response occurs at or below a predetermined criterion. Austin and Bevan (2011) observed elementary school-aged children during 20-min classroom sessions and differentially reinforced low rates of requests for attention from the teacher (e.g., hand raising, calling out for the teachers). For example, on average, one student requested her teacher's attention nine times during baseline sessions; however, during the DRL condition, the teacher only delivered a reinforcer if the student requested the teacher's attention three or fewer times. *Interval DRL* involves delivering a reinforcer when the target response occurs at or below a predetermined criterion following a specified interval length. For example, Deitz et al. (1977) observed disruptive behavior during a 30-min session and divided the session into 2-min intervals. If disruptive behavior occurred one or zero times during a 2-min interval, the student received a star. If the disruptive behavior occurred more than once during the interval, the interval was reset. The stars were exchangeable for playtime at the end of the session. *Spaced responding DRL* involves delivering a reinforcer based on a predetermined IRT (i.e., a predetermined amount of time must pass between a response and a subsequent response; Deitz, 1977). For example, Lennox et al. (1987) combined response interruption and spaced responding DRL to increase the time between bites of food (i.e., to reduce rapid eating). Any attempt to have a bite of food before 15 s elapsed was interrupted by blocking; therefore, 15 consecutive seconds were required to occur between bites of food. Additionally, Becraft et al. (2017) combined schedule-correlated stimuli and spaced responding DRL (and compared this condition to full-session DRL and DRO), which reduced bids for attention in a simulated classroom. In both examples, it is clear that the target responses must occur at some level. For example, complete extinction of self-feeding or classroom participation is not the goal. Thus, this procedure's utility mainly relies on selecting responses that should persist at a socially valid or a medically safe level.

The DRL approach is considered a time-intensive procedure (Cooper et al., 2020). Practitioners can choose this procedure when the response does not require immediate response suppression and can withstand incremental changes. It is appropriate for responses that do not require complete elimination (e.g., reducing rapid eating; Wright & Vollmer, 2002). Practitioners should aim to prevent (i.e., implement safety procedures) or eliminate the occurrence of dangerous behavior that places the individual or others at risk. The procedure is not designed to gradually wean an individual off of problem behavior when the aim is complete reduction. Although incremental change when treating severe behavior disorders is a possible outcome of behavioral treatment, practitioners should not deliberately plan for gradual progress in these cases. The type of DRL selected for the response depends on the terminal goal and schedule of reinforcement required to produce an effect. For example, full-session DRL seems most useful when individuals can follow instructions (e.g., "if you only raise your hand three times, you can earn playtime."), and the delivery of the preferred stimulus can be delayed. Interval and spaced responding DRL might be useful when the response necessitates a denser schedule of reinforcement. Spaced responding DRL, specifically, seems more useful when IRT is particularly important (e.g., seconds between bites).

28.3.2 Functional Variations of Differential Reinforcement

Functional variations of differential reinforcement include *differential positive reinforcement*, *differential negative reinforcement*, and *differential automatic reinforcement* (Cooper et al., 2020; Vollmer & Iwata, 1992). Although these procedures can be applied as either DRA or DRO, we will use primarily examples of DRA in our discussion (for reasons that we will subsequently clarify relating to practical implementation of differential reinforcement).

28.3.2.1 Differential Positive Reinforcement

Most commonly, differential positive reinforcement is used to treat behavior maintained by positive reinforcement, such as attention or tangibles (e.g., Pizarro et al., 2021). The logic behind this approach is that if the alternative behavior produces the reinforcer previously maintaining problem behavior, the alternative behavior functionally replaces the problem behavior, which either is placed on extinction or otherwise produces a minimal outcome. An example of this approach involves varying the duration, quality, or delay when accessing positive reinforcers contingent on problem behavior or alternative behavior (Athens & Vollmer, 2010). For example, Athens and Vollmer (2010) provided qualitatively different forms of attention contingent on aggression (reprimands) and exchanging a picture card to obtain an adult's attention (praise and physical interaction).

Another application of differential positive reinforcement is to use positive reinforcement *even when* behavior is maintained by negative reinforcement (Lalli et al., 1999). The logic behind this approach is that the use of positive reinforcement may reduce the aversiveness of the instructional context, and the positive reinforcement for behavior such as compliance with instructional activity might compete with the negative reinforcement in the form of escape (i.e., if it is a higher-quality reinforcer). For example, Slocum and Vollmer (2015) compared the effects of providing escape (the reinforcer maintaining problem behavior) and edibles (reinforcers previously unrelated to problem behavior) contingent on compliance. During both treatments, the problem behavior continued to produce escape. The results demonstrated that problem behavior decreased more substantially, and compliance increased more substantially in the condition where compliance was followed by positive reinforcement (edible delivery).

28.3.2.2 Differential Negative Reinforcement

Differential negative reinforcement is used to treat behavior maintained by negative reinforcement. The logic behind this approach is that by providing escape or avoidance contingent on alternative behavior (such as compliance, functional communication), the alternative behavior functionally replaces the problem behavior, which would be placed on extinction or otherwise produce minimal escape. An example of this approach involves providing a 60s break from instructions contingent on compliance and delivery of another directive contingent on problem behavior (e.g., Ringdahl et al., 2002). Alternatively, differential escape intervals (240 s break following compliance, 10 s break following problem behavior) can increase compliance and reduce problem behavior (Rogalski et al., 2020).

28.3.2.3 Differential Automatic Reinforcement

Differential automatic reinforcement is most commonly used to treat behavior maintained by automatic reinforcement (reinforcement not delivered via social mediation). The logic of this approach is that by bringing alternative behavior into contact with alternative sources of reinforcement (e.g., toy play, music, activity), it will functionally replace at least some amount of problem behavior. Because the problem behavior produces its own source of reinforcement, it is sometimes difficult to minimize that source of reinforcement. As a result, researchers have examined an approach known as a *competing stimulus assessment* (see Haddock & Hagopian, 2020). In a competing stimulus assessment, one can evaluate (a) whether a stimulus is highly preferred, as indicated by high levels of engagement, and (b) whether engagement with a stimulus suppresses instances of the problem behavior, as indicated by low levels of problem behavior when the item is available (Haddock & Hagopian, 2020).

Differential automatic reinforcement, even when based on a competing stimulus assessment, may require some additional components. One is that some individuals with automatically reinforced problem behavior do not have repertoires that bring them into contact with appropriate sources of automatic reinforcement, such as play skills. As a result, it is sometimes critical to explicitly teach a skill or set of skills that ultimately produces automatic reinforcement (e.g., Britton et al., 2002; Leif et al., 2020). Another is that, for some individuals, engagement with highly preferred items does not necessarily suppress the occurrence of problem behavior (e.g., review Gover et al., 2019; Lindberg, Iwata, Kahng, 1999; Lindberg, Iwata, Kahng, & DeLeon, 1999; Piazza et al., 1998; Ringdahl et al., 1997). As a result, differential automatic reinforcement is sometimes combined with response blocking (e.g., Lerman & Iwata, 1996a; Lindberg, Iwata, Kahng, & DeLeon, 1999; Lindberg, Iwata, Kahng, 1999; Roscoe et al., 2013) or response interruption (e.g., Gibbs et al., 2018; Shawler et al., 2020). Examples of these problems and potential solutions can be seen in Vollmer et al. (1994). Three children participated in the study. One child displayed SIB that was entirely replaced by toy play with a preferred toy. A second child required explicit reinforcement of toy contact to learn play skills that subsequently competed with SIB. A third child also required explicit reinforcement for toy contact but further required a response blocking procedure to reduce SIB to acceptable levels.

28.3.3 Limitations and Special Considerations

Differential reinforcement procedures can be limited in ways similar to how extinction procedures are limited (see the list above under limitations and special considerations for extinction). However, these limitations brought about by side effects, feasibility, and consideration of root causes are less pronounced when using differential reinforcement because alternative means of obtaining reinforcement are explicitly arranged and taught.

It is important to note that DRL is limited to use with a relatively restricted range of behavior disorders: those that are problematic only because the behavior occurs too frequently. Thus, DRL is most commonly used for behavior such as rapid eating, talking out in class, and other topographies that should not be extinguished entirely. As a result, most general types of behavior disorders are not treated using DRL. DRO is limited because it is highly sensitive to treatment integrity failures in the form errors of commission (e.g., Mazaleski et al., 1993). For example, even if someone refrains from reinforcing problem behavior 95% of the time it occurs (which sounds on the surface like good integrity), the problem behavior is still reinforced on a variable ratio (VR) 20 schedule. A VR 20 schedule of reinforcement could easily sustain high levels of behavior for some individuals. Further, DRO does not explicitly arrange for reinforcement of alternative behavior, so it is not always clear which behavior is being reinforced. As a result of these limitations and special considerations, implementation in practice would focus largely on DRL in restricted circumstances, DRO probably only in conjunction with reinforcement of new or alternative skills, and nearly continuous application of DRA-like contingencies throughout an individual's daily routine (Vollmer et al., 2020).

28.3.4 Using Differential Reinforcement in Practice

Our conclusion, based on the literature summarized above, is that DRL and DRO are valuable procedures but used in special circumstances and as adjuncts to DRA. To the contrary, DRA is a general "lifestyle" of interactions between a care provider and an individual. By translating the interpretation of DRA expressed by Vollmer et al. (2020) into practice, DRA circumvents many of the limitations of extinction and differential reinforcement described previously. DRA is not restricted to placing one response on extinction and reinforcing another response. It is possible to present greater reinforcement for alternative behavior even when problem behavior continues to be reinforced (e.g., greater magnitude, higher quality, longer duration, more immediate). Also, practitioners need not select one and only one topography of alternative behavior to reinforce. Appropriate behavior of all sorts (e.g., communication, play skills, self-care skills, academic skills) can and should be richly reinforced to compete with the reinforcement schedules maintaining problem behavior. DRA is not only well supported for the treatment of problem behavior but is also essential for establishing skills (Grow & LeBlanc, 2013; Vladescu & Kodak, 2010).

Because the DRA procedure does not necessitate perfect execution to maintain treatment effects (e.g., Brand et al., 2019), treatment integrity errors become less detrimental as long as DRA is implemented with high levels of integrity at the onset of treatment (St. Peter Pipkin et al., 2010; Vollmer et al., 1999). More specifically, errors of omission (i.e., withholding reinforcement for an alternative response) are less problematic than errors of commission (i.e., reinforcing problem behavior) or both errors in combination (St. Peter Pipkin et al., 2010). To this end, it is clear that DRA produces robust effects that maintain even in the face of at least some treatment integrity failures. Thus, DRA is flexible enough to operate throughout the day as a lifestyle, where differential schedules can be moderated loosely (so long as the schedules generally favor appropriate or target responses).

Establishing an alternative response may require a dense schedule of reinforcement at the outset of treatment (e.g., Greer et al., 2016). Thus, practitioners should plan for systematic schedule thinning to ensure that the alternative response is occurring at a rate that is feasible to reinforce and to avoid the resurgence of problem behavior (e.g., see Hagopian et al., 2011). Finally, DRA does not require additional time expenditure (because it occurs in naturally occurring situations) or the use of gadgets (such as re-setting timers). Practitioners or caregivers might equate decreased time expenditure and decreased "setup" with decreased response effort. Response effort is a factor that practitioners often consider, as it might impact caregiver's adherence to treatment recommendations (Allen & Warzak, 2000). Presenting DRA as a lifestyle that caregivers can integrate into their daily interactions with their child, family member, student, or client might increase acceptability and, therefore, adherence to DRA as a treatment recommendation.

It is also important to consider the use of differential positive reinforcement when treating escape-maintained behavior. This approach is notable because a more commonly discussed route to treating escape-maintained problem behavior involves the use of differential negative reinforcement. Although differential escape intervals (e.g., Rogalski et al., 2020) or teaching an individual to ask for a "break" can reduce problem behavior, there are some less favorable implications of adhering strictly to this "functional match" treatment approach. When the demand context remains aversive, it precludes individuals from learning in more favorable conditions and can potentially limit the rate of engagement in learning activities. Further, the arrangement essentially requires an acceptance that instructional activity should be aversive, which seems counterintuitive to good instructional practices (e.g., review possible implications for practice proposed by Haq & Aranki, 2019). Thus, as a comprehensive treatment for escape-maintained behavior, (a) features of the instructional context must be carefully examined to determine *why* instructional activity is aversive, (b) the instructional context should then be modified or arranged such that it is less aversive, and (c) the use of differential positive reinforcement is useful as it has been shown to engender less escape behavior even when problem behavior is not fully placed on extinction (e.g., Lalli et al., 1999; Slocum & Vollmer, 2015).

Using DRA in combination with other procedures has also produced favorable results when targeting problem behavior maintained by automatic reinforcement. Leif et al. (2020) identified stimuli that could potentially compete with automatically reinforced problem behavior (e.g., hand mouthing). However, item engagement was relatively low when participants were provided with noncontingent access to different leisure items and, therefore, problem behavior persisted. Including prompting (i.e., vocal and physical support to interact with items) in conjunction with DRA significantly increased item engagement, which permitted the identification of multiple competing stimuli. In this case, simply providing positive reinforcers (edibles) contingent on 10 s of manipulating an item established a sustained item engagement repertoire, which permitted identifying stimuli that successfully suppressed problem behavior.

28.4 Conclusions

Extinction and differential reinforcement are central procedures and processes that have been tested and used effectively for many years. Extinction presented in isolation can create a range of practical and even ethical problems. By combining extinction and reinforcement (i.e., differential reinforcement), many of these problems and limitations associated with extinction can be circumvented. We have ultimately concluded that a general differential reinforcement approach, in which reinforcement for appropriate behavior is presented richly and reinforcement for problem behavior is minimized, is best practice.

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29 Response Interruption and Redirection

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29.1 Introduction to Response Interruption and Redirection

Response interruption and redirection (RIRD) is an applied behavior analytic procedure commonly implemented to treat stereotypic behavior and other responses thought to be maintained by the sensory consequences that engaging in the response produces (i.e., automatic reinforcement; see Rapp & Vollmer, 2005). RIRD consists of interrupting the target behavior and redirecting in the form of prompting alternative behavior (Ahearn et al., 2007). For example, if a child emits stereotypic vocalizations during a community outing, their teacher asks the child to answer questions (e.g., "What's your name?," "Where do you live?," "What's your brother's name?") they have readily answered in the past. The general purpose of the procedure is to promote appropriate behavior when repetitive behavior is interfering or stigmatizing.

In 1984, Fellner et al. published a case study in which a 6-year-old engaged in hand flapping, hyperventilating, hand mouthing, and lip pulling that was reported to be significantly hindering their progress. The responses were presumed to be automatically reinforced by the authors, and they compared a treatment package consisting of differential reinforcement for incompatible behavior (DRI) and differential reinforcement of other behavior (DRO) to DRI and DRO combined with what was referred to as a *mild interruption procedure*. The child had access to leisure materials at all times. Interruption was brief, 1–2 s, and results demonstrated that the DRI + DRO was only effective when combined with interruption. The authors reported that several additional topographies emerged during treatment, and they applied the interruption procedure to those as well. By the end of the second treatment phase involving interruption, problem behavior occurred at near zero levels and toy play had increased substantially. These procedures were adapted by Ahearn et al. (2007) to use redirection to an appropriate response as interruption for stereotypic vocalizations.

In the years following the Ahearn et al. (2007) paper, studies have systematically replicated the Ahearn et al. procedure, evaluated RIRD procedural variations, assessed methods for enhancing treatment effects, and compared

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RIRD to other interventions. To summarize the RIRD literature, we conducted a literature review of RIRD studies published from 2007 to 2020 as the foundation of this chapter. The primary purposes of this chapter were to outline procedural variations of RIRD, identify areas warranting further research, and recommend considerations for practitioners considering RIRD as an intervention for stereotypic behavior.

29.2 Literature Search Method

Seven databases and behavior analytic journals were searched to identify potential studies for this review, including APA PsycINFO, Academic Search Premier, JSTOR, ERIC, *Journal of Applied Behavior Analysis*, *Behavioral Interventions*, and *Behavior Modification*. The search was conducted in September of 2020, and only articles published since the Ahearn et al. (2007) study were selected for review. Results were limited to English-language and peer-reviewed research. All databases and journals were searched by combining the terms "automatic reinforcement" and "stereotypy" with the terms "redirection," "response redirection," "response interruption and redirection," "RIRD," "contingent demands," and "overcorrection" to conduct advanced searches. These search procedures yielded a total of 116 articles. The titles and abstracts of the 116 articles were screened to identify articles for potential inclusion in this review. During the title-abstract review, articles were excluded if they (a) were not empirical (e.g., case studies, reviews, commentary in nature), (b) did not mention stereotypic repetitive behavior as a dependent variable (e.g., aggression, SIB), or (c) were off topic to the study of interest (e.g., token economies, picture activity schedules, aneurisms). Following the title-abstract review, 68 articles were identified for further review.

29.2.1 Inclusion Criteria

The 68 articles were then downloaded and evaluated based on preset inclusion criteria. To be included in the literature review for this chapter, an article had to meet the following criteria: (a) participants were human subjects, (b) peer-reviewed and published in English, (c) used a single-case research design, (d) evaluated RIRD, procedurally defined as redirection to other behavior contingent on repetitive behavior, and (e) measured at least one dependent variable pertaining to repetitive behavior. In regard to the RIRD procedural definition, articles were included if the intervention(s) included redirection to alternative and/or appropriate behavior (e.g., clap your hands, hands down, hand in lap, touch your head) – procedures referred to as *hands down* were not included. After application of these criteria, a total of 41 studies met inclusion criteria. An extended search was conducted by reviewing the references of each of these 41 articles. Articles identified during the extended search were reviewed using the same procedures as described above. Of the 37 additional articles identified via the extended search, 15 were selected for the full inclusion review and 2 met inclusion criteria. Therefore, in preparation for this chapter, a total of 43 articles were reviewed, resulting in a total of 118 cases that experienced RIRD.

29.2.2 Interrater Agreement (IRA)

To ensure accurate application of the search process and inclusion criteria, a second independent rater coded at least 33% of the articles ($M = 35\%$, range = 33–40%) across each step of the search process. IRA was calculated by dividing the total number of agreements by the sum of the agreements and disagreements and multiplying by 100. The resulting IRA was an average of 94% agreement across each phase of the search process. Any article in which the raters disagreed was discussed before proceeding to the next step of the search.

29.3 RIRD Overview

To understand the evolution in the RIRD research literature, it is imperative to begin with a detailed description of RIRD, as implemented by Ahearn et al. (2007). In that study, appropriate vocalizations were reinforced with praise and access to requested items whenever possible, while vocal stereotypy was interrupted and redirected to appropriate vocal responses. Specifically, upon engagement in vocal stereotypy, the researchers called the participant's name, initiated eye contact, then presented a series of social questions or vocalizations to occasion vocal imitation. Finally, praise for use of appropriate communication was delivered following completion of the RIRD requirement. For all participants, the tasks selected for RIRD implementation were in the participant's repertoire. In addition, prompts were presented until the participant complied with the three consecutive tasks without engaging in stereotypy. In this study, RIRD decreased vocal stereotypy for all participants and increased appropriate vocalizations for three of four participants. In addition, vocal stereotypy and appropriate vocalizations that occurred during RIRD implementation were excluded from the data analysis because the experimenter stopped the session timer during RIRD.

Since the publication of Ahearn et al. (2007), many iterations of RIRD alone or in combination with other interventions have been evaluated (see Martinez & Betz, 2013, for a brief review), which will be described below. To note, Martinez and Betz concluded RIRD to be an effective intervention in reducing levels of stereotypy across all studies included in their review and also identified several gaps in the literature (e.g., social validity measures, treatment integrity, RIRD in natural environments) that are still present to date. Moreover, the review by Martinez and Betz was limited to articles published in the *Journal of Applied Behavior Analysis*. Past and present research on RIRD has been published in many sources, and as such, we conducted a broader, updated review (see search method above). Thus, this chapter discusses a much larger range of literature on RIRD and provides an updated discussion on the existing gaps in the literature.

29.3.1 Study Characteristics

29.3.1.1 Participants

Similar to Martinez and Betz (2013), all of the individuals included in the studies reviewed for this chapter were children or young adults. Specifically, 75.4% (n = 89) of the participants were males, all participants were 24 years old or younger, and 98.3% (n = 116) of the participants had an autism spectrum disorder diagnosis alone or in combination with another diagnosis. Studies included information about verbal repertoires for 86.4% (n = 102) of the participants, and 79.4% (n = 81) of these had a verbal repertoire consisting of functional vocalizations alone or in combination with at least one augmentative and alternative communication (AAC) system. In addition, studies seldomly provided additional information about participants' repertoires, but 2.5% (n = 3) and 17.8% (n = 21) of the participants were described as having a repertoire of motor imitation and to follow verbal instructions, respectively.

29.3.1.2 Target Behavior and Functional Assessment

Across studies, the most common target behavior was vocal stereotypy (61% of the participants; n = 72), followed by motor stereotypy (28% of the participants; n = 33), the combination of vocal and motor stereotypy (5.9% of the participants; n = 7), and then public masturbation (3.4% of the participants; n = 4). For a single participant, the target behavior was hand and object mouthing. Although the function of target behavior was not reported for 5.9% (n = 7) of the participants, the target behavior was maintained by automatic reinforcement alone or in combination with social reinforcement (e.g., automatic plus attention) for all remaining participants (n = 111). To determine the function of the target behavior, a functional analysis (e.g., Iwata et al., 1982/1994) that included at least one test for social reinforcement was completed with 65.3% (n = 77) of the participants, an automatic screen or repeated no consequence sessions (Querim et al., 2013) was employed for 17.8% ($n = 21$) of the participants, and descriptive assessments alone were completed with a couple participants ($n = 2$). In fact, for the two participants whose disruptive behavior was concluded to be reinforced by both access to attention and sensory consequences (i.e., automatic reinforcement), a functional analysis was completed for one of these cases and an indirect assessment for the other.

For cases in which the functional analysis did not include tests for social functions (i.e., automatic screen only), it is possible that the target behavior also had a social function that was not identified due to the lack of test conditions for maintaining social consequences. However, given that RIRD was effective in reducing stereotypy, and it involves the contingent delivery of attention, it is unlikely that the functional reinforcer for the disruptive behavior of these individuals was access to attention or, presumably, disruptive behavior would have increased. Moreover, given that the implementation of RIRD results in the immediate delivery of attention in the form of contingent prompting, it may not be appropriate as an intervention for stereotypy that is also maintained by access to attention as suggested by Ahearn et al. (2007). To address this possibility, Cividini-Motta et al. (2020) conducted a brief attention screen with one participant for whom the target behavior was suspected to be reinforced by attention and found that the target response persisted only in the no-interaction condition. On the other hand, RIRD involves the contingent presentation of redirection tasks; thus, perhaps it would have a therapeutic effect on disruptive behavior maintained by escape from demands. However, we did not identify any studies in which RIRD was implemented for problem behavior maintained by escape.

29.3.1.3 Target Behavior Measurement

It is important to consider the type of measurement system that will be employed to collect data on the target behavior during baseline and treatment analyses. There are various ways in which data can be collected and factors such as ease of implementation, reliability, and correspondence of measurement systems may impact the interpretation of results. Specifically, continuous data collection procedures such as duration or frequency are the most sensitive methods to measure target behaviors (LeBlanc et al., 2016). However, other discontinuous measurement such as momentary time sampling (MTS) and partial interval recording (PIR) may be more feasible and/or reliable data collection depending on the treatment context and resources.

Meany-Daboul et al. (2007) conducted a comparison of measurement methods and demonstrated that time sampling procedures, such as MTS and PIR, often yield data similar to continuous recording. However, MTS produced data that more closely aligned to the continuous duration recording (CDR) data and PIR tended to match well to continuous frequency recording. In the Martinez and Betz (2013) review, the authors noted that studies evaluating the impact of RIRD on stereotypy have used continuous measurement methods (e.g., CDR) as well as discontinuous measurements methods (e.g., time sampling), and they concluded that discontinuous measures appeared to be reliable. Thus, given that discontinuous methods are easier to use and appear to produce data similar to continuous measures (Meany-Daboul et al., 2007), they are suitable for use in clinical work and research, but continuous measurement methods should be used whenever possible.

In addition to various measurement methods for the target behavior, session measurement systems (i.e., interrupted or uninterrupted measurement) have also been evaluated. In the seminal study evaluating RIRD by Ahearn et al. (2007), the session timer was paused and data were not collected on occurrences of the target behavior during RIRD implementation. Thus, it is not surprising that subsequent RIRD evaluations have employed a similar interrupted measurement system or did not specify whether the data reported included instances of target behavior that occurred during RIRD implementation (i.e., uninterrupted measurement). However, in 2014, Carroll and Kodak demonstrated that the use of interrupted measurement of target behavior may overestimate treatments outcomes.

Since the publication of the Carroll and Kodak (2014) study, approximately 60% of the articles evaluating RIRD have employed either interrupted measurement or both interrupted and uninterrupted measurement systems. It is important to note that multiples studies have produced results similar to those of Carroll and Kodak (e.g., DeRosa et al., 2019; Wunderlich & Vollmer, 2015), but other studies have demonstrated significant RIRD treatment effects using uninterrupted measurement (e.g., Toper-Korkmaz et al., 2018). Given these findings, uninterrupted measurement methods should be employed when possible to portray a more accurate representation of the occurrence of stereotypy. Supplemental measures of RIRD implementation (e.g., frequency, duration) might also help researchers and clinicians interpret the efficacy and practicality of RIRD procedures.

29.3.2 RIRD Evaluations

Up to this point, this chapter has focused on the considerations to be made before the implementation of RIRD (e.g., participant characteristics, functional assessment, measurement methods); however, RIRD is an intervention with multiple moving parts, and as such, various adaptations have been evaluated. These have included procedural variations to the key components of RIRD, antecedent manipulations, and combining RIRD with other interventions (e.g., differential reinforcement of alternative behavior, response cost).

29.3.2.1 RIRD Procedural Modifications

Topography of RIRD Demands

One variation in the implementation of RIRD is the topography of demands presented to the participant. These are the demands that are provided by the implementer to the participant or client that redirect the individual's target behavior to an alternative response (e.g., a vocal response such as stating their name in response to the question, "What is your name?" or a motor response such as touching their head in response to the instruction, "Touch your head"). Ahearn et al. (2007) treated vocal stereotypy by redirecting the participants to complete tasks that required a vocal response. That is, the topography of the target behavior (i.e., vocal stereotypy) matched that of the RIRD demands (i.e., vocal tasks). Results of more recent studies have shown that RIRD is effective independent of the topography of the target behavior or the demands (e.g., Ahrens et al., 2011; Shawler & Miguel, 2015). Ahrens et al. (2011) conducted a series of experiments evaluating the impact of both vocal RIRD (i.e., presentation of demands requiring a vocal response) and motor RIRD (i.e., presentation of demands requiring a motor response) on vocal and motor stereotypy. In Experiment 1, the researchers compared the relative efficacy of motor RIRD and vocal RIRD on vocal stereotypy and results indicated that they were equally effective at reducing vocal stereotypy. In Experiment 2, the researchers assessed the impact of vocal RIRD and motor RIRD on vocal and motor stereotypy. Motor RIRD led to slightly greater reductions of both vocal and motor stereotypy; however, the differing prompt hierarchies between the motor and vocal RIRD procedures might have affected these results. Similarly, motor RIRD and both motor and vocal RIRD were also effective in reducing vocal stereotypy in the studies completed by Cassella et al. (2011) and Shawler and Miguel (2015), respectively. However, these studies differ in that appropriate vocalizations did not increase in the Cassella et al. study. Given that the topography of disruptive behavior and the RIRD demands can differ from one another, it is possible for RIRD to be implemented with a larger number of participants. More specifically, many individuals with autism do not have a functional vocal repertoire (CDC, 2019) and some even lack echoic responding (Carroll & Klatt, 2008), making the implementation of vocal RIRD unviable. Thus, it is important to note that both motor and vocal RIRD demands can be used to implement RIRD to reduce either form of stereotypy.

Type of RIRD Tasks

In addition to the topography of RIRD demands, the implementer can also vary the type of task presented to the individual during the RIRD implementation. These can include mastered tasks (i.e., tasks the participant readily and independently emits), nonmastered tasks (i.e., tasks the individual requires assistance to emit), or a mix of both. Although we did not identify any studies that have evaluated the effects of RIRD task type on RIRD efficacy, results of previous studies show that RIRD that includes the presentation of mastered (e.g., Ahearn et al., 2007) or nonmastered tasks (e.g., Cook & Rapp, 2020) is effective in reducing stereotypy. However, the majority of the studies reviewed reported that the demands presented consisted of tasks the participant could readily complete, had previously mastered, or were selected based on a direct assessment (e.g., RIRD probes).

A case in point is the study conducted by Love et al. (2012), in which RIRD probes were completed to identify vocal responses that the participants consistently responded to correctly (i.e., minimum of 89% accuracy across settings and experimenters). This study provided only a general description of the procedures employed in the RIRD probes, but in more recent studies the authors reported repeatedly (e.g., five times each) presenting various tasks that required vocal or motor responses until they identified a minimum number of tasks the participant readily completed independently (e.g., McNamara & Cividini-Motta, 2019). It remains unclear whether the type of task affects the efficacy or feasibility of RIRD, but it is likely that RIRD that involves mastered tasks may be easier to implement and potentially less aversive to the individual and the implementer.

RIRD Termination Criteria

In an effort to increase the practically of implementing RIRD in clinical and naturalistic settings, several studies have evaluated the relative efficacy of different RIRD termination criteria in terms of the number of required RIRD demands. Specifically, this refers to the criteria determining when each RIRD interval is considered complete. The majority of studies reviewed for this chapter required compliance with three RIRD demands (RIRD-3), and of these, more than half required either prompted or independent completion of the RIRD demands. Saini et al. (2015) and Toper-Korkmaz et al. (2018) compared the effects of different RIRD requirements (e.g., RIRD-1 vs. RIRD-3), and the results suggested that RIRD-1 was equally effective as RIRD-3, including when RIRD-1 preceded RIRD-3.

Additional variations related to the termination criteria have included whether the authors required compliance in the absence of problem behavior as well as whether a duration-based criterion was used to terminate RIRD. For instance, Athens et al. (2008) presented a single RIRD task, but termination of RIRD was contingent on at least 5 s without stereotypy. Moreover, Cividini-Motta et al. (2020) evaluated the relative efficacy of RIRD and a brief response interruption procedure in the treatment of public masturbation. During RIRD, participants were prompted to complete 1 min of physical activity. Both RIRD and the brief response interruption reduced the target behavior, but RIRD required longer durations and resources to implement. To date, no studies were found that systematically compared the effects of different duration-based termination criteria on the efficacy or efficiency of RIRD. Additionally, it does not appear that any studies have evaluated whether compliance (e.g., independent vs. prompted) or the absence of stereotypy (e.g., RIRD is terminated independent of or contingent on the absence of stereotypy) has an effect on the efficacy of RIRD.

29.3.2.2 Components to Enhance RIRD

In addition to the RIRD literature involving numerous procedural variations of the procedure itself, several studies have packaged other treatment components with RIRD. These components have included antecedent modifications (e.g., abolishing operation procedures, stimulus control procedures), reinforcement components (e.g., competing stimuli, differential reinforcement), and other interventions implemented contingent on stereotypy (e.g., verbal reprimands, response blocking, response cost). Several studies have specifically evaluated the enhancing (i.e., additive) effects of these treatment components packaged with RIRD.

Antecedent Modification

In regard to antecedent modifications, two main components have been substantially evaluated, including abolishing operation procedures prior to RIRD implementation and stimulus control procedures.

Abolishing Operation Procedures

Two studies evaluated the use of an abolishing operations component (AOC) prior to RIRD implementation (Lang et al., 2009; Lang et al., 2010) to measure the collateral effects on stereotypy during treatment. During the AOC condition, the participant was given free access to a variety of toys and was permitted to engage in stereotypy or any other behavior freely. No consequences were delivered for problem behavior or stereotypy and the access period lasted until the participant stopped engaging in stereotypy for 10 s and attempted to leave the room. In the no AOC condition, the free-access period was omitted, and treatment started immediately at the beginning of session. The purpose of this evaluation was to determine if the AOC condition would reduce the reinforcing value of stereotypy during treatment sessions. Results demonstrated that when the AOC condition was implemented before treatment, that stereotypy was lower compared to when the AOC condition was omitted. Additionally, reductions in problem behavior were observed in the AOC condition compared to the no AOC condition, suggesting that presession access to stereotypy may abate the occurrence of stereotypy and other topographies of problem behavior during regular treatment conditions.

Stimulus Control Procedures

Another antecedent manipulation that has been evaluated is the addition of stimulus control procedures. In RIRD studies using a stimulus control procedure, stereotypy was not interrupted in the presence of the stimulus used as the discriminative stimulus (SD), whereas RIRD was implemented contingent on stereotypy when it occurred in either the absence of the SD or in the presence of different stimulus (S-delta). Moreover, a rule was commonly provided to the participants during these evaluations (e.g., "the red card is out; please set the string down"; Brusa & Richman, 2008). Previous studies have used a variety of stimulus control cues including red cards (e.g., Sloman et al., 2017), red and green cards (Brusa & Richman, 2008; Falligant & Dommestrup, 2020; Gould et al., 2019), the presence or absence of a wristband worn by the participant (Frewing et al., 2015), and large colored poster boards placed on the wall behind the therapist (Martinez et al., 2016; Pastrana et al., 2013).

To test for inhibitory control in the absence of RIRD, Sloman et al. (2017) evaluated a stimulus cue only (SCO) condition in which the S-delta was present, but stereotypy was not interrupted. Results demonstrated that when the SCO condition was implemented in the environment where signaled RIRD was previously conducted, moderate suppression of stereotypy (e.g., inhibitory control) was achieved, but when the SCO condition was conducted in a novel setting, stereotypy remained at baseline levels. Similarly, other studies evaluating stimulus control procedures with RIRD have found mixed results. Brusa and Richman (2008) demonstrated that stereotypy was under the control of the stimulus conditions, but the S-delta condition was never evaluated in the absence of RIRD implementation. That is, RIRD was always implemented when the S-delta (e.g., red card) was present. Similarly, Frewing et al. (2015) evaluated stimulus control procedures in which RIRD was implemented across three additional settings. During the generalization probes to novel settings, stimulus control plus RIRD suppressed stereotypy compared to baseline. Taken together, the use of stimulus control procedures may lead to quicker suppression of stereotypy during RIRD implementation compared to when no stimulus conditions are present. However, when RIRD is not implemented, inhibitory control is unlikely to be achieved.

RIRD Plus Reinforcement Components

Lanovaz et al. (2013) reviewed the effects of reducing stereotypy on untargeted responses and concluded that stereotypy interventions can result in response reallocation to untargeted responses, suggesting that practitioners arrange reinforcement for appropriate behavior. Within the published RIRD literature, RIRD is commonly packaged with noncontingent reinforcement (NCR; e.g., free access to leisure items) and/or differential reinforcement of appropriate alternative responses (DRA; e.g., praise following appropriate vocalizations).

Noncontingent Reinforcement

With respect to noncontingent sources of reinforcement, Love et al. (2012) systematically evaluated the effects of RIRD paired with access to sound-making toys, which were presumed to produce matched stimulation (MS), on the vocal stereotypy of two participants. Prior to implementing treatment, authors conducted an MS assessment (i.e., competing items assessment) to demonstrate that the items used in the MS conditions competed with vocal stereotypy. RIRD and RIRD + MS decreased stereotypy, but RIRD + MS was slightly more effective for one participant and required less time implementing RIRD. However, the sound-making toys were removed during RIRD implementation in the RIRD + MS condition, which might have functioned as punishment and affected the observed treatment effects. Similarly, Gibbs et al. (2018) conducted a competing stimulus assessment to identify stimuli that competed with vocal stereotypy and compared RIRD and RIRD + MS. The results suggested that RIRD + MS decreased stereotypy relative to RIRD alone. One limitation, however, was that the comparison did not include a condition without RIRD or with MS alone. Thus, it is unclear how RIRD alone affected stereotypy engagement, if both components combined were necessary to observe treatment effects, or if MS alone would have decreased stereotypy. Taken together, NCR may enhance the effects of RIRD, but given that a competing stimulus assessment is warranted to identify appropriate stimuli to be used during MS, it is unclear whether or not this is a worthwhile component to enhance the effects of RIRD on stereotypy.

Differential Reinforcement

Other studies have specifically evaluated the degree to which the delivery of a reinforcer contingent on alternative responses enhances the effects of RIRD on both stereotypy and alternative responses. Dickman et al. (2012) evaluated the effects of additional reinforcement for appropriate vocalizations in the treatment of vocal stereotypy by comparing RIRD with praise contingent on appropriate vocalizations (similar to Ahearn et al., 2007) and RIRD with praise and tokens exchangeable for edibles contingent on appropriate vocalizations. Both procedures effectively decreased stereotypy engagement, but the addition of the token reinforcement enhanced the effects with lower levels of stereotypy and higher levels of appropriate vocalizations.

Cividini-Motta et al. (2019) conducted a similar comparative study that evaluated the enhancing effects of a DRA component with reinforcement contingent on appropriate vocalizations and leisure engagement packaged with RIRD. In the DRA component, praise and available requested items were provided contingent on appropriate vocalizations and a tangible reinforcer was provided contingent on leisure engagement. Both procedures with RIRD (i.e., RIRD, RIRD + DRA) effectively decreased the targeted stereotypy for all participants, but sustained levels of appropriate vocalizations or leisure engagement were not observed during any intervention. Cividini-Motta et al. suggested that the tangible item delivered contingent on leisure engagement likely affected the levels of appropriate behavior because consumption of the item competed with appropriate responses. Thus, practitioners should consider whether the reinforcers contingent on appropriate responses might compete with functional engagement.

RIRD Plus Contingent Interventions

To enhance treatment efficacy, a few studies have paired RIRD with other behavioral intervention implemented contingent on the occurrence of stereotypy. For instance, two studies have evaluated the enhancing effects of response cost (RC) paired with RIRD (McNamara & Cividini-Motta, 2019; Toper-Korkmaz et al., 2018). Both studies compared RIRD and RIRD + RC, with the RC component involving contingent toy removal during RIRD implementation. RIRD and RIRD + RC effectively decreased the targeted vocal stereotypy, but RIRD + RC enhanced the treatment effects in some cases. Toper-Korkmaz et al. suggested that the degree to which a RC component affects treatment outcomes is dependent on the degree to which the removed stimulus functions as a reinforcer throughout the treatment analysis. Thus, the degree to which RC enhances RIRD treatment effects is likely idiosyncratic across individuals and dependent on which stimulus is contingently removed.

29.3.2.3 RIRD Added to Other Interventions

RIRD has also been added following other approaches to stereotypy treatment. For example, Colón et al. (2012) first arranged a DRA in the form of verbal operant training to train and reinforce appropriate vocalizations prior to implementing RIRD. Verbal operant training alone increased appropriate vocalizations for all three participants and sufficiently decreased stereotypy for one participant. RIRD was then added for the other two participants, and stereotypy decreased while appropriate vocalizations continued to occur. The results suggest that at times reinforcement-based procedures (e.g., DRA) for appropriate responses can promote response reallocation from stereotypy to appropriate alternative behavior. Similarly, the results from Steinhauser et al. (in press) suggest that some contexts with naturalistic stimuli and DRA arrangements might not warrant the addition of RIRD. In contexts in which stereotypy remains problematic with reinforcement-based procedures alone, RIRD can be packaged with DRA to promote response reallocation to functional engagement and decrease stereotypy.

Cook and Rapp (2020) conducted a similar study involving a progressive treatment analysis for stereotypy to determine the extent practitioners need to treat stereotypy during academic tasks. The study involved five participants. Each participant experienced a five-phase assessment, with each phase involving a different behavioral intervention for stereotypy with more components than the previous phase and a variation of RIRD (i.e., overcorrection) as the last phase. The earlier phases prior to RIRD sufficiently decreased the stereotypy of four of the five participants, suggesting that interventions with fewer procedural components than RIRD might effectively decrease stereotypy.

29.4 RIRD Efficacy and Outcomes

Taken together, this chapter has provided a discussion on various measurement methods, procedural variations, and additive effects of RIRD. Overall, RIRD has been found to be effective at reducing both motor and vocal stereotypy for participants across a variety of ages and diagnoses. In most cases, when RIRD is implemented alone, appropriate behavior and untargeted challenging behavior remain unchanged. Although RIRD alone does not reliably produce increases in appropriate behavior, RIRD is often combined with other interventions or various procedural modifications (e.g., RIRD + DRA for appropriate vocalizations; Colón et al., 2012) to achieve therapeutic effects for behavior other than stereotypy. However, a more thorough discussion on the use of RIRD as an evidence-based practice is introduced in the next section, followed by a discussion of effects of RIRD on other behavior, and the relative efficacy of RIRD compared to other interventions.

29.4.1 RIRD Is an Evidence-Based Practice

An evidence-based practice (EBP) consists of an intervention that has been shown to be effective through multiple replications of rigorous and well-controlled research studies (Kazdin, 2011). The identification of EBPs should facilitate clinical decision-making by ensuring that clinicians implement interventions that are likely to have therapeutic effects, and thus, improve outcomes for clients.

There are currently multiple criteria to evaluate treatments and determine whether they meet specific criteria to be considered an EBP (e.g., Council for Exceptional Children, 2014; What Works Clearinghouse, 2017), all of which take into consideration variables related to the design employed and results attained. Multiple sources have identified RIRD as an evidence-based practice (Akers et al., 2020; Steinbrenner et al., 2020; Tomaszewski et al., 2017; Wang et al., 2020).

For instance, the National Clearinghouse for Autism Evidence and Practice (NCAEP) identified RIRD as an evidence-based practice for children to young adults (i.e., age 22 years or younger) with autism based on a systematic review of studies published from 1990 to 2017 (Steinbrenner et al., 2020). This review identified 29 studies evaluating RIRD with individuals between the ages of 3 and 22 years old. According to the authors, to determine if studies met methodological acceptability each study was independently reviewed by two external reviewers using protocols developed based on the quality indicators described by Gersten et al. (2005; for the group design protocol), Horner et al. (2005; single-case design protocol), and the guidelines described by What Works Clearinghouse (WWC). Then, interventions were rated as an evidence-based practice if they met one of the three criteria developed by the National Professional Development Center on ASD (NPDC) team: (a) at least two high-quality group design studies by different research teams; (b) at least five high-quality single-case design studies, totaling at least 20 participants, conducted by at least three different research teams; or (c) at least one high-quality group design and three high-quality single-case design studies conducted by at least two different research teams. As such, RIRD is an EBP.

29.4.2 RIRD Relative Efficacy Compared to Other Interventions

The relative efficacy of RIRD compared to other interventions for stereotypy has been evaluated in comparative studies, comparing RIRD to antecedent and consequent interventions.

29.4.2.1 Medication

Unlike other comparative studies that compared RIRD and other behavior analytic interventions, Miguel et al. (2009) compared RIRD and sertraline, a selective serotonin reuptake inhibitor (SSRI), that had been prescribed for stereotypy. The results suggested that the SSRI did not affect stereotypy engagement, but RIRD effectively decreased stereotypy. Therefore, when possible, behavioral interventions for stereotypy should be evaluated prior to considering medicinal intervention.

29.4.2.2 Reinforcement-Based Procedures

In addition to Love et al. (2012) evaluating the enhancing effects of matched stimulation paired with RIRD, the study also evaluated the relative efficacy of the RIRD and MS. Although all three procedures decreased stereotypy, higher levels of appropriate vocalizations were observed during the procedures with RIRD. These results suggest that in addition to considering a treatment's effects on stereotypy, practitioners and researchers should also consider other outcomes such as engagement in appropriate alternative responses. Shawler et al. (2020) conducted a similar comparative study, comparing RIRD, sound-producing stimuli, and nonsound-producing stimuli. Shawler et al. concluded that both RIRD and sound-producing stimuli effectively decreased stereotypy with the two participants but neither procedure produced consistently higher levels of appropriate vocalizations. Similarly, results from Gibney et al. (2020) suggested that both RIRD and presumably matched competing stimuli effectively decreased vocal stereotypy with three of four participants. Carroll and Kodak (2014), Experiment 2, involved a similar comparative analysis following an evaluation of measurement methods. However, the results differed from other studies, suggesting that NCR was more effective than RIRD when stereotypy was measured using uninterrupted measurement methods. During Experiment 1 and Experiment 2 with the same two participants, Carroll and Kodak measured stereotypy with both interrupted and uninterrupted measurement systems and suggested that interrupted measurement overestimated RIRD efficacy relative to uninterrupted measurement. Although RIRD resulted in more modest reductions than NCR in Experiment 2, both RIRD and NCR effectively reduced vocal stereotypy.

With respect to the relative efficacy of RIRD and reinforcement contingent on alternative responses (i.e., DRA), Colón et al. (2012) and Steinhauser et al. (in press) demonstrated that RIRD can be effective when stereotypy persists in DRA conditions. Cividini-Motta et al. (2019), however, is the only study identified in the chapter literature review that sought to systematically evaluate the relative efficacy of RIRD with respect to DRA procedures for appropriate alternative behavior. As noted previously, none of the procedures resulted in sustained levels of appropriate responses (i.e., appropriate vocalizations, leisure engagement), but the procedures with RIRD were consistently more effective for all three participants compared to the DRA alone procedure.

29.4.2.3 Other Contingent Interventions

As for the relative efficacy of RIRD compared to other interventions implemented contingent on stereotypy, several studies have compared RIRD to other interventions. Notably, Verriden and Roscoe (2019) compared variations of RIRD (i.e., contingent demands, overcorrection) to other contingent interventions (e.g., verbal reprimands, response blocking, response cost) with noncontingent and contingent sources of reinforcement simultaneously available in a punisher assessment. Across the four participants, all interventions effectively decreased stereotypy, but they had differing effects on leisure engagement and emotional responding. Following this assessment, Verriden and Roscoe involved the participants' clinicians in the decisions regarding which interventions to evaluate and in determining which intervention was most effective overall for each of the participants. Results suggested that the most effective and socially valid intervention was idiosyncratic across participants.

Other comparative studies have evaluated the relative efficacy of RIRD and other interventions. These comparable studies provide considerations for practitioners deciding between stereotypy interventions. For example, Cividini-Motta et al. (2020) compared RIRD involving a 1 min physical redirection and a brief response interruption procedure in the treatment of public masturbation (i.e., inappropriate sexualized behavior). The procedures were equally effective in decreasing the target behavior, but the brief response interruption procedure required considerably fewer resources and less time to implement. Giles et al. (2012) compared the efficacy and participant preference of RIRD and response blocking in the treatment of motor stereotypy, concluding that RIRD was both more effective and preferred relative to response blocking for all three participants. DeRosa et al. (2019) conducted a similar comparative study but also evaluated the effects of response measurement methods, concluding that response blocking was substantially more effective than RIRD when uninterrupted measurement was used. These conflicting conclusions of Giles et al. and DeRosa et al. suggest that the measurement method likely affects the perceived relative efficacy. However, it is also important to note that the RIRD procedural variations and the specific variations of the other contingent interventions have likely affected the concluding relative efficacy of procedures.

Toper-Korkmaz et al. (2018) and McNamara and Cividini-Motta (2019) evaluated the relative efficacy of RIRD and RC. Across the two studies, RC, which consisted of toy removal contingent on the target behavior, effectively decreased stereotypy of some of the participants. In contrast, RIRD produced treatment effects for all participants. These results, again, are consistent with the Verriden and Roscoe (2019) assertion that the most effective intervention is likely idiosyncratic.

29.4.3 Additional Considerations with RIRD

Although RIRD is an EBP and is usually at least as effective as other behavioral interventions, there are additional considerations that should be made when implementing RIRD in practice. These include the effects on untargeted responses, the social validity of this type of intervention, maintenance and generalization of treatment effects, and how treatment integrity may impact results. A discussion is provided on each of these topics.

29.4.3.1 Indirect Effects of RIRD on Untargeted Responses

Although results of the studies reviewed indicated that RIRD is effective in reducing automatically reinforced problem behavior, clinical decisions must also consider the impact of a behavior intervention on untargeted responses such as untargeted topographies of stereotypy, appropriate behavior, and challenging behavior (e.g., emotional responding, aggression).

Untargeted Stereotypy

A few studies have evaluated the effect of RIRD on untargeted stereotypy. For instance, Cook et al. (2014) implemented RIRD, termed by the authors as *verbal reprimand*, contingent on the occurrence of either vocal or motor stereotypy but also measured untargeted stereotypy. In this study, the impact of RIRD on untargeted stereotypy was idiosyncratic across participants (e.g., decreased for two, increased for one of the five participants). Similarly, Pastrana et al. (2013) implemented RIRD contingent for motor stereotypy and also measured levels of untargeted vocal stereotypy. In this study, RIRD resulted in marginal increases in untargeted vocal stereotypy for one participant and decreases in vocal stereotypy of the second participant. To evaluate the subsequent effects of RIRD on targeted motor stereotypy, Pastrana et al. included no-interaction (NI) sessions prior to and following each RIRD session and compared the RIRD sequence to an NI sequence (i.e., three consecutive NI sessions). Results showed that RIRD resulted in an immediate decrease in levels of motor stereotypy, but motor stereotypy occurred at levels similar to baseline immediately after RIRD implementation ceased. In other words, RIRD did not increase or decrease levels of motor stereotypy during the subsequent NI sessions and these results are similar to those attained by Schumacher and Rapp (2011). More recently, Cook and Rapp (2020) implemented motor RIRD [termed *positive practice overcorrection (PPOC)* by the authors] contingent on motor stereotypy but also measured levels of vocal stereotypy. During the motor RIRD phase, an increase in vocal stereotypy was observed during one of the activities but levels of vocal stereotypy did not change during the other two. Furthermore, levels of vocal stereotypy also did not change when motor RIRD was implemented contingent on both vocal and motor stereotypy.

Appropriate Behavior

For approximately half of the participants included in the reviewed studies, data were also reported on the effects of RIRD on appropriate behavior (e.g., appropriate vocalizations, leisure engagement). In general, RIRD either increased appropriate behavior (e.g., appropriate vocalizations; Ahearn et al., 2007; Ahrens et al., 2011; Guzinski et al., 2012), did not have an impact on appropriate behavior (e.g., communication; Cassella et al., 2011), or the effects were not reported. Thus, decisions about treatment selection should consider the impact of the intervention on target and appropriate behavior.

Challenging Behavior

Additionally, with some individuals, supplemental measures of challenging behavior or emotional responding might be appropriate. For example, Verriden and Roscoe (2019) used supplemental measures of emotional responding, defined as whining, crying, screaming, aggression, self-injury, and attempts to escape from the procedure or physical resistance, as another measure used to evaluate interventions. These measures might also serve as social validity measures for participants or clients with limited verbal repertoires.

29.4.3.2 Social Validity

Given that RIRD can be conceptualized as a punishment procedure, the inclusion of social validity measures is warranted. However, of the studies reviewed in this chapter, the majority of evaluations did not assess social validity. When it was measured, the most common social validity measure was a questionnaire or a questionnaire plus video review of treatment sessions conducted with a caregiver, teacher, aides, or clinician. For studies involving a questionnaire for social validity, the majority of results were favorable, indicating the RIRD was effective, acceptable, and likely to be carried out by stakeholders.

Another form of social validity measurement was based on participant preference and was evaluated using a preference assessment for the various treatment components (Cividini-Motta et al., 2019; Giles, & St. Peter, C. C., Pence, S. T.,, & Gibson, A. B., 2012). In Giles et al. (Giles, & St. Peter, C. C., Pence, S. T.,, & Gibson, A. B., 2012), RIRD was compared to response blocking and all three participants preferred RIRD. In Cividini-Motta et al. (2019), three treatment conditions were evaluated (RIRD, DRA, RIRD + DRA) in a concurrent-chains preference assessment. Based on participants' selections, two of three participants preferred RIRD alone, whereas one participant preferred RIRD + DRA. These results suggest that although redirection to another task may seem aversive, or that it would require higher response effort for the participant, oftentimes participants preferred RIRD to other types of interventions that did not include prompting another task. Related to participant preference, but novel in approach, Frewing et al. (2015) implemented RIRD and stimulus control procedures and measured the participant's heart rate as a measure of distress. During the generalization probes to novel settings, the participant's heart rate did not increase when treatment was implemented or immediately after it was removed. These results suggest that although RIRD is a punishment procedure, it may not be aversive based on participant's physiological responses.

Also related to preference, Peters and Thompson (2013) did not assess preference for the various treatment conditions, but instead evaluated the relative preference for activities after they were used during RIRD implementation. Authors found that the activities used during treatment did not acquire aversive properties after RIRD was implemented with the activities. Thus, if certain items or activities are used during RIRD implementation, they may still function as reinforcers outside of treatment settings.

29.4.3.3 Maintenance of RIRD Treatment Effects

Out of the articles reviewed in this chapter, few measured the maintenance of treatment effects over time. In the majority of cases in which maintenance data were collected, RIRD remained in effect, whereas only two studies, which included a total of four participants, measured maintenance of effects without RIRD (Schumacher & Rapp, 2011; Sivaraman & Rapp, 2020).

In all cases in which RIRD remained in effect, treatment effects were sustained (i.e., the therapeutic effect on stereotypy persisted). Furthermore, when maintenance was assessed in the absence of RIRD, stereotypy increased to levels similar to those observed pretreatment (i.e., baseline). That is, treatment effects did not persist in the absence of RIRD (e.g., Schumacher & Rapp, 2019). An exception is the study by Sivaraman and Rapp (Sivaraman & Rapp, 2020), which showed that lower levels of stereotypy persisted when RIRD was withdrawn and that repeated exposure to RIRD increased its efficacy. Specifically, authors found that when RIRD was implemented for 20 min and then removed, posttreatment levels of stereotypy were below those observed in the initial baseline phase. However, these results were not achieved when RIRD was implemented for only 5 min. These results suggest that as RIRD is implemented repeatedly, and for longer periods of time, that the intervention functions more effectively and more efficiently as the frequency of RIRD intervals decreased over repeated exposures. However, it is possible that over extended periods of time without intervention, stereotypy may steadily increase to baseline levels, and as such, RIRD booster sessions may be required to maintain long-term treatment effects (e.g., Colón & Ahearn, 2019).

29.4.3.4 Generalization of RIRD to Naturalistic Settings

The original RIRD procedures described by Ahearn et al. (2007) were conducted in a controlled setting, absent of anyone other than the implementer and any unnecessary materials. Given that stereotypy may prevent acquisition of new skills in an educational context or be socially stigmatizing in the community (Cunningham & Schreibman, 2008), evaluating the efficacy of RIRD in less controlled settings is warranted. Since 2007, researchers have evaluated the effectiveness of implementing RIRD in more naturalistic settings, such as classroom, community, and home settings.

One of the earliest evaluations of RIRD in naturalistic settings was conducted by Liu-Gitz and Banda (2010), in which RIRD was implemented by a special education teacher in a classroom setting with other students of various abilities present. Appropriate vocalizations were reinforced with behavior-specific praise (e.g., "I like it when you use your pretty voice"), while vocal stereotypy was interrupted and redirected with questions about topics of interest to the student (e.g., "Do you like *Toy Story*?"). The teacher maintained high procedural integrity and results suggested that RIRD was effective in decreasing vocal stereotypy in a classroom context. Similarly, Wells et al. (2016) evaluated the effects of RIRD implemented by a teacher and educational assistant with an adolescent during group instruction with other students present. Results were similar to those obtained by Liu-Gitz and Banda; staff easily learned to implement the RIRD procedure with ease and the intervention was successful at decreasing vocal stereotypy during classroom group instruction. Moreover, Martinez et al. (2016) transferred the implementation of RIRD in a controlled environment to a classroom setting for sessions lasting up to 30 min. Notably, as sessions progressed, the time spent in RIRD and the number of instructions delivered during RIRD decreased substantially, indicating that repeated exposure to RIRD had long-term effects in regard to treatment efficacy and efficiency. Lastly, Giles et al. (2018) used behavior skills training (BST) to coach novice teaching assistants to implement RIRD with students during ongoing classroom activities. Results of Giles et al. and the above-mentioned studies support the use of RIRD in a classroom context.

RIRD procedures have also been effective in community settings such as at a restaurant table with peers and other staff members while waiting for meals to arrive (Sloman et al., 2017) or in the home or clinic setting with a parent implementing the intervention (Gibbs et al., 2018). In Sloman et al., staff members implemented RIRD across three educational activities (morning group, independent activities, and deskwork) and one community setting (restaurant). Results demonstrated that RIRD was effective for one participant across a variety of settings and activities. Similarly, Gibbs et al. first trained clinicians to implement RIRD with MS in a clinic setting and then conducted generality probes either in the clinic (Elizabeth) or in the home setting (Matthew) with the participants' mothers implementing the intervention. Results of the generality probes indicated positive results were obtained when parents implemented the intervention outside the clinical or instructional context. Given these results, research supports the use of RIRD in both controlled and naturalistic settings.

29.4.3.5 RIRD Treatment Integrity

As discussed thus far, RIRD is often used in the treatment of automatically reinforced stereotypic behavior that is either interfering or stigmatizing. Therefore, research assessing the effects of varying levels of RIRD treatment integrity is of particular importance for clinicians adopting RIRD procedures during naturally occurring activities. Multiple studies have evaluated aspects of RIRD treatment integrity. For example, Giles et al. (2018) evaluated teacher-implemented RIRD in a classroom setting. The study involved dividing the prescribed RIRD procedure into task analysis steps and measuring treatment integrity (i.e., the percentage of correct task analysis steps) before and after BST. Before BST, the teachers implementing RIRD received a flowchart outlining the RIRD procedure and performed approximately 50% of the RIRD steps correctly. The authors concluded that initiating RIRD within 3 s and terminating RIRD after three responses without stereotypy were the two most common integrity errors across teachers. However, BST drastically improved treatment integrity and teachers quickly met the mastery criterion (i.e., 90% accuracy across two sessions). These results support using BST with RIRD implementers, but the Giles et al. evaluation does not allow for conclusions with respect to how integrity errors at specific steps of RIRD impact its efficacy.

Two studies, Colón and Ahearn (2019) and Gauthier et al. (2020), sought to evaluate the impact of RIRD implemented at various treatment integrity levels on stereotypy. In Experiment 1 of Colón and Ahearn (2019), the authors first trained staff to implement RIRD and then identified treatment consistency (i.e., implementing RIRD contingent on each occurrence of stereotypy) as the most common treatment integrity error in a classroom setting. The authors found that when the staff implemented RIRD contingent on stereotypy, they implemented it accurately but they did not implement RIRD following each occurrence of stereotypy. Therefore, Experiment 2 was designed to systematically evaluate the effects of RIRD when implemented contingent on 100%, 75%, 50%, and 25% of stereotypy occurrences. RIRD remained effective at 50% treatment consistency for all three participants. These findings are comparable to those of Experiment 3 of Ahrens et al. (2011) that sought to identify the operant mechanism responsible for efficacy of RIRD by systematically presenting RIRD contingent on 0.5, 0.25, and 0.1 proportions of stereotypy occurrences. Additionally, the last phase of the Colón and Ahearn parametric analysis involved alternating between 25% and 100% treatment consistency conditions and resulted in reduced levels of stereotypy. These results suggest that occasional booster sessions with high integrity might facilitate maintained of RIRD effects when implemented following only a proportion of responses (i.e., 25%).

Similar to Colón and Ahearn (2019), the study conducted by Gauthier et al. (2020) systematically evaluated different levels of treatment consistency; however, the participants did not experience RIRD implemented with 100% consistency prior to the evaluation. Thus, the evaluation involved an ABAB design with an alternating treatments comparison of 33% and 100% treatment consistency in the B phase. Both treatment consistency levels reduced stereotypy across participants but the degree to which stereotypy decreased varied across participants. Gauthier et al. concluded that the study adds to the RIRD treatment integrity literature by demonstrating that diminished treatment consistency can maintain low levels of stereotypy in some cases. Although Ahearn et al. (2007) suggested that low treatment integrity might negatively affect RIRD efficacy, results of Gauthier et al. and Colón and Ahearn suggest that, at least in some cases, treatment integrity errors might have a lesser impact on the efficacy of RIRD than initially expected.

29.5 Clinical and Research Recommendations

Although decreasing stereotypic repetitive behavior is often the primary objective of RIRD procedures, Rapp and Vollmer (2005) and Lanovaz et al. (2013) suggested that treatment packages that involve reinforcement components for appropriate behavior can help promote response reallocation to appropriate alternative responses (e.g., appropriate vocalizations, functional engagement). In fact, as noted above, RIRD in combination with reinforcement-based procedures has been shown to increase appropriate responses such as appropriate vocalizations and leisure engagement (e.g., Dickman et al., 2012; Verriden & Roscoe, 2019). Additionally, the behavior analytic ethical standards require the implementation of reinforcement-based procedures in conjunction with punishment-based procedures (Behavior Analyst Certification Board [BACB®], , 2014), and Pokorski and Barton (2020) suggested that behavior analytic research, in addition to clinical applications, must be in accordance with these BACB® ethical standards.

Thus, we recommend that clinicians always combine RIRD with reinforcement-based procedures and also evaluate reinforcement-based interventions prior to the introduction of RIRD. For instance, Verriden and Roscoe (2019) evaluated the impact noncontingent access to stimuli and DRA prior to evaluating the impact of punishment-based interventions implemented contingent on the targeted stereotypy. In addition, the reinforcement-based components remained in effect during the punisher assessment. In some cases, similar to what was observed by Colón et al. (2012), Cook and Rapp (2020), and Steinhauser et al. (in press), reinforcement-based procedures alone might promote appropriate alternative behavior and make the addition of RIRD unnecessary. If appropriate behavior is not occurring at desirable levels during the evaluation of reinforcement-based procedures, we recommend using prompting or other instructional procedures (e.g., shaping, chaining) to foster an increase in appropriate responses such as functional play. Lastly, if RIRD implementation is warranted, to promote response reallocation and be in accordance with the BACB® ethical standards, clinicians should program noncontingent sources of reinforcement and differential reinforcement contingent on appropriate behavior.

One way to easily program reinforcement into RIRD is through the inclusion of nonmastered tasks during RIRD. That is, instead of selecting skills that the individual has already acquired, clinicians can select tasks still in training but that can be easily prompted. Then, during RIRD implementation, prompts can be used to promote compliance with the tasks and reinforcers can be delivered following task completion. In this case, the repeated implemented of RIRD may lead to skill acquisition. Furthermore, by including nonmastered tasks, the efficacy of RIRD can be increased by omitting the resources required to identify mastered tasks. Although previous research on RIRD has used both mastered and nonmastered tasks, given that no studies have compared these iterations of RIRD, future research should evaluate the relative efficacy of RIRD with mastered and nonmastered tasks, investigate whether participants indeed acquire new skills when nonmastered tasks are presented during RIRD, and assess whether further modifications to the RIRD procedure (e.g., inclusion of prompts, reinforcement) make acquisition of these skills likely. Moreover, given that both Martinez and Betz (2013) and the current chapter identified measures of social validity as a gap in the RIRD literature, future research on RIRD should include measures of social validity to ensure that the intervention being provided is acceptable and socially significant. Furthermore, it would be helpful to determine whether the version of RIRD recommended here, which includes prompts and reinforcement of completion of nonmastered tasks, would be associated with higher social validity measures.

Based on results of previous research, there are additional procedural modifications that can be used to increase the feasibility of RIRD. For instance, RIRD has been found to be effective independent of the number of tasks required (e.g., RIRD-1 vs. RIRD-3; Saini et al., 2015; Toper-Korkmaz et al., 2018), in cases in which RIRD was terminated based on independent (e.g., Ahearn et al., 2007) or both independent and prompted compliance (e.g., Gauthier et al., 2020) with tasks, and in procedures in which RIRD termination was based on a certain duration of RIRD implementation (e.g., Cividini-Motta et al., 2020; Cook & Rapp, 2020). Therefore, in clinical settings where feasibility of implementation is imperative, we recommend that clinicians consider setting the criterion to terminate RIRD implementation as compliance, independent or prompted, with one RIRD task or a specified duration of RIRD implementation (e.g., 1 min as done by Cividini-Motta et al., 2020). Furthermore, given that uninterrupted measurement provides more stringent information about the impact of RIRD on target behavior (e.g., Carroll & Kodak, 2014; Wunderlich & Vollmer, 2015), and it is likely easier to implement, we recommend that clinicians use this method instead of the interrupted method used in a large number of previously published studies. However, clinicians can improve feasibility by using discontinuous measures (e.g., MTS) and potentially by collecting data only during specific times when target behavior is more likely to occur. Furthermore, the results of Colón and Ahearn (2019) indicate that RIRD implemented at variable levels of treatment integrity remains effective as long as it is implemented with high integrity at least some of the time. Thus, it is plausible that in clinical settings after RIRD has been implemented at a high degree of integrity and shown to reduce stereotypy, some components of RIRD (e.g., long termination criteria; implementing contingent on every response) can be omitted from behavioral plans that are implemented on a daily basis by technicians with limited training as long as clinicians with more expertise implement booster sessions on a regular basis. However, research is needed to determine which components can be omitted on a regular basis and the appropriate schedule of implementation for booster sessions. Additionally, RIRD can be faded by gradually increasing the amount of time the implementer is out of the room (e.g., Athens et al., 2008) or by changing the schedule of RIRD implementation from continuous to an intermittent schedule (e.g., Sloman et al., 2017). For example, Athens et al. (2008) first implemented RIRD throughout an entire session, then faded the presence of the implementer in the room by leaving the room for 10 s, 20 s, and so on and returning for 1 min or contingent on the occurrence of stereotypy to implement RIRD. Results of the fading procedure demonstrated that time alone increased while stereotypy remained low. Sloman et al., however, evaluated the effects of intermittent RIRD on vocal stereotypy during two other activities after RIRD effectively decreased vocal stereotypy during two other activities. In this study, intermittent RIRD, consisting of the implementation of RIRD following each instance of stereotypy during the first minute of the session and subsequently on a FI 1 min schedule, was effective at reducing stereotypy. Results of these two studies indicate that once treatment effects are attained with full delivery of RIRD, certain components, time spent in the room, or the schedule of RIRD implementation may be adjusted to increase feasibility of implementation and maintain suppressed levels of stereotypy.

However, findings from previous research evaluating the relative efficacy of RIRD iterations or RIRD packages with other interventions suggest that the most efficacious and socially valid intervention may be idiosyncratic across participants and relevant stakeholders. Therefore, although we recommend that clinicians begin with the least intrusive version of RIRD in conjunction with at least one reinforcement-based procedure, we suggest that clinicians consider a systematic comparison of several treatment options in cases in which RIRD does not decrease the target behavior to therapeutic levels. We recommend an evaluation similar to the Verriden and Roscoe (2019) punisher assessment and discourage the successive addition of components (e.g., increase number of RIRD tasks; increase duration of implementation of RIRD) meant to increase the aversive properties of RIRD due to the potential for habituation. Future research should provide additional information about participants' characteristics and repertoires so that these data can be used to identify RIRD variations that are more likely to be effective for a given individual. With these data, it may be possible to develop efficient methods for identifying the most efficacious intervention in particular cases rather than continuing to pose general relative efficacy questions. Furthermore, clinicians must consider other implementation measures, such as the frequency or duration of implementation, to determine whether an intervention is effective or feasible. Although it is likely that RIRD may initially be implemented frequently and potentially require large amounts of time, research has demonstrated that repeated exposure to RIRD may function more efficiently and require fewer RIRD presentations as time passes (Sivaraman & Rapp, 2020).

Additionally, RIRD might not be necessary in an ongoing basis and can be transferred to other interventions for maintenance of effects. For instance, the study by Cook and Rapp (2020) found that at least for some individuals, interventions less intrusive than RIRD (e.g., academic instruction; academic instruction plus auditory stimulation) were effective in reducing stereotypy. In addition, most topographies of stereotypy do not have the potential to result in injury to the individual or persons in their environment. That is, stereotypy is not SIB, and thus, is not inherently harmful. In determining whether an intervention is warranted, it is imperative that clinicians determine whether the stereotypy emitted by their client is posing a negative impact on their life such as limiting access to social interactions or disrupting skill acquisition for the individual or others in their vicinity. Additionally, the ultimate goal for SIB interventions is to completely eliminate SIB from the individual's repertoire; however, it is likely that a more appropriate goal for stereotypy is to ensure it is not impeding acquisition of skills or access to social situations. Thus, whenever deemed appropriate by the clinical team and caregivers, discrimination training procedures should be considered so that the individual engages in this response only during times or locations when it is socially acceptable (e.g., independent leisure, downtime; Frewing et al., 2015). Additionally, less intrusive interventions similar to those described by Cook and Rapp may maintain low levels of stereotypy following RIRD implementation.

Many additional areas of research were identified. For instance, although it is presumed that RIRD is contraindicated as a treatment for attention-maintained problem behavior, we have not identified any studies that evaluated the use of RIRD with repetitive behavior maintained only by access to attention. Given that RIRD is considered a punishment-based procedure, perhaps its aversive property may be more potent than the potentially reinforcing effects resulting from the attention delivered during its implementation. Thus, future research should consider evaluating the effect of RIRD on attention-maintained repetitive problem behavior that has not decreased when function-based treatments were implemented. Furthermore, few studies have systematically evaluated the enhancing effects of other interventions implemented contingent on the target behavior (e.g., verbal reprimands, response blocking) combined with RIRD, even though these treatment components are regularly packaged with RIRD. Thus, future research should consider evaluating the additive effects of these procedures packaged with RIRD similar to the evaluations with response cost (McNamara & Cividini-Motta, 2019; Toper-Korkmaz et al., 2018). In conclusion, RIRD is an evidence-based practice to reduce stereotypy. This chapter has provided an overview of various iterations of RIRD and discussed clinical implications of each. Given that RIRD comprises many variables that can be individualized, future research is warranted to further our understanding of the effects of each component on stereotypy and how adaptations may be employed to produce socially significant, lasting treatment effects. For further descriptions of each procedure, please consult the empirical sources provided.

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30 Building Independence: Self-Management for Individuals with Autism Spectrum Disorder

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30.1 What Is Self-Management?

Skinner (1953) used the term self-control to describe the application of techniques of operant control to one's own behavior when he said a man "controls himself precisely as he would control the behavior of anyone else-through the manipulation of variables of which behavior is a function". More recently, Cooper et al. (2007) defined self-management as "the personal application of behavior change tactics that produces a desired change in behavior" (p. 578). While some behavior analysts have suggested separating these definitions (Newman et al., 1996), others have used them synonymously and focused instead on the importance of ensuring that these terms are used precisely (Epstein, 1997).

30.1.1 Theoretical Basis of Self-Management

Inherent in the presented definitions of self-control and self-management is the assumption that behavior change tactics or operant control are behavior (Epstein, 1997; Newman et al., 1997; Skinner, 1953). As such, the two responses defined within self-management, the behavior change tactics and the desired change in behavior, can still be traced back to environmental functions (Cooper et al., 2007; Epstein, 1997; Skinner, 1953). The behavior change tactics (e.g., keeping track of one's completion of chores on a checklist) may be reinforced by a social community (e.g., a family) that prioritizes self-control. Moreover, the desired change in behavior (e.g., completing the expected tasks) may be reinforced through the social environment (e.g., payment for completion of chores) or the physical environment (e.g., access to clean clothes after doing the laundry). This analysis of self-management stresses the relationship between environmental stimuli and behavior and, therefore, still maintains the scientific assumptions of determinism. Skinner (1953) captured this point when he stated that self-control "is a proper object of analysis, and eventually it must be accounted for with variables lying outside the individual himself" (Skinner, 1953, pp. 228–229).

In his analysis of self-control, Skinner (1953) drew upon the same methods of control that are used in the control of someone else's behavior. The difference in self-control was that the individual manipulates the environmental variables of which their own behavior

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is a function. In discussing self-control, Skinner defined two important responses: (1) a controlling response that manipulates environmental variables that impact the likelihood of (2) a controlled response. In Cooper et al.'s (2007) definition of self-management, the controlling response is akin to the behavior change tactics and the controlled response is represented by the desired change in behavior. Each of these responses is ultimately controlled by the environment with the controlling response evoked by present conditions and a history of reinforcement, and the controlled response evoked by those stimuli that resulted from the controlling response.

Skinner (1953) identified nine methods of self-control. In one of these methods, the controlling response results in the addition of an aversive to the environment in order to increase behavior that results in the removal of the aversive stimulation. Examples of controlling responses that result in aversive stimulation include setting an alarm clock or writing items on a to-do list in which the loud sound of the alarm and the presence of incomplete items on the to-do list function as aversive stimuli, respectively. Engaging in the controlled response, turning off the alarm clock, and completing and checking off the item are negatively reinforced through the removal of these aversive stimuli. Another, changing the stimulus is a controlling response that either removes or adds a discriminative stimulus to the environment that may evoke a controlled response. Removing candy from your home to increase the likelihood of healthy eating or setting a reminder on your phone to increase the likelihood of attending an important meeting exemplify self-control resulting from changing the stimulus.

The changes in the environment that result from the controlling response are the variables of which the controlled response is a function. However, this provides little information about the function of the controlling response. The mechanisms responsible for the controlling response are less well understood, although many explanations have been suggested. Catania (1975) suggested that self-awareness is the underlying mechanism of self-management, whereas Hayes et al. (1985) suggested that public goal setting and the resulting social scrutiny may be the operative process. Newman et al. (1996) discussed the controlling response in terms of Skinner's (1953) conceptualization of conditioned aversive stimuli. When a stimulus is consistently paired with an aversive stimulus, then any behavior paired with that stimulus may in itself become a conditioned aversive stimulus. "Any behavior which reduces this conditioned aversive stimulation will be reinforced" (Skinner, 1953, p. 188). Take the example of an individual who has previously told others about their New Year's resolutions. If others have historically punished their lack of follow through on their plans, then engaging in a different behavior (e.g., eating ice cream) rather than their planned behavior (e.g., eating healthy foods) will become a conditioned aversive stimulus as a result of consistent pairing with the social punishment. Even if their newest New Year's resolution is not shared with others, the act of engaging in or even thinking about behavior that conflicts with their resolution (e.g., spending money) will be aversive. Engaging in the planned behavior (e.g., saving money) or behavior that evokes the planned behavior (e.g., setting up a direct deposit system) is negatively reinforced as they escape from the aversive condition of engaging in or thinking about the conflicting behavior. As such, self-management might be best explained as a negative reinforcement process (Newman et al., 1996).

30.1.2 Importance and Benefit of Self-Management

Epstein (1997) asserted that self-management aids in developing citizens who can be most productive and who engage in behavior most supportive of the long-term interests of the society. Relatedly, Lovitt (1973) discussed the need for educational systems to systematically instruct students in self-management skills to build independence and self-reliance. Skinner (1953) also discussed the purpose of education to be, most importantly, the acquisition of skills of self-control. While educational systems may be those held most responsible for teaching self-management skills, these skills have broad value to the community as a whole (Epstein, 1997). The extent to which such skills among citizens develop has a large impact on society broadly.

Newman et al. (1996) proposed that the term *self-control* be used for situations that involve selecting between the types of responses, discussed by Epstein, that conflict in terms of their long- and short-term consequences, whereas *self-management* should be used when referring more generally to the application of operant principles to one's own behavior. Mallott (2004) conceptualized self-management differently and asserted that it is more often concerned with competition between immediate consequences and cumulative consequences. For example, the immediate consequence of relaxing may be in competition with the cumulative consequence of losing weight that comes from repeated exercise. Through either conceptualization, there are clear benefits to society of selecting the long-term or cumulative reinforcers over the short-term or immediate reinforcers. Reinforcement in the form of warmth may lead an individual controlled by their immediate environment to turn up the thermostat, while the longer-term consequences on the environment may lead a self-manager to turn it down (Epstein, 1997).

There are also benefits of self-management to the individual. Individuals who exhibit a repertoire of self-control behavior are able to more independently transition across the lifespan, problem solve, and generalize and maintain skills across environments (Koegel & Koegel, 1990; Lee et al., 2007; Skinner, 1953). These individuals can access more opportunities for learning and reinforcement as a result of generalizing controlling responses that lead to further controlled responses. This generalized repertoire can increase independence across academic, social, and vocational settings. For example, learning to set and respond to an alarm clock allows greater opportunity for a student to access an educational setting. Increased opportunities for education may lead to improved employment skills and, in combination with the ability to generalize alarm setting to their new schedule to arrive to work on time, will increase their success in this new role. Self-management may be self-perpetuating in that it leads to further opportunities for reinforcement. Relatedly, it has been suggested that self-management empowers individuals and can improve self-determination and quality of life (Lee et al., 2007).

30.1.3 Concerns with Self-Management in Behavior Analysis

Despite the noted importance of self-control, concerns have been expressed about the term self-management in behavior analysis because of the potential use of such a term as an explanatory fiction, its potential to be considered antithetical to determinism, and long-standing debate about the efficacy of the concept of self-reinforcement (Epstein, 1997; Newman et al., 1997; Poppen, 2004). However, if self-management is used by behavior analysts in the way self-control was discussed by Skinner (1953), as the manipulation of variables that evoke further behavior, then the term can continue to be conceptually systematic and fit solidly into a scientific attitude of determinism. As Newman et al. (1997) stated, "It is not the term that is a threat to the rigor of the discipline, but its inappropriate usage" (p. 89).

The term self-reinforcement, in particular, has been the subject of many concerns within behavior analytic interpretations of self-management. These concerns have generally fallen into three categories: (1) the self or individual is not reinforced, (2) reinforcement is accessible to the individual at any time, and (3) self-reinforcement is an explanatory fiction indicative of many processes including self-monitoring and self-evaluation (Catania, 1975; Newman et al., 1996). As in the control of others' behavior, reinforcement increases the probability of similar behavior and should be discussed technically, regarding its effect on behavior rather than its effect on the individual. Consequently, while the term self-reinforcement seems to imply one is reinforcing them*self*, *self* would be better thought of as the location of the behavior that is reinforced (Newman et al., 1997; Poppen, 2004). It is true that in self-reinforcement the reinforcer is accessible to the individual at any time, yet the individual does not contact the reinforcer when it is not earned. This behavior of accessing the available stimulus only when the conditions are appropriate can be best explained by focusing on the mechanisms discussed previously that control the controlling response. If the individual has previously contacted punishment for cheating or lying, then that behavior will function as a conditioned aversive stimulus and escape from that aversive condition will negatively reinforce behavior that is incompatible with dishonesty. Finally, self-reinforcement does require other mediating responses including self-monitoring and self-evaluation, and, as such, may be more indicative of a repertoire of responses rather than as a single operant (Newman et al., 1997).

The issue of self-reinforcement is indicative of the larger challenge of determining the underlying mechanisms of self-management. In the clinical application of self-management, the use of treatment packages including multiple components of self-management is common. This furthers the difficulty of discerning the mechanisms of change and the effective and necessary components of self-management treatments.

30.2 Self-Management Interventions

As has been discussed here, the controlling response in self-management is controlled by the external environment and a history of reinforcement. In self-management interventions, clinicians, teachers, or caregivers manipulate environmental stimuli to teach the controlling response that the individual will use to manipulate the environment to control their own behavior (the controlled response). These methods of control can be broken down into various components, some or all of which may be part of an intervention package. Package components may include goal setting, self-monitoring, self-evaluation, self-reinforcement, and self-instruction (Carr et al., 2014; Cooper et al., 2007; Lee et al., 2007).

30.2.1 Goal Setting

Goal setting refers to selecting a performance standard to achieve in order to change behavior (Bandura, 1977). Goal setting is often used in conjunction with self-monitoring and self-evaluation. Individuals identify a performance standard (i.e., set a goal), track their own behavior (i.e., self-monitor), and then review whether they achieved the goal (i.e., self-evaluate). Fellner and Sulzer-Azaroff (1984) offered a behavior analytic conceptualization of goal setting. They described the setting of the goal as an antecedent stimulus, and the praise for meeting the goal as a reinforcing consequence. Once these are sufficiently paired (e.g., several instances of setting the goal, achieving the goal, and receiving praise), the goal itself becomes both a discriminative stimulus and a conditioned reinforcer. In addition to this contingency-shaped conceptualization, goal setting can also be viewed as rule-governed behavior, in which a verbal chain (rather than past experience) influences future performance (Skinner, 1974).

Goal setting is often incorporated as part of a self-management package. Kazdin (1974) found that providing a performance standard or goal augmented the reactive effects of self-monitoring, but that goal setting on its own (without self-monitoring) did not significantly change behavior. However, Locke and Latham (1990) posited that there is efficacy in goal setting as an intervention independent of other procedures. Despite these differing views on the conditions of effectiveness, goal setting has been shown to be associated with behavioral improvements in a broad range of areas including organizational behavior management (Pritchard & Curtis, 1973) and sports settings (Brobst & Ward, 2002).

Hughes et al. (2013) trained three typically developing high school peers to set a goal with respect to the number of interactions they would achieve with an identified peer with autism spectrum disorder (ASD). The typically developing peer was trained on topics that might be of interest to the peer with ASD, then was asked to set a goal with respect to the number of interactions they would have with their identified partner and to try to achieve their goal during a shared general education class. Initiations from the typical peers increased significantly, and the duration of interaction time between the peers and the participants with ASD was found to be consistent with the duration of interactions of other (typically developing) normative peer dyads observed. Importantly, social validity measures were also high. Typically developing partners indicated that they generally found their interactions enjoyable, and participants with ASD stated that they had a new friend and responded positively when asked about this relationship.

Goal Setting in Mrs. Simon's Class

Mrs. Simon wanted to increase the number of assignments her students completed during morning work in her third-grade classroom. On Monday morning, she asked each student to set a goal for the number of assignments they would complete by the end of morning work each day that week.

30.2.2 Self-Monitoring

Self-management interventions often rely on self-monitoring, which requires an individual to systematically observe their own behavior and respond to the occurrence or nonoccurrence of the specified target response (Cooper et al., 2007). Self-monitoring systems often include self-recording, which involves documenting occurrences or nonoccurrences of the target behavior as it occurs or after an identified interval (e.g., Harris 1986; Koegel & Koegel, 1990; Lloyd et al., 1989; Soares et al., 2009). Figure 30.1 shows two data sheets that could be used for self-monitoring and self-recording of on-task behavior in a classroom or other instructional setting. The self-monitoring systems associated with these data sheets might include the use of an auditory timer to cue an individual to self-record if they have been on-task throughout the interval (i.e., whole interval recording) or when the timer sounds (i.e., momentary time sampling).

Importantly, self-monitoring does not require that individuals evaluate their behavior or respond to their behavior beyond identification of occurrences and nonoccurrences. That is, the quality of responses emitted by the individual is not compared to a particular criterion. However, self-monitoring in isolation has been shown to be effective in increasing appropriate behavior. Holifield et al. (2010) evaluated the impact of a self-monitoring intervention on the on-task behavior and accuracy of work completion in two elementary school students with ASD. The students were provided a verbal cue to identify if they were on-task every 5 min during a 20 min work block in language arts and math classes and instructed to record a yes or no accordingly. When the intervention was implemented, increases above baseline were immediately observed in both on-task behavior and work accuracy across both subject areas. This exemplifies how the reactivity that often occurs with self-monitoring treatments can have clinically beneficial effects. That is, the act of assessing or measuring one's own behavior often results in responses that are in the direction of desired behavior change (Broden et al., 1971).

Self-monitoring interventions are frequently accompanied by preintervention training in which the individual is taught to accurately identify their own behavior (Carr et al., 2014; Koegel & Koegel, 1990; Mancina et al., 2000). In the above example, the participants were trained on accurate self-reporting during the first six sessions and data collected during the intervention showed 90% agreement between staff and participant evaluations of on-task behavior (Holifield et al., 2010). Initial training may include simple discrimination of the target behavior in videos or in the moment. Training may also include ongoing reinforcement provided for accuracy of self-monitoring. This additional component is sometimes referred to as self-evaluation and will be discussed further in the next section.

Interestingly, research has shown that even when individuals' self-recording is inaccurate, positive outcomes of self-monitoring are still observed (e.g., Koegel & Koegel, 1990; Newman et al., 1997). Koegel and Koegel (1990) used a self-management intervention to decrease the stereotypic behavior of four children with ASD

On-Task ☺	Off-Task ☹

At the end of each 5-minute interval, record a check if you are presently on-task and a minus if you are presently off-task (your behavior prior to the timer going off is not recorded).

Questions to ask myself:
- Do I know what the teacher just said?
- Am I looking at my work or the teacher?
- Am I working on the present task?

Class	5:00	10:00	15:00	20:00	25:00	30:00	35:00	40:00	45:00

Fig. 30.1 Self-monitoring data sheets for on-task behavior

and severe intellectual disability across clinical and community settings. In the preintervention condition, the participants were trained to check a box when stereotypic behavior was absent during the interval. During the self-monitoring intervention, the participants' accuracy of self-monitoring ranged from 18% to 98% across sessions. Despite inaccuracies in self-recording, marked decreases in stereotypic behavior were observed in trained settings across all participants, including when the number of boxes and length of intervals was increased.

Self-Monitoring in Mrs. Simon's Class

During the week in which goal setting was implemented, Mrs. Simon noted that a few students increased the number of assignments that they completed. However, most students did not show an improvement. Therefore, during the next week, Mrs. Simon placed a post-it note on each student's desk at the start of morning work every day. The students were instructed to record a tally mark on their post-it when they completed an assignment.

30.2.3 Self-Evaluation

Self-evaluation or self-assessment involves monitoring one's own behavior and making accurate judgments about the appropriateness of that behavior. Self-evaluation typically involves self-recording and comparing the results to another observer's record. Within a self-management context, individuals are generally taught to (1) assess their own behavior and (2) "match" their assessment with those of a teacher or clinician. Frequently, the individual is then rewarded contingent on either the accuracy of their assessment or the quality of their performance on the task (Sainato et al., 1990). For example, in an interval-based self-monitoring system, a clinician and student might compare their data sheets to check for correspondence following every interval initially. A data sheet that could be used at this stage is shown in Fig. 30.2. Errors would be corrected and reinforcement provided for matching responses. Over time, the schedule of checks on accuracy would be faded from continuous to intermittent in order to increase the student's independence with the self-monitoring system. Eventually, the reinforcement contingency would be shifted to engagement in the desired behavior only.

Sainato et al. (1990) evaluated the effect of a self-evaluation treatment package on the appropriate classroom work behavior (i.e., on-task and waiting) of preschoolers with disabilities. The treatment package included self-assessment, match with teacher, and reinforcement. First, the children were taught to indicate whether they had engaged in a specified target behavior by marking either a smiling or frowning face next to a picture of the behavior following completion of a task. Next, students reviewed their self-assessment with the teacher individually and were praised for both appropriate behavior and accuracy of self-assessment (i.e., matching with the teacher). Finally, students received a small toy contingent on matching with the teacher. This study included a component analysis that was conducted by systematically withdrawing each component (i.e., reinforcement, matching with teacher). All four participants maintained high levels of appropriate behavior (on-task, waiting) with only the self-assessment component in place.

A second use of the term self-evaluation involves an individual assessing the extent to which their engagement in the target behavior meets a specified standard. This relates to goal setting as an individual may set a goal to attain, and then evaluate their own behavior in relation to this goal. This type of self-evaluation may also involve comparisons to other-determined goals. Two responses are required for this type of self-evaluation: (1) the individual must recognize when certain behavior has been emitted (i.e., self-monitor) and (2) determine whether their behavior meets a standard (King-Sears, 1999). Self-evaluation involving comparison of a response to a standard has been shown to be associated with increases in appropriate behavior (e.g., Sainato et al., 1990) and decreases in disruptive behavior (e.g., Koegel et al., 1992).

Period	**Complete Work**		**Stay in Seat**		**Kind Words & Actions**	
	Student	*Staff*	*Student*	*Staff*	*Student*	*Staff*
Period 1	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
Period 2	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
Period 3	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
Period 4	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
Total						

Fig. 30.2 Self-monitoring data sheet including self-evaluation

In an example of self-evaluation toward a preset criterion, King-Sears (1999) taught a 7-year-old child with multiple disabilities to independently transition across settings in her elementary school. The intervention included self-monitoring (i.e., checking off a smiley face for each step of the routine she completed appropriately), self-evaluation (i.e., determining if she met the criterion of all three checks), and self-reinforcement (i.e., accessing a reward if she met the expected criterion). The intervention was effective in increasing the number of steps completed independently during two trained transitions and generalization effects were observed across a third transition.

Self-Evaluation in Mrs. Simon's Class

While some students were observed to regularly record their completed assignments when provided with the post-it notes and instructions, Mrs. Simon noted that other students were not recording tallies on their post-it notes. In addition, increases in assignment completion were observed in only a subset of the class. Mrs. Simon decided to make two changes to her plan to incorporate self-evaluation. First, Mrs. Simon taught her students to graph the number of assignments completed each day. Mrs. Simon also graphed the number of assignments handed in by each student each day and compared her graph to the students' graphs. She provided feedback to the students on the accuracy of their self-recording. Second, Mrs. Simon had the students draw a yellow line on their graph each morning to indicate their goal for the day. At the end of morning work, Mrs. Simon reminded the students to check if they met their daily goal.

30.2.4 Self-Reinforcement

Self-reinforcement involves an individual selecting and/or accessing desirable consequences after observing that a previously established criterion for the target behavior has been met (Goldiamond, 1976). Self-reinforcement requires a repertoire of underlying skills including self-monitoring and self-evaluation. An individual must first monitor their own behavior (e.g., tally each completed math problem), then evaluate if their behavior met an expected criterion (e.g., compare these tallies to the expectation of 10 problems), and then provide oneself the reinforcer only if the behavior was equal to or above the criterion (e.g., 12 problems were completed). The use of self-reinforcement techniques has resulted in decreased challenging behavior (e.g., Newman et al., 1997) and increased appropriate behavior (e.g., Newman et al., 1995; Shogren et al., 2011).

Using self-reinforcement, Koegel et al. (1992) demonstrated extended improvement in the social interactions of four children with ASD. The social improvements observed were associated with reductions in disruptive behavior such as self-injury, tantrums, spinning, and yelling. The participants ranged from 6 to 11 years old and had been described as characteristically unresponsive to others' social initiations. To promote responsiveness to others' initiations, the participants were first taught to discriminate between a correct and incorrect response. They were then taught to self-monitor correct responses, which were continually reinforced initially and then reinforced on a thinned schedule. Eventually, the children were taught to self-reinforce by accessing the reinforcer on their own (i.e., it was not delivered by the adult). The self-management procedure was effective in improving sustained responding to questions as well as decreasing disruptive behavior, which importantly supports the use of self-management procedures in cases where challenging behavior may interfere with social opportunities and where independence from adult support is desirable.

Similar to self-monitoring, accuracy of self-reinforcement has not been observed to be a necessary condition for the effectiveness of self-management interventions. Newman et al.

(1997) taught three children with ASD and mild to moderate intellectual disability to implement a differential reinforcement of other behavior (DRO) procedure to decrease their inappropriate behavior including out-of-seat and nail-flicking. For all participants, decreases in the target behavior were observed at the outset of adult-provided contingent reinforcement and were observed to maintain in the presence of prompted self-management, unprompted self-management, and a follow-up phase. During self-management, all participants were taught to provide themselves a token for each interval in which they did not engage in the target behavior. In both the unprompted self-management and follow-up phase, data were collected on participant accuracy with self-reinforcement. One participant took approximately 50% of the tokens he had earned, another was observed to frequently take tokens prior to the timer going off, whereas the third participant showed a greater degree of accuracy. Despite this variability, all participants maintained substantial decreases in target behavior in the unprompted self-management and follow-up phases.

Self-Reinforcement in Mrs. Simon's Class

After adding in self-evaluation, Mrs. Simon observed a substantial increase in completed assignments during morning work. However, a few students were still handing in only one completed assignment. Mrs. Simon decided to add a self-reinforcement component to her plan to see if she could increase task completion for those last few students. Mrs. Simon placed an empty jar at the front of the room. She informed the students that when they filled the jar with marbles, they could choose a class prize (e.g., bring a stuffed animal to class day, watch a movie at lunch). The students were told to put a marble in the jar at the end of morning work if they met their daily goal.

30.2.5 Self-Instruction

Like other forms of self-management, self-instruction involves a controlling response that manipulates the environment to increase the likelihood of a controlled response (Cooper et al., 2007; Skinner, 1953). In the context of self-instruction, the controlling response is often overt or covert verbal behavior that serves as a prompt or additional discriminative stimulus to engage in the controlled response (Cooper et al., 2007; Skinner, 1953). Self-instruction may also involve controlling responses that increase access to materials that alter the probability of the controlled response, such as opening and observing an online video that provides instructions on how to complete a task. Further self-instruction may ensue following access to materials, such as overtly or covertly repeating the instructions from the video, which increases the likelihood of recalling the steps delineated in the video (Epstein, 1997; Skinner, 1953). Humans are generally better at recalling rather than remembering, which is why self-instruction is observed to be an effective self-management technique (Epstein, 1997). Here, recalling refers to behavior evoked by a discriminative stimulus and supplementary stimuli that the individual provides to themselves in the form of a self-probe (e.g., When trying to recall the next step in a sequence, the individual may covertly state, "The second step is"; Skinner, 1953). Whereas, remembering is behavior evoked by a discriminative stimulus and private stimuli that already exist in strength and require no supplementary stimulation (Skinner, 1953).

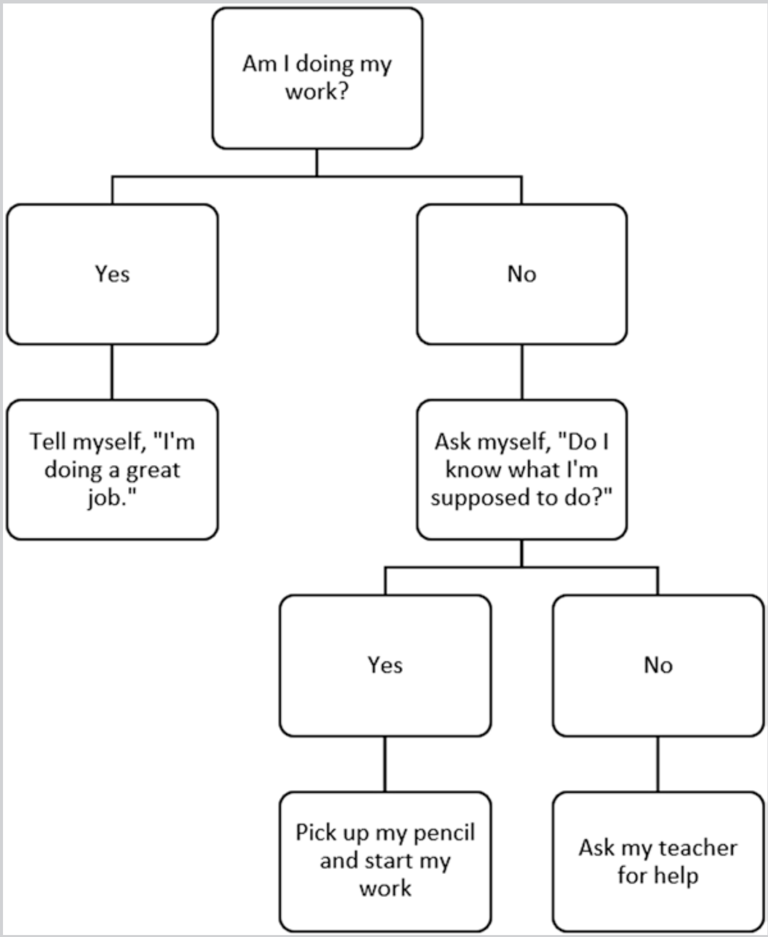
Hughes et al. (1995) used self-instruction combined with multiple exemplar training (MET) to improve the conversational skills of four individuals with moderate intellectual disabilities, including one with a comorbid ASD diagnosis. The self-instruction strategy, which was based on the steps outlined by Meichenbaum and Goodman (1971), included (1) stating the problem (e.g., "I want to talk"), (2) stating the solution (e.g., "I need to look and talk"), (3) evaluating the steps taken (e.g., "I did it, I talked"), and (4) self-praise (e.g., "I did a good job"). The self-management intervention was trained by typically developing peers in a high school setting. Across the conversational skills targeted (e.g., initiation of conversations, eye gaze toward conversational partners), all four participants showed increases to levels consistent with typically developing peers. In addition, all participants generalized these skills to conversations with novel conversational partners with and without disabilities, generalized skills to novel settings, and maintained most skills at the range of expected behavior in a follow-up 9–11 months later (for the two participants who continued to attend the school).

In a study involving access to additional stimuli as part of self-instruction, Smith et al. (2015) taught three adolescents with ASD to use instructional videos on a mobile device to teach themselves to complete unknown tasks. Then a novel task was presented to evaluate their ability to independently self-instruct. When the materials for the task and the mobile device were made accessible, two of the three participants used the device independently, whereas the third participant required verbal prompting to use the mobile device to self-instruct. While the use of materials beyond the individual (i.e., instructional videos) may be seen as a limitation in this study, access to technology is commonly used as a method of self-instruction in our society (Smith et al., 2015). Frequently, when the steps to a task are unknown, people use the internet to access information that will allow them to self-instruct (Lopez & Wiskow, 2020; Smith et al., 2015). Consequently, teaching this problem-solving repertoire as part of a self-management strategy for individuals with ASD can be described as a pivotal behavior (Smith et al., 2015).

Palmer (1991) described problem solving as the condition in which "the required response is part of the repertoire of the individual but is not directly controlled by the nominal discriminative stimulus, the individual must engage in precurrent behavior providing himself with supplementary discriminative stimuli until the combined effect of the nominal and the supplementary stimuli are enough to occasion the target response" (p. 271). When behavior has not been previously conditioned to occur in the presence of a discriminative stimulus, self-instruction has been used as a problem-solving strategy to supply the needed supplementary stimuli. In this context, self-instruction has been shown to generalize across problem situations in the context of vocational activities (Hughes et al., 1996). Self-management interventions targeting problem-solving could have broad implications in terms of generalizability across a variety of problem scenarios and domains. In a series of experiments, Hughes and colleagues (Hughes et al., 1995, 1996) found that the inclusion of MET with self-instructional strategies improved maintenance and generalization of skills within social and vocational domains. Further research evaluating the generalizability of self-instruction problem-solving repertoires across domains could be beneficial in identifying far-reaching strategies. Table 30.1 provides a summary of the self-management procedures discussed, including definitions and examples of each.

Self-Instruction in Mrs. Simon's Class

Following the addition of self-reinforcement, Mrs. Simon observed an increase in assignment completion across all but two students in her class. Mrs. Simon decided to implement a self-instruction intervention for these two students. First, she placed the visual below on their desks. Then, Mrs. Simon reviewed the visual with the students and modeled its use.



30.3 Self-Management and Autism Spectrum Disorder

An advantage of self-management, which may be particularly important for individuals with ASD, is that this repertoire increases the likelihood that an individual will engage in appropriate behavior in the absence of prompting or support from others (Koegel et al., 1992; Newman et al., 1995; Stahmer & Schreibman, 1992). Prompting is a common and evidence-based procedure for teaching skills (Cooper et al., 2007), and it is commonly used to teach children with ASD (Wilson et al., 2014). Although prompts can be effective while teaching, individuals with ASD may become dependent on prompts, particularly if the prompts are not systematically faded

Table 30.1 Definitions and examples of the components of self-management

Term	Definition	Example
Goal setting	Selecting a performance standard to achieve, in order to change behavior	A student you work with is having difficulty staying seated during work sessions. He sets the following goal, "during work time, I will sit for 5 minutes."
Self-monitoring	Systematically observing one's own behavior and responding to the occurrence or nonoccurrence of the specified target response	Your student is continuing to have difficulty staying seated independently, you give him a timer to record how long he sits for during the work session.
Self-evaluation	Monitoring one's own behavior and making accurate judgments about the appropriateness of that behavior	To continue to increase the duration of sitting, you provide the student with a length of time to match his timer to (e.g., 6:00). The student runs the timer up, and when it matches the time written, he is asked to identify that he met his goal.
Self-reinforcement	Selecting and/or accessing desirable consequences after observing that a previously established criterion for the target behavior has been met	Your student has increased his time sitting to 10 min and now you want him to be able to access his own reward. You have the student determine if he met his criteria, and then take out a preferred activity.
Self-instruction	Engaging in a controlling response that manipulates the environment to increase the likelihood of a controlled response	The time required to sit has increased, and you find that your student is frequently getting out of his seat again. You provide him with a flowchart on his desk: 1. Do I need something? 2. Yes, I can ask for what I need 3. No, I need to stay in my seat 4. I can get up when my timer matches my goal

(Bryan & Gast, 2000). This tendency to respond to the teaching prompts rather than naturally occurring environmental cues makes it especially critical to plan for independence and self-management for individuals with ASD. Sustained attention and independence with academic tasks, daily living routines, and social interactions can promote autonomous and self-driven lifestyles and reduce reliance on caregivers and staff. Self-management strategies have been used widely as a method to promote independence and decrease dependence on treatment providers (Stahmer & Schreibman, 1992).

Systematic reviews and meta-analyses on the use of self-management techniques with individuals with ASD have shown that self-management is an effective intervention for this population (e.g., Carr et al., 2014; Lee et al., 2007). Lee et al. (2007) identified 11 articles published between 1992 and 2001 that evaluated the use of self-management interventions to improve the appropriate behavior of individuals with ASD. The authors analyzed trends across the studies and found that 64% of the studies used self-management packages that included prompts, self-monitoring, and self-reinforcement procedures, 64% of the studies provided pretraining and discrimination training prior to the self-management intervention, and 73% of the studies targeted only increases in appropriate behavior. A meta-analysis using the percentage of nonoverlapping data (PND) in baseline and intervention showed that 81.9% of data points did not overlap, displaying that self-management is an effective treatment (Lee et al., 2007; Scruggs & Mastropieri, 1998).

Southall and Gast (2011) compared self-management interventions across two groups of individuals with ASD: individuals diagnosed with autistic disorder (AD) and individuals diagnosed with high-functioning autism (HFA) or Asperger's syndrome (AS). The authors identified 16 studies between 1994 and 2008 that used a single-subject design to evaluate the effectiveness of a self-management intervention for an individual with AD, HFA, or AS. Interventions used for both groups were similar and most commonly consisted of self-monitoring, self-recording, and self-reinforcement. While token economies were used more frequently with the AD group and contracting was used only with the HFA/AS group, other intervention components including peer training, pictures, and videos were used across groups. Despite these differences, Southall and Gast found that self-management interventions were effective for individuals with AD and HFA/AS with all participants showing an increase in targeted skills. Social validity measures across studies also indicated that the interventions were perceived by parents, teachers, and peers as effective and easy to implement.

As the previous mentioned reviews did not screen studies based on quality, in their 2014 meta-analysis, Carr and colleagues only included self-management research for individuals with ASD that met the quality standards outlined by the What Works Clearinghouse (WWC). The authors identified 23 articles published in peer-reviewed journals between 1992 and 2008. The mean PND score of all participant and experimental data was 84.3%, which indicates that self-management can be considered an effective treatment for increasing appropriate behavior for individuals with ASD. The authors calculated mean PND scores across a number of variables including functioning level, target behavior, and setting and found all but one PND score to be in either the effective or highly effective range. Preschool-aged children were the only group that did not meet this criterion. This group's PND averaged 68.4%, below the 70% criteria to be considered effective, which the authors asserted may have been a result of the experimental procedures in one of the two studies that targeted this population. Finally, Carr and colleagues evaluated the findings in reference to established parameters for synthesizing single-subject literature to determine if an intervention is empirically supported. Both the WWC and Kratochwill et al. (2013) recommended the following standards: (1) five single-subject design papers published in a peer-reviewed journal and meeting quality assessment standards, (2) studies are conducted across three separate teams in three different geographic locations, and (3) the studies include a minimum of 20 total participants. According to these criteria, self-management interventions for individuals with ASD exceed the standards required and can, therefore, be considered an effective treatment for individuals with ASD between the ages of 3 and 20 years old (Carr et al., 2014).

30.4 Uses of Self-Management for Individuals with Autism Spectrum Disorder

For all individuals, self-management may be conceptualized as a pivotal skill. This is because learning to self-manage one's own behavior facilitates opportunities to engage across environments, with various people, and independent from a support provider (Koegel & Koegel, 1990; Koegel et al., 1999). Opportunities afforded may be social, academic, or adaptive.

30.4.1 Social Skills

Access to social opportunities may be preceded by certain foundational or prerequisite skills coming together. Vernon (2017) noted that "as social motivation, language sophistication, and cognitive development converge, the stage is set for self-monitoring social exchanges. This is the developmental precipice of a third pivotal area of development—the area of self-monitoring, management, and regulation" (p. 193). As a pivotal area of development, self-managing one's own social behavior can be a critical skill in moving toward independent and effective social engagement, including the development of friendships and other relationships. Self-monitoring and self-assessment are skills that typically developing individuals often engage in as a way to modify their behavior in response to social feedback. As individuals on the autism spectrum often experience challenges with understanding and engaging in typical social behavior, developing independence with navigating social situations is of critical importance.

Importantly, self-management affords a level of independence for the training and generalization of social skills that other interventions may not and is therefore a viable intervention for promoting independence for individuals with ASD (Stahmer & Schreibman, 1992). That is, self-management allows the individual to monitor and adjust their own responses in the absence of a practitioner's immediate involvement. Self-management in academic and community settings is particularly important for this reason as social interactions may be hindered by clinician prompting (Koegel et al., 1992). Self-management procedures have also been used to increase social interactions of typical students and their peers with ASD, which aligns with the movement away from adult facilitation. As discussed previously, Hughes et al. (2013) implemented a treatment package involving goal setting and self-monitoring to increase the social interactions between high school students with ASD and their typically developing peers. Social skills and play continue to be areas of significant interest in ASD research and practice. Self-management interventions have been used to teach a variety of social skills, including responsiveness to social initiations (Koegel et al., 1992), appropriate play (Stahmer & Schreibman, 1992), appropriate social communication (Koegel & Frea, 1993), conversation skills (Koegel et al., 2014), and compliment-giving (Apple et al., 2005).

Stahmer and Schreibman (1992) taught three children with ASD to appropriately play with toys in the absence of a treatment provider, which represented an important extension of the existing self-management literature. Specifically, the researchers demonstrated the effectiveness of self-management as a procedure to promote generalization of taught skills in the absence of both treatment providers and self-management materials. This suggests that appropriate play may have been under the control of the individuals' own behavior rather than the materials or trainer. The children maintained appropriate play 1 month later during a maintenance follow-up. Additionally, self-stimulatory behavior (e.g., flapping, spinning) decreased following implementation of the self-management intervention.

Appropriate and varied play skills are particularly important targets for individuals with ASD since children with ASD characteristically engage in repetitive, restricted, or inappropriate play that limits their opportunities to engage in more typical play with their peers (American Psychiatric Association, 2013). By teaching children with ASD to self-manage their own appropriate play responses, they may be more likely to be invited to social groups and maintain social interactions over time. These opportunities are ultimately critical to promoting friendships. Newman et al. (2000) taught three individuals with ASD to vary their play and other social responses using a self-management intervention. The participants were taught first to self-monitor their variations in responding, and then self-reinforce (i.e., take a token contingent on varying their response in relation to previous responses in that session). Participants were taught to vary their responding in imaginative play activities, verbal responding to social questions, and drawing/coloring activities. Variation in social skills may facilitate opportunities for more positive social interactions and friendships, and ultimately lead to a larger repertoire of leisure activities.

In addition to play skills, prosocial behavior can be targeted with the use of self-management techniques. One prosocial behavior, compliment-giving, can facilitate relationships with greater social reciprocity (Attwood, 1998). Apple et al. (2005) demonstrated an increase in compliment-giving for three preschoolers using a video model and self-management treatment package. The children were shown videos of peers engaging in both “initiations” (i.e., compliments given in the absence of a peer approaching such as, “I like your picture!”) as well as “responses” (i.e., compliments given as a response to a peer’s initiation of, “Look!”). Video modeling improved participants’ engagement in compliment initiations and responses, and the self-management component allowed the preschoolers to independently monitor and maintain their compliment-giving. Two of the three participants generalized compliment-giving across settings, and both parents and teachers reported improved scores in general social skills as compared to pre-study ratings. Parent reports also indicated that the participants generalized their compliment-giving in the absence of self-management materials (i.e., wrist counter or paper checklist), suggesting that this type of intervention may have validity and utility outside of the preschool setting.

Self-management of social skills may lead to increased opportunities for social engagement and improved quality of social relationships. Various studies discussed here reported social validity measures that demonstrated improvement in the quality of social interactions. For example, Koegel et al. (2014) noted that naive observers reported meaningful improvements in participants’ conversational skills across interest, naturalness, and desirability as a conversational partner following self-management intervention.

30.4.2 Academic Skills

Self-management interventions have been used to increase a variety of academic and related skills including writing (Asaro-Saddler & Saddler, 2010; Delano, 2007), following directions (Agran et al., 2005), on-task behavior (Harris, 1986), classroom behavior (Shogren et al., 2011), and independent work skills (Sainato et al., 1990). Additionally, self-management procedures targeted at improving academic responding have resulted in consequent reductions of disruptive behavior (e.g., Koegel et al., 1992; Soares et al., 2009). Educational agencies have often been tasked with teaching self-management skills (Lovitt, 1973; Skinner, 1953); however, it is also evident that self-management is primary to students’ success in educational systems, where students are expected to maintain appropriate and on-task behavior in both structured (e.g., classroom) and unstructured (e.g., cafeteria, recess) settings.

Delano (2007) evaluated the use of the self-regulated strategy development model (SRSD) to improve essay writing for three adolescents diagnosed with Asperger’s syndrome. SRSD, which had been previously shown to be effective for students with learning disabilities, is a combined package using self-video modeling to instruct students on self-management strategies including goal setting, self-monitoring, and self-evaluation. The intervention was effective in increasing the number of words written, the number of functional essay elements included (e.g., premises, reasons, conclusion), and the duration of writing time for the trained skill of writing a persuasive essay. Increased number of words written was observed to generalize to the writing of an expository essay and to maintain in follow-up essays 1 week and 3 months later.

Asaro-Saddler and Saddler (2010) also used SRSD to improve the writing abilities of individuals with ASD. The researchers used a scaffolded set of six lessons to teach three elementary-school children to use goal setting, self-monitoring, self-evaluation, and self-instruction to increase the number of story elements and words in their fictional stories and to improve holistic story quality (as measured on an eight-point scale). PND was analyzed and the treatment was observed to be very effective across all dependent measures. Notably, participants were observed to overtly use self-management strategies including writing bullets for the number of story elements required and crossing them out as they included them and stating self-instruction and self-prompts aloud (e.g., “I know I can do this.”). On a social validity measure, participants all indicated that they believed the strategies made them better writers.

In addition to academic skills, classroom behavior is an important target for individuals with ASD. Increased independence and appropriate behavior can lead to increased academic opportunities because of the decreased potential for interruption to classroom activities as a result of disruptive behavior or prompting from support staff. Self-management in inclusive classroom settings can consequently promote increased opportunities for students to engage both with peers and with academic content.

Shogren et al. (2011) compared the effectiveness of a token economy and self-management intervention for two kindergarten students with ASD in an inclusive classroom setting. During baseline, the two participants did not consistently engage in the classroom rules: stay in your space, keep your hands to yourself, and do what the teacher says. These deficits were reported to interfere with the students' focus on classroom activities and task instructions. The children were first taught to discriminate between examples and nonexamples of each rule, and then a token economy managed by the teacher was introduced. During the self-management phase, the same token board was utilized, but the students were taught to report on their own rule following behavior during three classroom activities. The students showed a high level of accuracy in recording their own behavior, and both the token economy and self-management interventions led to improvements in classroom behavior. Although the rates of behavior change were comparable in both treatment conditions, the classroom teacher reported a preference for the self-management procedure. The teacher adopted, maintained, and expanded the self-management intervention into a class-wide system following the completion of the study. The high social validity of this intervention has implications for the implementation of self-management strategies that can improve access to learning in classroom settings.

Restricted and repetitive behavior associated with ASD can interfere with a student's attention to academic tasks, and as such on-task behavior is a common concern for individuals with ASD. There has been debate about the relative value of self-management interventions designed to directly target on-task behavior versus those designed to target academic productivity (Harris, 1986). In an initial experimental evaluation, Harris (1986) compared self-monitoring of on-task behavior and academic productivity for four children with learning disabilities during spelling practice. All participants were taught to record if they were on-task when a timer sounded and to record the number of spelling words they wrote during the session. While consistent increases were observed in on-task behavior under both interventions, during the academic productivity phase, one participant consistently wrote a greater number of words and two others showed variable increased words written compared to the on-task phase. When provided a choice of intervention following the study, three of the students chose academic productivity (although one later switched to on-task), and the final participant chose to run a combined approach. Social validity data showed that all participants and the teacher approved of both interventions.

In an effort to control for the limitations of Harris (1986; e.g., differences between the intervention formats with self-recording of productivity only including a graphical representation), Lloyd et al. (1989) also compared self-management interventions targeting on-task behavior and academic productivity. Lloyd et al. found that all five students with learning and/or emotional disabilities displayed increased completion of math work and on-task behavior as a result of both interventions. Unlike the previous study, the students displayed a preference for the on-task self-management intervention. The students stated that the academic productivity intervention was confusing, indicating that these selections may have been reflective of the increased complexity of this procedure resulting from efforts to make it more consistent with the on-task intervention (Lloyd et al., 1989). Another possibility suggested by the authors was that the graphical representation of academic productivity in Harris' study may have functioned as a reinforcer. Further evaluation of this potential effect of self-graphing is merited.

While Harris' (1986) findings displayed that self-management of productivity was marginally more effective and preferred, Lloyd et al. (1989) found no difference between the two self-management interventions and, converse to Harris, observed a preference for the on-task self-management intervention. As such, it can be inferred that both intervention types are useful for improving academic performance and on-task behavior of individuals with disabilities. Notably, this line of research has focused on individuals with disabilities other than ASD, and empirical evaluation of this effect with an ASD population is needed to determine if similar findings would be observed. Further research could also evaluate additional variables, such as self-monitoring format, that may impact student preference and effectiveness of self-management interventions.

30.4.3 Independent Living and Vocational Skills

Self-management interventions to increase independent and adaptive skills for individuals with ASD have also been shown to be effective (Newman et al., 1995; Pierce & Schreibman, 1994), though the empirical basis for these targets is less extensive than for social or academic skills. Task engagement in vocational and independent living skills is paramount to improving successful employment and other community opportunities for individuals with ASD, as reliance on parents and service agencies is common across the lifespan (Howlin et al., 2004).

While there is less research on the use of self-management interventions for the improvement of daily living skills for individuals with ASD specifically, there is ample evidence to suggest that self-management strategies have been effective in this domain across individuals with developmental disabilities (e.g., Carr et al., 2014; Harchik et al., 1992; Pierce & Schreibman, 1994). Harchik et al. (1992) reviewed nearly 60 studies that used self-management procedures to address a variety of skills for individuals with developmental disabilities. Participants were taught to use self-management strategies to increase on-task behavior (e.g., Hughes & Petersen, 1989; Sugai & Rowe, 1984), as well as pre-vocational tasks such as packaging, boxing, and assembly tasks (e.g., Mace et al., 1986; Zohn & Bornstein, 1980). Although most participants included in this review were diagnosed with developmental disabilities, some were identified as having ASD (e.g., Koegel & Koegel, 1990; Sainato et al., 1990). Given that self-management procedures have been shown to be effective in addressing a wide range of skills for individuals with developmental disabilities, these procedures should be considered for use across these same domains for individuals with ASD.

In one study that evaluated the use of a self-management intervention for teaching individuals with ASD independent living skills, Newman et al. (1995) implemented a self-management package with three adolescents and found that their accurate verbal identification of transition times (as indicated by a schedule and timer) increased following training. Students were taught to use tokens to self-reinforce their accurate statements that it was time for a transition. Consistent with this example of schedule-following, self-management procedures have been shown to be successful in increasing performance of other important independent and daily living skills (Lovett & Haring, 1989).

Pierce and Schreibman (1994) evaluated the use of a self-management package on daily living skills in three individuals with ASD between 6 and 9 years old. The treatment package included pictorial task analyses as prompts, self-selection of reinforcers, and self-reinforcement. All three participants mastered their three individualized target routines, which included tasks such as setting the table, getting dressed, and doing laundry. This study extended the previous literature by evaluating the efficacy of self-management interventions in young children with ASD and moderate to severe intellectual disabilities and by evaluating student completion of daily living skills in the absence of supervision. In other words, individuals were asked to engage in self-selection of reinforcement, self-prompting, and self-reinforcement without a parent or researcher present. The ability to generalize skill completion to these conditions illustrates the value of self-monitoring interventions in increasing the generalizability of skills, increasing independence, and decreasing the need for adult support. Finally, Pierce and Schreibman analyzed the training time required for each skill and found that for each participant, the time required to teach the self-management skills decreased progressively across the skills taught. This provides further support for self-management as a tool that could both improve student performance of daily living skills and decrease the long-term response effort of families and teachers.

30.4.4 Decreasing Challenging Behavior

While decreasing challenging behavior in individuals with ASD has often not been the primary target of research on self-management interventions, many researchers have evaluated decreases in challenging behavior as a secondary measure (e.g., Koegel et al., 1992; Soares et al., 2009; Stahmer & Schreibman, 1992). For example, when using self-management to increase academic task completion, off-task behavior has been observed to simultaneously decrease (Harris, 1986; Lloyd et al., 1989). In a study with one individual with ASD, Soares et al. (2009) increased academic task completion through implementation of a self-monitoring package and observed simultaneous decreases in tantrums and self-injury when the intervention was applied and increases in these challenging behaviors when the intervention was removed. As discussed previously, improvements in challenging behavior have also been observed when self-management interventions are targeted at improving social skills (e.g., Stahmer & Schreibman, 1992).

Some studies have more directly addressed the use of self-management interventions to decrease challenging behavior for individuals with ASD. Mancina et al. (2000) implemented a self-management package including self-monitoring, self-evaluation, and self-reinforcement with a 12-year-old girl diagnosed with ASD and a moderate intellectual disability to decrease vocalizations (i.e., humming, tongue clicking, echolalia) that were interfering with her participation in her public school setting. The intervention was effective in decreasing vocalizations and both the length of the interval and the criteria required for reinforcement were able to be increased during training sessions with the special education teacher. However, intervals were only able to be lengthened to a period of 40 s and, despite the student not achieving full independence with the self-management procedures, the training time was significant. The special education teacher indicated the student was quieter and had more appropriate behavior when the self-management intervention was in place, indicating that despite these limitations the intervention was still considered to be socially valid. Like Mancina et al., Singh et al. (2011) found that while a self-management intervention using mindfulness strategies was effective for decreasing the aggressive behavior of three boys with ASD in their home settings, the training time required for the intervention and the time required to achieve notable results were lengthy (i.e., 23–30 weeks before the participants met the criteria of zero incidents for 4 weeks).

Unlike the previous interventions discussed, Coyle and Cole (2004) observed rapid and consistent results across participants when an intervention package including self-monitoring, self-reinforcement, and self-video modeling was implemented to decrease the off-task behavior of three children with ASD. The intervention included video observations of their own on-task behavior, self-monitoring using a timer and visual check sheet, and self-reinforcement when criteria were met. Off-task behavior was shown to vary consistently with the implementation and withdrawal of the intervention including in a follow-up 2 weeks later. In addition, for one participant, an increased interval length of 1 min showed more substantial decreases in off-task behavior. The ability to successfully increase interval length within self-management systems is promising for generalization of interventions across settings and activities. Lengthier intervals are less intrusive and cause less disruption to activities, making procedures more feasible for use in settings, such as general education classrooms and work sites. However, as this was observed with only one participant, further evaluation of this effect is needed to determine the potential for increasing interval lengths in self-management systems targeting decreases in challenging behavior.

30.5 Future Research in Self-Management

The effectiveness of self-management packages has been attributed to many variables. As with self-management broadly, the mechanisms underlying self-management interventions are not well understood or agreed upon (Stahmer & Schreibman, 1992). One possible mechanism is that the individual becomes a stimulus associated with the controlling and controlled responses removing the need for behavior change agents, such as parents and therapists, to evoke the target behavior. Understanding those mechanisms that underlie self-management interventions may allow researchers and practitioners to increase the effectiveness and efficiency through which self-management interventions are used. If the mechanisms were better understood, then self-management interventions that most efficiently allow individuals to access the necessary contingencies could be developed.

There is a particular need for research that elucidates the contingencies that lead to the effectiveness of self-monitoring and self-reinforcement procedures in the absence of accuracy. Koegel and Koegel (1990) provided some potential mechanisms that may have led to the effectiveness of self-monitoring interventions in the absence of accuracy in their study, including reactivity to self-recording and inadvertent reinforcement of appropriate behavior instead of self-management behavior. The authors noted that the students' errors were most commonly in recording the presence of stereotypic behavior rather than the absence; as such, it is possible that the recording of the absence of stereotypic behavior was the controlling variable. Further studies should evaluate these potential explanations of the effectiveness of self-management systems in the absence of accurate performance of self-recording, self-evaluation, and self-reinforcement.

Similarly, there is a need to evaluate the separate components of self-management programs to identify which are effective and necessary (Carr et al., 2014; Southall & Gast, 2011). As Stahmer and Schreibman (1992) indicated, the "problem of separating self-management from other factors of treatment plagues the self-management literature" (p. 457). Future research should include component analyses to identify which self-management techniques are most efficient and effective and which provide little value or only repetitious effects. Of particular focus should be less utilized components of self-management, including goal setting (Carr et al., 2014). Identification of effective components could have a significant impact on clinical practice as self-management packages may be able to be narrowed in scope. Narrowing the components of self-management packages could make these interventions more attractive to teachers and caregivers who may presently perceive these interventions as requiring significant response effort due to the multifaceted nature of these intervention packages.

Further, a deficiency of procedural integrity data in the research evaluating self-management interventions makes it challenging to ascertain which components are effective in both the training of students to implement these systems and in the systems themselves (Southall & Gast, 2011). Future research should attend to the accuracy of implementation of self-management techniques by participants as well as the accuracy of implementation of training procedures by instructors. This research could lead to more robust findings about best-practice models for training stakeholders (e.g., parents, teachers, peers) to teach individuals with ASD to self-manage their behavior and evidence-based training methods for those stakeholders to use when training individuals with ASD to implement self-management techniques. While the role of peers as trainers has been evaluated in previous self-management research (e.g., Hughes et al., 1995, 2013), further study of potential roles for and effective use of peers in self-management systems could contribute to the development of self-management packages that require fewer adult resources and have an increased likelihood of generalizing across settings (Carr et al., 2014; Southall & Gast, 2011).

The resources used within self-management systems may also have a large impact on the likelihood of generalization. Southall and Gast (2011) suggested making materials and equipment unobtrusive to increase the potential for generalization. For example, much of the previous research used auditory timers to cue self-monitoring (e.g., Harris, 1986; Koegel & Koegel, 1990); however, vibrating timers or similarly functioning apps on smartphones may be less disruptive and stigmatizing. Evaluations are needed to determine if results of self-monitoring procedures using these technologies are consistent with previous results. Dynamic technology is important to consider broadly across self-management procedures. The advent of smartphones, smart watches, and other ubiquitous technologies increases the likelihood that components of self-management strategies can be readily incorporated into the academic, vocational, and social lives of individuals with ASD. Relatedly, Lopez and Wiskow (2019) taught individuals with ASD to respond to tactile and textual prompts on an Apple Watch® to increase social initiations. While recent research has begun to evaluate this technology, further study is needed to assess the value of such personal devices in improving self-management procedures including self-monitoring, self-reinforcement, and self-instruction.

Videos including self-video modeling (Coyle & Cole, 2004), peer video modeling (Apple et al., 2005), and other instructional videos (Smith et al., 2015) have been used as part of efficacious self-management interventions for individuals with ASD. While the use of videos and other visual prompts has been highly effective, only a small number of studies have incorporated these components (Carr et al., 2014). Researchers should continue to evaluate the importance and relative effectiveness of these materials as part of self-management packages.

Finally, researchers should continue to evaluate the impact of more idiosyncratic characteristics of self-management interventions on desired changes in target behavior and social validity. For example, across previous research, self-recording and self-evaluation have varied significantly in terms of the length of intervals. Future research should continue to work toward the development of best-practice guidelines for length of intervals, criteria for increasing intervals, and the terminal length of intervals required for social validity. Another variable that has been asserted to impact the effectiveness of self-management interventions is the format of self-monitoring (Harris 1986; Lloyd et al., 1989). DiGangi et al. (1991) evaluated the effectiveness of self-monitoring with and without self-graphing for two individuals with learning disabilities. The researchers found greater improvements in both students' academic performance and for one student's on-task behavior when graphing was incorporated. Further evaluation of different self-monitoring formats is needed to evaluate if these findings would generalize beyond the limited population evaluated in this study and if similar results would be observed in individuals with ASD.

The empirical study of self-management interventions for individuals with ASD is robust. However, while the overall effectiveness of self-management interventions for individuals with ASD has been shown, more research is needed to evaluate the use of self-management interventions under specific conditions for this population. For example, in their systematic review, Carr et al. (2014) noted a lack of literature evaluating the use of self-management systems to improve academic skills for lower functioning individuals with ASD and to target social skills in preschool-aged children with ASD. Notably, there is also a lack of literature evaluating the use of self-management techniques to target increases in leisure skills for individuals with ASD.

30.6 Clinical Use and Benefits of Self-Management

One of the primary benefits of self-management procedures is increased independence. Since individuals with ASD can become dependent on prompts from adults (Bryan & Gast, 2000), it is critical that interventions systematically transfer at least partial control over behavior from the clinician to the individual themselves. The transfer of control that is inherent in self-management interventions makes them valuable procedures to increase independence (Newman et al., 1995).

Self-management interventions have notable advantages over other types of interventions. As discussed above, because the individual becomes a discriminative stimulus or prompt for self-management behavior, these skills can be used over time in the absence of ongoing support (Newman et al., 1996). Cooper et al. (2007) identified a number of additional benefits of self-management interventions including that the individual may be able to catch all occurrences of a behavior including those that might be missed by a clinician, individuals can observe their own behavior that is unobservable to others, self-management responses can control many topographies of other behavior, self-management has been shown to be effective across populations, and self-management helps people "feel free and good" (p. 586). Self-management skills also generalize more readily to new environments because of the ongoing presence of the individual as a controlling stimulus (Newman et al., 1996).

Self-management interventions have led to improved behavior across a variety of settings including special education classrooms (e.g., Holifield et al., 2010; Lloyd et al., 1989), general education classrooms (e.g., Shogren et al., 2011), unstructured school settings (e.g., Hughes et al., 2013), home environments (e.g., Singh et al., 2011), and community settings (e.g., Koegel & Koegel, 1990). The broad variety of environments in which self-management interventions have been efficacious indicates that self-management systems are not confined to one setting and can and should be used broadly by practitioners across the settings in which they work with clients.

Self-management systems have also been associated with high levels of social validity. Teachers who implement self-management systems in their classrooms report that they have more time to spend on instruction and across students (Agran et al., 2005). There is also evidence that teachers value self-management interventions and expand these interventions to other students and responses (Shogren et al., 2011). Increased independence with behavior management is associated with reduced parental stress; therefore, similar to teachers, there are benefits to self-management procedures from a family perspective (Koegel et al., 1992). Additionally, procedures that involve self-management components are generally rewarding for the individual (Ganz & Sigafoos, 2005). Participants have reported increased confidence in their skills following self-management interventions (Holifield et al., 2010) and noted they would recommend self-management procedures to others (Harris, 1986).

Relatedly, social benefits are also associated with self-management procedures. As discussed above, general social skills ratings (Apple et al., 2005) as well as dimensions of conversational skills (Hughes et al., 1995; Koegel et al., 2014) improved following interventions using self-management. Improvements in these and other social responses can lead to greater access to a variety of settings and social opportunities for individuals with ASD.

Self-management is a pivotal skill that has been associated with generalization of skills across settings and behaviors (Koegel et al., 1999), resulting in a level of independence that is unique to these types of systems. As the individual becomes the discriminative stimulus or prompt for engagement in target behavior, these systems do not require extensive materials for implementation (Ganz & Sigafoos, 2005). Control of behavior by the individual also increases the likelihood of maintenance of intervention results (Loftin et al., 2008; Stahmer & Schreibman, 1992) with students continuing to perform at high levels when interventions are faded (Lloyd et al., 1989). However, maintenance in the absence of self-management materials is not consistently observed (Koegel & Koegel, 1990), indicating that the materials used in training and initial implementation of self-management systems may also be an important stimulus-controlling behavior. Given the findings related to maintenance and materials, practitioners should select self-management materials that are nonstigmatizing, commonly found in the environment, and can be easily reimplemented if needed.

While many recommendations for best practice when implementing self-management systems can be drawn from the previous literature, questions still abound regarding the underlying mechanisms and effective components of self-management systems. Despite studies evaluating the relative efficacy of self-management interventions for work completion and on-task behavior (Harris, 1986; Lloyd et al., 1989), a singular best option has not been identified. As such, it has been suggested that selection of targets for self-management systems should be determined by individual student need, ongoing data collection, and measures of client preference (Lloyd et al., 1989). Notably, while some studies have evaluated self-management interventions to decrease challenging behavior, these studies have shown mixed results (Mancina et al., 2000; Singh et al., 2011) and a much larger research base supports the use of self-management to increase appropriate behavior (Carr et al., 2014). As such, it is recommended that responses to increase are prioritized when selecting targets for self-management interventions.

While the evidence is only preliminary, there is some support for self-graphing increasing the effectiveness of self-monitoring (DiGangi et al., 1991; Harris, 1986). The mechanisms through which this increase is observed are unclear. Some possibilities have been suggested including self-graphing functioning as a reinforcer and self-graphing increasing reactivity to self-monitoring (DiGangi et al., 1991). However, practitioners may want to consider utilizing this component of self-monitoring with careful evaluation of the effects, given the limited empirical support for and limited understanding of the procedure.

Inclusion of discrimination training has generally been shown to be beneficial as an initial component of self-management systems (Koegel & Koegel, 1990). Common training components include behavioral practice (Palmen & Didden, 2012), instructions (Agran et al., 2005), and modeling (Koegel et al., 1986; Agran et al., 2005). In addition, ongoing instruction and intermittent feedback are often included components and may improve self-evaluation (e.g., Koegel & Koegel, 1990).

In building self-management systems, it is recommended that clinicians maintain the assumption of parsimony and keep it simple. Notably, when self-monitoring procedures are overly complex (Lloyd et al., 1989) or multiple components are implemented simultaneously (DiGangi et al., 1991), interventions have been observed to become less effective. For example, DiGangi et al. (1991) observed improvements in on-task behavior across two individuals with learning disabilities when self-monitoring and self-graphing were combined but saw subsequent decreases in on-task behavior when self-reinforcement was added to the package. For one participant, increases were again observed when self-evaluation was added, indicating that the decrease may have been related to a lack of self-evaluation skills for this individual. However, it has been observed that complex interventions may detract from students' success with self-monitoring systems and, as such, should be avoided.

Recommendations for Using Self-Management

Planning your self-management system:

- Select materials
  - Readily available
  - Easy to use
  - Easily incorporated into the existing milieu
  - Easily reimplemented if needed
- Recruit teacher or caregiver input
- Select a behavior to increase
  - Collect data on baseline levels to establish criteria for reinforcement
- Create procedures that are simple to implement
- Build in steps for the fading of clinician support
- Consider incorporating into existing treatment package

Implementing your self-management system:

- Incorporate discrimination training
- Consider reinforcing accurate self-recording
  - Initially reinforce accuracy continuously
  - Fade reinforcement for accuracy and shift reinforcement to the target behavior
- Collect and analyze data to determine needed changes to the plan

Self-management interventions are well established as evidence-based procedures for improving a wide range of skills for individuals with ASD as well as other populations. Self-management interventions may incorporate several related interventions (e.g., goal setting, self-monitoring, self-reinforcement) that may be used individually or in conjunction with one another. Though there is not a clear consensus related to the responsible mechanisms for its success, generally self-management can be conceptualized as an effective behavior analytic procedure that relies on an individual making modifications to the environment to effect change on their own behavior. As self-management interventions are implemented by the individual themselves, they do not require ongoing involvement of a clinician. Additionally, in some cases materials have been successfully faded, leading to greater autonomy and integration into social and community settings. The application of self-management systems to a wide variety of behaviors and environments makes these systems dynamic and versatile interventions. The importance of independence and autonomy in the lives of individuals with ASD makes self-management procedures valuable additions to treatment options. Individuals who can monitor and change their own social, adaptive, academic, and vocational behavior can more readily and independently navigate their communities.

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31 Evidence-Based Practices: What Does the Future Hold?

Justin B. Leaf, Joseph H. Cihon, Julia L. Ferguson, and Mary Jane Weiss

31.1 Evidence-Based Practices: What Does the Future Hold?

With every passing year, the outcomes for autistics/individuals diagnosed with autism spectrum disorder (ASD) have and continue to improve. In the 1960s and 1970s, many autistics/individuals diagnosed with ASD were relocated into institutions, with many facing horrible living conditions. Robert Koegel (2015) described one of his early experiences with these institutions:

> He [Lovaas] took me on a tour of a mental hospital where all kids with autism were. All these kids tied to their beds in four-point restraints. People [not behavior analysts] giving them electric shocks, painful electric shocks for punishment. If the kids tried to bite somebody they were pulling the teeth out of their head.

The deinstitutionalization movement continuing into the 1980s led to many adults no longer being placed in institutions, but rather group homes. Simultaneously, the field of behavior analysis was beginning to identify the benefits of behavioral intervention for autistics/individuals diagnosed with ASD. Most notably with the publication of Lovaas' (1987) outcome study. In the 1990s, growth and improvement of high-quality, evidence-based interventions continued for autistics/individuals diagnosed with ASD. This included the publication of Catherine Maurice's (1994) book about her experience with applied behavior analysis (ABA). Maurice told the story of how intensive behavioral intervention led to best outcomes for her two children. This parental memoir catapulted the level of interest in behavior analytic intervention for individuals with autism and there was a dramatic increase in the number and need for practitioners implementing behavioral intervention.

The 1990s also involved the development of certification standards (Johnston & Shook, 1993; Moore & Shook, 2001; Weiss & Shook, 2010). Growth in the field continued in the 2000s with many more practitioners entering the field, more universities offering behavior analytic coursework and degrees, and refinements and improvements in commonly used procedures (Leaf, Cihon, et al., 2018a). The 2010s gave birth to changes in insurance law (thanks in large part to the work of Lorri Unumb and Dan Unumb, among many others), which resulted in children accessing behavior analytic services that were not formerly available. All of these events, and others, have directly led to the improvement of the field of ABA, and, more importantly,

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improved outcomes for autistics/individuals diagnosed with ASD.

These outcomes are also directly related to the development and refinement of a plethora of procedures that are considered evidence-based practices (EBPs). This handbook provides an excellent resource regarding EBPs for professionals, caregivers, and autistics/individuals diagnosed with ASD. The early chapters discussed what it means to be an EBP, the history of the development of EBPs, and why EBPs are important. Those chapters were followed by a series of chapters discussing specific procedures/approaches [e.g., discrete trial teaching (DTT), teaching interaction procedure, shaping] and comprehensive models of intervention [e.g., Pivotal Response Training (PRT), Early Start Denver Model] that have been clinically implemented and experimentally evaluated to improve desired behavior and decrease undesired behavior for autistics/individuals diagnosed with ASD. Although there have been marked improvements of our procedures and outcomes for autistics/individuals diagnosed with ASD, our work is far from complete. As such, the editors dedicated the final chapter of this handbook to discussing possible future endeavors related to EBPs and autistics/individuals diagnosed with ASD.

31.2 The Importance of Science

Science, and the tenants thereof, empirical evidence, and objective data seem to be under attack within society. Credible evidence is being crowded out by misinformation shared on social media and fueled by conspiracy theories. This phenomenon is apparent worldwide, with large members of the population questioning the utility of masks for COVID-19 and/or vaccines. The value of science and the scientific process seems to be more easily questioned or disregarded completely. Unfortunately, the field of ABA, especially in the context of autism services and EBPs, is not immune to this phenomenon. One of the most important goals of the future is for professionals to change the narrative within the field, and for individual practitioners and researchers to emphasize the power of science and the scientific process.

One possible way to stress the importance of science and EBPs is developing more effective methods to train consumers and professionals on the value and importance of science and the scientific method. This training is essential for behavior analysts whose goal is to work in the field of ABA and behaviorally based autism services. Training on the scientific method/process should include the traditional steps, the rationales for those steps, and other behaviorally oriented, pragmatic approaches (e.g., Skinner, 1956). Furthermore, this training will help practicing behavior analysts discriminate between methodologically sound empirical research and less methodologically rigorous research published in predatory journals. While this training will be essential for practicing behavior analysts, components may also be helpful for consumers – especially with respect to an understanding of EBPs.

Training others on and disseminating the importance of science and the scientific method/process will not be an easy task. It will likely require collaboration between many professionals and professional organizations. We recommend that large professional behavior analytic organizations [e.g., the Association for Behavior Analysis International (ABAI), the Council of Autism Service Providers (CASP), the Association of Professional Behavior Analysts (APBA), the Behavior Analysis Certification Board (BACB)] help lead these initiatives. These organizations can provide continuing education opportunities, allocate resources to research informing the development of policy statements, and help guide third-party payers and government officials in the endorsement of EBPs. Peer-reviewed journals, especially those within the field of behavior analysis, could also help in this endeavor. For example, journal editors could dedicate special issues to this topic and ensure reviewers of submitted manuscripts include an evaluation of scientific merit in their reviews. Ultimately, behavior analysts cannot adopt a passive role and must be actively involved in ameliorating efforts to devalue science and the scientific method/process. This involves having active discussions on the importance of EBPs, promoting peer-reviewed journals, and validating sources and data.

31.3 EBP Definition

Although EBP generally consists of best research evidence, clinical expertise, and consumer input, there are many different criteria that are used to determine if a procedure is an EBP. Further, there have been discussions concerning if EBP should be used to refer to a list of procedures (e.g., Smith, 2013) or a well-developed professional decision-making skill set used to determine which procedures to implement for specific clients in specific contexts (e.g., Slocum et al., 2014). While this is a necessary discussion, until a conclusion is reached, it is likely to lead to confusion among practitioners and consumers of behavioral intervention. This confusion could, in part, lead to professionals and consumers not understanding EBPs and minimizing the importance of EBPs in the context of science. As such, it is imperative that future work continues to address these challenges.

One possible fruitful venture would be reviewing the literature for the conditions under which the term “evidence-based practice” is used. Data collected could then be examined for any general themes that could assist in efforts to determine an agreed upon use and description of EBP. This data could also be compared to large-scale efforts to determine if an approach or procedure should be considered an EBP (e.g., Steinbrenner et al., 2020). At the same time, large professional behavior analytic organizations (e.g., ABAI, APBA, CASP, BACB) could help form advisory committees to assist in this work. These advisory committees could assist in reviewing the historical use of the term “EBP” as well as discussing the development of the desired conditions under which “EBP” should be used (e.g., as a list of procedures or a process used by practicing behavior analysts). These efforts could prove to be invaluable in clarifying the importance of EBP and any areas of consumer confusion regarding EBPs. In addition, these professional groups could consider and clarify the use of alternate terms that have emerged including empirically supported treatment and evidence-based practice in psychology.

31.4 Research

31.4.1 Expanding Participant Demographics

A general theme of this handbook is that there has been an abundance of research on the many different behaviorally based procedures used throughout the course of intervention for autistics/individuals diagnosed with ASD. While this abundance of research is necessary, impressive, and methodologically sound, there are numerous areas that are ripe for additional research. First, more research is needed with a wider demographic of participants and the necessary demographic variables of these participants need to be well documented within this research (Jones et al., 2020). For example, adolescents and adults diagnosed with ASD are largely underrepresented in much of the research involving autistics/individuals diagnosed with ASD (Gerhardt & Lainer, 2011), and future research should actively strive to evaluate the effectiveness of different procedures (e.g., DTT, PRT, script fading) with adolescents and adults diagnosed with ASD. This research should also include participants who commonly require more supports (e.g., less vocal-verbal language, higher rates of aberrant behavior, lower cognitive skills). Furthermore, more analysis on the impact of socioeconomic status, race and ethnic identity, and other demographic variables on responsiveness to intervention should be examined. By evaluating the effectiveness of behaviorally based procedures with a more diverse population, it will be possible to determine the conditions under which these procedures are helpful for a wider population of autistics/individuals diagnosed with ASD.

31.4.2 Group Research Methodology

Second, additional research that embraces the use of group research methodology, where possible, is needed. Many of the empirical studies cited in this handbook made use of single-case research methodology. Single-case research designs (e.g., reversal, changing criterion, multiple baseline) are excellent for clear demonstrations of experimental control (i.e., the independent variable is responsible for the changes in the dependent variable). The benefits of the use of single-case research designs, which permit using individual participants as their own baseline, are well known within the field of behavior analysis. They allow for an evaluation of the effectiveness and efficiency of a procedure at an individual level. Despite the strengths of single-subject design methodology, they also come with some limitations and criticism (mostly from outside of the field of behavior analysis). One issue is the extent to which results can be generalized to a larger population. That is, the generality of one study using single-subject design methodology is limited. It should be noted, however, that a core principle of single-subject design methodology is replication, which increases the generality of the body of research. Nevertheless, utilizing group research design methodology can help address concerns of generality within behavior analysis and, perhaps more importantly, outside of behavior analysis where group designs are viewed as the gold standard (Smith, 2012). These efforts will also likely be helpful for policymakers who are more accustomed to the use of group designs, such as randomized control trials, when it comes to making important policy decisions regarding funding options. In sum, producing group design and single-case design research within behavior analysis may increase the extent to which behavior analytic research is understood and respected by allied disciplines, and may help to elevate behavior analysis as a field in research circles.

31.4.3 Comparative Research

Do we know that DTT can be used to improve expressive language? Yes, because both research and clinical practice have demonstrated it to be effective (e.g., Ferguson et al., 2020). Do we know that incidental teaching can also be used to improve expressive language? Yes, because both research and clinical practice have demonstrated it to be effective (e.g., McGee & Daly, 2016). Do we know that the teaching interaction procedure can be effective in improving social behavior for autistics/individuals diagnosed with ASD? Yes, because both research and clinical practice have demonstrated it to be effective (e.g., Green et al., 2020). Do we know that video modeling can also be effective in improving social behavior for autistics/individuals diagnosed with ASD? Yes, because both research and clinical practice have demonstrated it to be effective (e.g., Rudy et al., 2014). But we are less confident in the conditions under which DTT or incidental teaching, comparatively, will be more effective or efficient in teaching language skills. We are less confident in the conditions under which the teaching interaction procedure or video modeling, comparatively, are more effective and efficient in teaching social skills. More importantly, we know little about which procedures are more or less preferred for teaching particular goals, for specific clients, and under which contexts. Thus, a third area that we encourage researchers to engage in is comparative studies to help evaluate the conditions under which different procedures and approaches are more effective, efficient, and preferred (Johnston, 1988). This research will help assist practitioners to select and implement the most effective, efficient, and preferred procedures for their clients. Such research is entirely consistent with the foundational tenets of the science of ABA; an essential research and clinical practice question is always to ask under what conditions is the procedure best applied.

31.4.4 Long-Term Outcomes

Finally, research is desperately needed evaluating the possible long-term outcomes of the use, or nonuse, of EBPs. There are several variables that should be assessed within this area of research including objective and subjective measures. More objective measures should include evaluations of maintenance and generalization of skills developed using EBPs. It may be the case that some EBPs, in some contexts, are more likely to lead to better maintenance and generalization. Other more objective measures should also include an evaluation of collateral behaviors or outcomes. This would include evaluating if the development of desired behaviors led to the development of more desired, but untargeted, behaviors as well as other possible outcomes (i.e., generalized behavior change). For instance, does the teaching how to initiate and maintain a conversation lead to the development of meaningful and desired friendships? Subjective measures must include an evaluation of the acceptability of the goals, procedure, and outcomes of those procedures – collectedly known as social validity (Wolf, 1978). There is a general dearth of the assessment of social validity within behavior analytic research (Ferguson et al., 2019), and when it is included, the assessment is commonly related to short-term outcomes and results. The importance of including the assessment of social validity within behavior analytic research cannot be understated. This is also the case with respect to the assessment of social validity within behavior analytic research related to long-term outcomes. That is, do ratings of the acceptability of the goals, procedures, and outcomes of those procedures change across time? This research has always been meant to be at the heart of behavior analysis, and future research should be no different.

Perhaps even more importantly, future research must evaluate any instances of negative or unwanted side effects of any EBPs. There have been claims that procedures based upon the principles of ABA have resulted in serious negative or unwanted side effects (e.g., trauma, anxiety; Kupferstein, 2018; Sandoval-Norton & Shkedy, 2019). Some of these claims have resulted in responses from the behavior analytic community to specific claims (e.g., Gorycki et al., 2020; Leaf, Ross, et al., 2018b) as well as more general discussions (e.g., Leaf, Cihon, et al., 2021a; Rajaraman et al., 2021). Any claims that procedures based upon the principles of ABA, or in some cases ABA more generally, have resulted in serious negative or unwanted side effects need to be taken seriously and approached compassionately. Furthermore, behavior analytic researchers are uniquely able to conduct research to evaluate any long-term, and short-term, negative or unwanted effects associated with ABA-based procedures and interventions (i.e., EBPs). The use of single-subject research methodology and the use of measures of social validity will be invaluable in this line of research. Data resulting from this research can be used to determine the necessity for any global and contextually specific changes to ABA-based procedures and interventions. Any data collected from this research are also more likely to be more welcomed and consumed by behavior analysts than anecdotal reports that may be found on social media outlets and blogs. This may accelerate the rate of change in adopting or adapting procedures to ensure that service delivery is more compassionate, humane, and tailored to the individual's preferences and the community's needs.

31.5 Training

Over the past 40 years, there has been a drastic and continual increase in the number of certified behavior analysts in the world. To illustrate, when the BACB was first established in 1999, there were only 30 Board-Certified Behavior Analysts (BCBAs) and Board-Certified Assistant Behavior Analysts (BCaBAs) in the world – today that number is over 55,000 (Behavior Analyst Certification Board., n.d.). This growth is mirrored with the Registered Behavior Technician (RBT) credential, with now more than 100,000 RBTs worldwide since its adoption in 2014 (Behavior Analyst Certification Board., n.d.). This does not take into account the number of behavior analysts who are not certified, autism processionals who are not behavior analysts, or the number of teachers who teach autistics/individuals diagnosed with ASD. Put simply, there are countless numbers of professionals providing services for autistics/individuals diagnosed with ASD.

It is critical that all professionals providing behavior analytic services for autistics/individuals diagnosed with ASD are well trained to help ensure the implementation of quality interventions with the highest degree of fidelity. There have been numerous studies that have demonstrated how to effectively train professionals on implementing the procedures highlighted in this handbook (e.g., Cheung et al., 2020; Green et al., 2020; Kirkpatrick et al., 2021; Weinkauf et al., 2011). There have also been several discussions within the literature about the importance of training and improving standards in training for certified behavior analysts (e.g., Leaf, Leaf, et al., 2021b; Leaf et al., 2017). With the increasing need for behavior analysts in the field of autism, effective and efficient training is needed now more than ever. As such, researchers and clinicians should continue to develop and evaluate comprehensive, effective, and efficient training methods to help ensure the implementation of quality interventions with the highest degree of fidelity. Some examples can be found within the literature (e.g., Cheung et al., 2020; Weinkauf et al., 2011), but much more research is needed to help improve standards in intervention as well as training for certified behavior analysts.

Comprehensive, effective, and efficient training methods may not just increase the quality and fidelity of behavioral intervention, but also increase the likelihood of the implementation of EBPs and decrease the likelihood of non-EBPs. As previously mentioned, if behavior analysts are trained in the value and importance of science and the scientific process, they may be less susceptible to suggestions or temptations to implement interventions that have little scientific merit or support. It may also be the case that this training would lead to more effective interventionists through the development of analytic skills often required by interventionists providing a progressive approach to ABA-based intervention (Leaf et al., 2016).

31.6 Increasing and Improving Standards

Current ethical standards for certified behavior analysts include requirements to implement EBPs that are consistent with the principles of behavior analysis (Behavior Analyst Certification Board, 2020). BACB-certified individuals providing nonbehavioral services "must be clearly distinguished from their behavioral services and BACB certification" (Behavior Analyst Certification Board, 2020, p. 16) by providing a disclaimer stating as such. While the purpose of this disclaimer, as well as the rationale for it, is logical on the surface, the possible ramifications are concerning. For example, is it reasonable to believe that an interventionist is providing quality, effective intervention if they use a functional communication training approach in one context, but implement facilitated communication while providing a disclaimer in another? We believe the answer is no; however, this remains an empirical question. Future research should examine the association between the level of analysis in the repertoires of certified behavior analysts and technicians and the quality and effectiveness of their provided interventions. As such, we suggest that certified behavior analysts should not provide and/or advertise dangerous or ineffective nonbehavioral services under any circumstances. Practitioners should be encouraged to stay abreast of emerging research evidence, organization position statements, and resources about how interventions are categorized along the EBP continuum. These are moving targets, and adherence to this goal requires continued vigilance and awareness of the available evidence. As data are collected from research evaluating the impact of certified behavior analysts providing and/or advertising nonbehavioral services, these expectations can be further refined.

31.7 Conclusion

The editors of this handbook believe that EBPs, science, and the scientific method are essential to ensure autistics/individuals diagnosed with ASD access high-quality, effective, and behaviorally based interventions. This handbook provides ample evidence of the number of procedures and interventions that have been documented within the peer-reviewed literature to improve desired behaviors and decrease undesired behaviors for autistics/individuals diagnosed with ASD. These procedures should be considered as part of comprehensive programing and should be adjusted to meet the individual needs of any specific learner. Despite the numerous procedures and plethora of research on these procedures, our work is far from done. ABA-based interventions and procedures are based on sound science and constantly evolve. The recommendations provided here should not be viewed as exhaustive or as a finite to-do list for researchers and practitioners. Rather, we offer this as a starting point and hope it functions as a motivational tool for additional work to keep our science and the application of that science progressing.

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