



# Early Intensive Behavioral Intervention for Autism Spectrum Disorder

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Early Intensive Behavioral Intervention (EIBI) is sometimes referred to as early behavioral intervention or the Lovaas Model (Green, 1996; Leaf & McEachin, 2016). Regardless of the label, EIBI is an evidence-based and comprehensive treatment for autism spectrum disorder (ASD; Anderson et al., 1987; Birnbrauer & Leach, 1993; Eikeseth et al., 2002; Lovaas, 1987; Sallows & Graupner, 2005; Smith et al., 2000). EIBI is a comprehensive treatment package that utilizes the principles of Applied Behavior Analysis (ABA) to teach a breadth of skills to young children diagnosed with ASD (Reichow et al., 2018). There has been a plethora of research that has evaluated the effect of EIBI (Anderson et al., 1987; Cohen et al., 2006; Eikeseth et al., 2002; Fenske et al., 1985; Kuppens & Onghena, 2012; Lovaas, 1987; McEachin et al., 1993). Despite the myriad of literature published on EIBI, several misconceptions exist (Leaf & McEachin, 2016).

EIBI targets skill development in the areas of communication skills, play skills, social skills, executive functioning skills, and cognitive skills (Eldevik et al., 2009; Howard et al., 2005; Lovaas, 1987; Reichow et al., 2018). EIBI is commonly implemented by highly trained professionals and is individualized to the child by identifying child-specific skill deficits and then breaking down each skill into smaller behavioral units that are achievable for the child (Lovaas, 1987; McEachin et al., 1993; Reichow et al., 2018). Finally, in order to increase learning opportunities and promote generalization of the skills taught, parents/caregivers are trained to carry out EIBI procedures (Larsson, 2003; Lovaas, 1981). It has been concluded that EIBI is most effective when treatment occurs as early as possible (i.e., before the age of four years old) and at a high intensity (i.e., averaging 25–40 h per week; Cohen et al., 2006; Eldevik et al., 2006, 2019; Fenske et al., 1985; Peters-Scheffer et al., 2010).

The purpose of the chapter is to provide a comprehensive review of EIBI. To help outline the evolution of EIBI and resolve misinterpretations, this chapter will afford an overview of the history of EIBI and discuss important seminal articles, as well as contemporary outcomes associated with EIBI. To guide parents and practitioners in practice, this chapter will thoroughly describe the defin-

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ing characteristics of EIBI, components, and methodologies of treatment plans, domains of intervention, and implications for the best outcome. Finally, the chapter will identify populations that benefitted from EIBI.

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## The History of EIBI

### Foundations in Behavioral Science

Principles of EIBI programs are rooted in the science of behavior analysis, and therefore a thorough discussion of EIBI and its history requires a preface to the history of ABA. ABA is the science of behavior, which uses behavioral principles to make effective and socially meaningful changes in the behavior of individuals (Baer et al., 1968; Wolf, 1978). ABA is rooted in the experimental analysis of behavior, with seminal studies evaluating the effect of respondent and operant conditioning on behavior (Jones, 1924; Pavlov, 1927; Watson & Rayner, 1920).

Early studies in behavior analysis discovered what are now known as the principles of behavior (e.g., reinforcement, punishment, and extinction). Later, a series of applied studies were published by pioneers of behavior analysis (Allen et al., 1964; Ayllon, 1963; Ayllon & Azrin, 1965; Ayllon & Haughton, 1962; Baer, 1960, 1961, 1962; Bijou, 1955, 1957, 1958; Isaacs et al., 1960; Lindsley, 1956; Williams, 1959; Wolf et al., 1963) which evaluated the applicability of behavioral principles such as reinforcement, punishment, and extinction to human behavior. For example, Williams (1959) successfully decreased the tantrum behavior of a 21-month-old child. Treatment took place in the child's home during his bedtime routine. Williams (1959) trained the parents to implement extinction by instructing the parents to place the child in his bedroom and to not reenter the room, even if the child engaged in a tantrum. By the tenth instance, the child no longer engaged in tantrums, whined, or cried when he was put to bed. The tantrum behavior spontaneously recovered about a week later but was then extinguished and maintained at zero levels in a two-year follow-up.

Isaacs et al. (1960) used positive reinforcement to increase vocal verbal behavior in one adult diagnosed with schizophrenia and another diagnosed with mutism. Reinforcement in the form of the delivery of gum was provided for behavioral approximations of vocal verbal behavior. Vocal verbal behavior increased for both participants following the implementation of treatment.

Instigated by these seminal applied studies, behavior analysis was first coined as an applied science (i.e., ABA) in 1968 when Baer and colleagues asserted that behavior analysis should target behaviors of interest to society and look at variables that restrain or improve socially important behaviors. Following the publication of Baer et al. (1968) the science of applied behavior analysis was formed, ABA's flagship journal, *The Journal of Applied Behavior Analysis* was created, Skinner began to discuss behaviorism as the philosophy of the science of human behavior (Skinner, 1974), behavioral principles were utilized to promote education (O'Leary & O'Leary, 1977) and the seminal studies on EIBI were completed (i.e., Lovaas, 1987; Lovaas et al., 1973).

### Comprehensive ABA-Based Intervention: The Young Autism Project

EIBI was pioneered by the work completed in the UCLA Young Autism Project (YAP; Lovaas, 1977; Lovaas et al., 1973), which was designed to help children with ASD develop socially important language and social skills and replace behavioral excesses (e.g., aggression, self-injury, and stereotyped behavior) with more functional behaviors (e.g., requesting; Leaf & McEachin, 2008). Lovaas et al. (1973) completed a long-term follow-up study that evaluated the effect of a comprehensive ABA

intervention on the development of prosocial behaviors (i.e., language, social skills, play skills, executive functioning skills, and cognitive skills) and the reduction of restricted and repetitive behaviors (e.g., stereotypy, aggression, and self-injurious behavior) for 20 children diagnosed with ASD between the ages of three and 10 years old. Lovaas et al. (1973) utilized behavioral principles and ABA procedures such as reinforcement, discrete trial training, shaping, punishment, extinction, and chaining. Assessment and response measures demonstrated substantial decreases in challenging behavior with improvements in prosocial behavior. However, in subsequent follow-up measures which were conducted up to four years following intervention, the participants' maintenance of skills varied largely across participants.

In 1987, Lovaas completed another seminal study that evaluated the effect of EIBI on children diagnosed with ASD. Participants included 38 children under the age of four years old, which were diagnosed with ASD. Participants were quasi-randomly assigned to one of two groups. Nineteen participants were assigned to an EIBI test group which received an average of 40 h of ABA intervention per week. Another 19 participants were assigned to a non-intensive model and received an average of 10 h or less per week of ABA intervention mixed with eclectic approaches. Intervention was employed across groups for a minimum of two years and occurred in the home, clinic, and community settings. Following the intervention, the participants were independently evaluated. An outcome score was assigned to each child based upon their intelligence quotient (IQ), school placement, and diagnosis at the end of treatment. Scores included poor, fair, and best outcomes. Participants who achieved the highest results were categorized as reaching the best outcome, meaning they scored within normal range IQ, attended general education classrooms without support, and presented as indistinguishable from their peers (i.e., did not present with behaviors or characteristics of autism). Participants who demonstrated fair outcomes were categorized as aphasic, and participants who met poor outcomes were categorized as autistic. Of the 19 participants in the intensive ABA group, 2 participants met poor outcomes (i.e., 10%), 8 participants met fair outcomes (i.e., 42%), and 9 participants achieved best outcomes (i.e., 47%). The results of the control groups were not as promising. Of participants in the non-intensive and eclectic group, 11 of the children achieved poor outcomes (i.e., 58%). The other eight children achieved fair outcomes (i.e., 42%), and none of the participants achieved the best outcome (i.e., 0%). With this study, Lovaas (1987) provided the first demonstration of the promising outcomes EIBI can achieve.

## Early Replications

To further evaluate the effect of EIBI, Anderson et al. (1987) completed a partial replication of Lovaas (1987) in a study that included 14 children, 65 months or younger. Participants received a less intensive model of the Lovaas (1987) intervention, receiving an average of 20 h per week of ABA. Five of these hours were allocated to parent training, and intervention was provided between one and two years. Additionally, instead of treatment occurring across a variety of settings (as in Lovaas, 1987) treatment occurred only in the home. Data demonstrated that four of the 14 participants achieved an IQ score of over 80. Additionally, these four participants were successful in a general education classroom but required some support. Many other replications followed, which demonstrated the effectiveness of EIBI (Birnbauer & Leach, 1993; Eikeseth et al., 2002; McEachin et al., 1993; Sallows & Graupner, 2005; Smith et al., 1997, 2000).

For example, Birnbauer and Leach (1993) observed IQ improvements in four out of nine of their participants after the participants received 19 h per week of EIBI for 1.5–2 years. However, the less intensive intervention model did not target all skill areas and as a result, the participants displayed limited play skills and engaged in self-stimulatory behavior. In replications that more closely resem-

bled the intensity of the Lovaas (1987) model, Smith et al. (2000) provided participants with 25 h per week of EIBI for 33 months and Eikeseth et al. (2002) provided participants with 28 h per week of EIBI for one year. Smith et al. (2000) and Eikeseth et al. (2002) reported an improved IQ score of over 85 or greater in 26% and 54% of participants, respectively. Additionally, the 26% and 54% of participants that showed improvements in IQ scores were all successful in the general education classroom, with some support or no support at all.

Studies have also evaluated the impact of EIBI on participants with varying baseline IQ scores (Harris et al., 1991; Smith et al., 1997). The results of a review completed by Harris and colleagues (1991) showed increases in IQ scores and language assessment scores for nine participants with baseline IQ scores of 70 or above, and who were all under the age of 62 months. Whereas Smith et al. (1997) evaluated the effect of EIBI for participants with lower mean IQ scores in baseline and who were diagnosed with intellectual disabilities. Data indicated increased participant IQ scores following 30 h of EIBI for two or more years. The results of Harris et al. (1991) and Smith et al. (1997) suggested promising outcomes following EIBI across participants with varying IQs at the onset of treatment.

McEachin et al. (1993) provided an evaluation of the long-term outcomes associated with EIBI (i.e., follow-up on the Lovaas, 1987 study). McEachin et al. (1993) examined participant IQ measures and outcome categorization (as defined in Lovaas, 1987) on six-year follow-up assessments. An intensive EIBI test group was compared to a non-intensive and eclectic treatment control group. Follow-up measures indicated significantly greater IQ increases in the EIBI group compared to the control group. Eight of the nine participants in the EIBI group also maintained the best outcome categorization. Following the publication of studies such as those completed by Harris et al. (1991), Eikeseth et al. (2002), and McEachin et al. (1993), a breadth of research on the efficacy and long-term outcomes of EIBI for individuals with ASD was completed (Cohen et al., 2006; Eldevik et al., 2006; Healy & Lydon, 2013; Kuppens & Onghena, 2012; Lechago & Carr, 2008; Peters-Scheffer et al., 2010).

## **Critiques and Clarifications: Evolution of Practice Across the Model**

Lovaas' body of work has often been interpreted as a prescriptive and standardized approach, wherein all children receive 40 h of discrete trial teaching in a restrictive setting (Leaf & McEachin, 2016). However, the minimum weekly hours of intervention administered within the Lovaas model were determined based on the child's progress (Eikeseth, 2001; Leaf & McEachin, 2016). While the intensive treatment group received an average of 40 h, some children received a minimum of 20 h weekly (Leaf & McEachin, 2008, 2016). Parents were trained in the therapist role and treatment was flexible and relied on reinforcement and the clinical judgment of highly trained therapists and parents (Eikeseth, 2001; Leaf et al., 2021; Leaf & McEachin, 2008, 2016). Additionally, to promote generalization as the child progressed, treatment was transferred from the one-to-one format to the group instruction format, and treatment was conducted across a variety of settings, some that imposed natural distractions (Leaf & McEachin, 2008, 2016). Treatment occurred at home, at school, and within the community and targeted the development of language skills, self-help skills, social skills, and play skills (Leaf & McEachin, 2008). Today, there have been many applications of the "Lovaas Model" (Leaf & McEachin, 2016). However, due to the complexity of the Lovaas model, modifications are commonly made, and exact replications have rarely occurred (Leaf et al., 2021; Leaf & McEachin, 2008, 2016).

## Associated Methodologies and Treatment Components of EIBI

Because applications and models of EIBI vary, based on the evolution of practice and interpretations of procedure in replication, it is useful to identify critical components and conceptual underpinnings of practice categorized as EIBI. To support this aim, the following sections identify key dimensions of the theoretical underpinnings of EIBI (i.e., Applied Behavior Analysis), common teaching procedures represented in the literature (as well as a critique of the specificity of those representations and interpretations), and critical characteristics of successful EIBI programs.

### Defining Dimensions of Applied Behavior Analysis

In their seminal work in 1968, Baer and colleagues outlined key defining dimensions of ABA. These are applicable to the study of early and intensive behavioral intervention, and the framework offered by Baer, Wolf, and Risley is particularly important in providing an overview of outcomes within the literature. This is because, as highlighted by Lechago and Carr (2008), not all literature demonstrating the efficacy of ABA-based interventions is sufficiently procedural to make easy analysis of which articles should or shouldn't be included in a review of the evidence base. Rather, by using a set of defining dimensions, the reader is able to make a determination whether a given set of procedures belongs within the "ABA-based" literature base.

Of note, the title of these seminal works includes the words "some" and "current." By titling the work "Some Current Dimensions..." the dimensions offered here may be interpreted as inexhaustive, as well as unapologetically temporal. That is to say, these dimensions may be interpreted, as all scientific premises are, as applicable as best knowledge at the time of publication, and fully acknowledged to be subject to the same course of continuously evolving study that applies to all works of science. It is therefore appropriate to both hold these dimensions as seminal, while also holding space for shaping philosophy and procedure over time, in order to fully serve the populations that stand to benefit from (or be made further vulnerable by) its application. In this spirit of philosophic doubt, the following evolutions, frameworks, and procedures that follow are balanced gently with established critiques, clarifications, and recommendations for future focus.

The dimensions offered by Baer, Wolf, and Risley (1968) include applied, behavioral, analytic, technological, conceptually systematic, effective, and generalizable. Applied refers to selection of a target problem that is of social significance. Behavior encompasses anything an organism does that is observable, measurable, and objectively defined. Analytic refers to the ability to demonstrate experimental control between a dependent variable (or in the case of EIBI programs, a procedure or intervention) and an independent variable (to be discussed below). Technology indicates that procedures are written with precision, such that a reasonably trained professional would be able to replicate the procedure with fidelity. Conceptually systematic is a dimension that requires interventions used to align with the science of behavior analysis. Procedures must effectively lead to the intended outcomes in order to demonstrate efficacy. Generality indicates a learned repertoire is durable across multiple exemplars of settings/routines, people, and materials.

### A Further Dimension: Social Validity

In a further extension of this work, Wolf (1978) makes the case for incorporating social validity measures as part of common practice of research in ABA. That is, procedures should be rated as acceptable and meaningful to the various stakeholders involved in the intervention, most notably the client

receiving direct services. Articles have since been produced (Ferguson et al., 2019; Kennedy, 1992; Schwartz & Baer, 1991) that discuss the extent to which this aim has been accomplished, and where the field has underdelivered on Wolf's vision. While beyond the scope of this chapter, it is notable that social validity is not a consistent independent variable reported in many of the excellent articles referenced throughout. Especially within current common funding contingencies (e.g., the medical model of care, funded by insurance plans), consumer preference is a key component to secure ongoing legislative support of and funding for autism treatment. Additionally, literature shows that treatments that are highly accepted by patients result in improved treatment adherence and in improved health outcomes overall (Martin et al., 2005). Therefore, social validity is a critically important aim of applied treatments such as ABA-based treatments for ASD, including EIBI.

## **Toward Procedural Descriptions of Program Components**

As discussed, some outcome studies in EIBI literature have been inconsistent in technological description of independent variables of the study. This becomes problematic conceptually, as ABA is in part defined via technological description (Baer et al., 1968). This is also problematic practically, presenting challenges to high-integrity replication and directive interpretation.

In their 2008 review of available EIBI outcome studies, Lechago and Carr offer a critique of the level of procedural specificity offered in much of the literature up to that point. They identified that critical components were presented in much of the seminal literature without sufficient detail for replication. In this evaluation, they viewed both components of the treatment package and a specific view of curricular targets as independent variables in the reviewed studies. They found that authors of both the original Lovaas studies (1973, 1987) and subsequent replications provided summary information regarding these variables, positing that this may have been in the interest of a concise manuscript, but resulting in outcomes that may be ultimately difficult to interpret or further replicate. Particularly relevant to the evolution of Lovaas' practices over his decades of publishing, a detailed account of the procedure at each point of inflection is useful for accurate replication and effective dissemination.

Lechago and Carr (2008) highlighted the following as areas of particular interest. First were variables related to the treatment team (both the behavior analysts as well as the direct interventionists). These variables included the background of the treatment team members, training of the treatment team members, how long they had been working in the field, and the frequency of interactions between members of the treatment team and caregivers. Additionally, caregiver involvement was positively correlated with outcomes.

After the demographic, educational, and involvement level of the treatment team, Lechago and Carr (2008) explored the methodologies of the treatment provided. They included in their list of potential treatment components: ratio of discrete trials to naturalistic teaching components, consequence procedures, trial arrangements, prompting procedures, and maintenance, generalization, and data collection protocols. This chapter offers a brief overview of several of these components in order to orient the reader to common applications of EIBI procedures, because without details of the precise procedures (and modifications of those procedures), studies written then (Lovaas, 1987) and since have potentially resulted in piecemeal replication, wherein researchers cobble together strategies from multiple successful case descriptions and combine them in new ways. While this may be an effective strategy for continuously testing, innovating, and evaluating practice, it poses a challenge in making statements about overall outcomes of EIBI treatment. This is because, based on similarly described outcomes within group design research, it is difficult to determine the extent to which any given study was truly replicated by the next. A notable exception to this critique was Green and colleagues' work (2002), which was described in detail in the manuscript; however, due to the study design (i.e., single

subject), Lechago and Carr recommend a cautious interpretation. Therefore, the critique still stands that few group designs present the necessary information on independent variables necessary to generate full external support for the outcomes and claims made. Mindful of and in response to this critique, the following treatment components are outlined to orient the reader to potential independent variables common to EIBI studies. Additional variables related to overall program characteristics, such as treatment intensity and duration, are outlined further in the chapter.

### **Commonly Used Evidence-Based Practices in EIBI**

A helpful orientation to commonly used procedures is provided by Leaf et al. (2018). In this chapter, the authors provide a summary of commonly used ABA-based procedures: discrete trial teaching (Lovaas, 1981, 1987), prompting (Grow & LeBlanc, 2013; MacDuff et al., 2001), incidental teaching (Hart & Risley, 1968, 1975), token economies (Ayllon & Azrin, 1965; Charlop-Christy & Haymes, 1998), differential reinforcement (Vladescu & Kodak, 2010), response cost (Phillips et al., 1971), time out (Donaldson & Vollmer, 2011), shaping (Ricciardi et al., 2006), behavioral skills training (Parsons et al., 2012), functional analysis (Iwata et al., 1982, 1994), functional communication training (Carr & Durand, 1985), and chaining (Spooner & Spooner, 1984). In the section that follows, select strategies are briefly described. This is not intended to be an exhaustive list of methodology, nor is it intended to be a detailed training resource for implementation, but rather an introductory resource of techniques that are conceptually systematic to a behavior analytic framework of instruction and commonly incorporated into EIBI programs.

**Discrete Trial Teaching** Discrete Trial Teaching (DTT; Lovaas, 1981, 1987) is one of the most common teaching methodologies within EIBI programs (Leaf et al., 2018). In DTT, complex skills are broken down into smaller teaching steps. The key components of a discrete trial include a discriminative stimulus (i.e., a cue from the instructor that indicates reinforcement is available following a given response), a response (i.e., a behavior emitted by the child, in response to the discriminative stimulus), and a contingent consequence (i.e., a stimulus, referred to in behavior analytic literature as a reinforcer or punisher, intended to increase or decrease the future likelihood of the emitted response). DTT is typically a highly structured method of teaching and is directed by the instructor. A common critique of DTT is that it may lead to rote or inflexible responding that is tightly controlled by a very specific set of contingencies that mimic the original stimulus situation (Luiselli et al., 2008), and therefore, special care for establishing generality is important when teaching with this methodology. In order to establish generality, discrete trial teaching programs typically include specific teaching steps to incorporate additional materials, instructors, and teaching settings, in order to improve the likelihood of the learner emitting the repertoire in novel and naturalistic settings.

**Incidental Teaching/Natural Environment Teaching** Another common strategy described by Leaf et al. (2018), this approach developed to teach naturalistic language and play skills goes by multiple names, so a description of core components is useful. Incidental teaching requires that the environment be arranged in a way to encourage responding (i.e., manipulation of motivating operations), an initiation by the child, an elaboration or expanded model by the instructor, and reinforcement for attempted responding (McGee et al., 1999). As an example, an instructor may reserve highly preferred toys for teaching expanded play repertoires (i.e., environment); as the child reaches for the toy train (i.e., initiation), the instructor models train sounds (i.e., elaboration), and the child imitates the instructor; the instructor then allows the child to take a turn with the toy train (reinforcement). A distinction between the first two procedures described (DTT and incidental teaching) is the nature of the reinforcer, which in the second procedure is integral to the play activity itself; that is, the teaching materials

(or the instructor's playful or expanded manipulation of the materials) also serve as the reinforcers. This method of teaching is inherently more child-led or may be described as incorporating shared control between the instructor and child. This method also potentially leads to more efficient generalization of repertoires and may be more acceptable to caregivers, as the procedures mimic naturalistic routines more closely than DTT. It is important, however, that each client's needs be assessed in order to determine under which contingencies they are able to best attend and respond to teaching interactions.

**Differential Reinforcement** Differential reinforcement may be defined as providing reinforcement for one [desired or target] behavior or response, while withholding reinforcement for a response targeted for reduction (Cooper et al., 2019); alternatively, differential reinforcement may be used to define a procedure wherein the highest quality reinforcement is reserved for higher quality responses (i.e., independent, correct responses), and a lower potency reinforcing stimulus is delivered for more prompted responses. Differential reinforcement is used across multiple applications, with the most common being differential reinforcement of an alternative behavior (DRA) and differential reinforcement of other behavior (DRO) (Chowdhury & Benson, 2011).

**Differential Reinforcement of Alternative Behavior (DRA)** DRA is a procedure wherein the instructor delivers reinforcement contingent upon emitting a prescribed behavior, identified as an alternative to a challenging behavior targeted for reduction (Deitz & Repp, 1983). A common application of DRA is functional communication training (outlined below), in which the alternative response is a communication response that is functionally equivalent to the challenging behavior. However, this approach does not dictate that the alternative approach be a functionally equivalent communicative response. For example, a child may be taught to select another toy to play with when denied access to a preferred activity (e.g., when a friend is using a desired toy), in place of engaging in aggressive behavior. In this case, the instructor would provide reinforcement contingent upon the desired replacement behavior (i.e., choosing a different toy).

**Differential Reinforcement of Other Behavior (DRO)** Another common procedure is DRO or differential reinforcement of other behavior. This procedure involves providing reinforcement contingent upon the absence of the challenging behavior that has been targeted for reduction (Reynolds, 1961; Weiher & Harman, 1975). This procedure may include providing reinforcement on an interval schedule, where a child receives reinforcement for engaging in any behavior other than the problem behavior targeted for reduction. For this reason, this procedure is somewhat of a broad category. In the absence of the specific challenging behavior targeted for reduction, the child may engage in any other behavior and still contact reinforcement. This is typically used when a challenging behavior is very severe. For example, if a child engages in aggression toward peers, they may receive reinforcement for any interval in which they do not engage in aggression, even if the behaviors they emit during that interval are less than desirable (e.g., swearing).

DRO has been shown to be highly effective in the literature as a procedure for reducing challenging behavior (Repp et al., 1976; Homer & Peterson, 1980; Conyers et al., 2003; Jessel et al., 2016). Notably, however, this is not a procedure that teaches an adaptive alternative to meet a functional need. The premise of behavioral interventions is built upon the functions of behavior (socially mediated positive or negative reinforcement, automatic reinforcement); that is to say, organisms engage in



responses to their environment in order to meet a need. These needs may include the need for attention, tangible items/activities, escape from aversive stimuli, or automatic reinforcement (also referenced as sensory input and pain attenuation). Because DRO does not teach a replacement behavior to help a child meet these needs, challenging behavior may reemerge, especially when predictable DRO contingencies are not in place (i.e., unplanned/unavoidable variation of the schedule, thinning a schedule of reinforcement too quickly, inconsistent reinforcement). For this reason, teaching a specific alternative behavior to replace the challenging behavior (DRA) is often a preferred approach. In some instances, both procedures may be implemented within a single program; a child will contact reinforcement for the absence of challenging behavior, as well as high potency reinforcement for use of alternative responses.

### **Prompting**

Prompting is a procedure wherein the instructor delivers assistance to increase correct responses from the learner. There are many antecedent modifications and actions that constitute prompting. Examples include gesturing to the correct response (Soluaga et al., 2008), providing a verbal model of the correct response (Leaf et al., 2010), physically assisting the child in completing a correct response (Leaf et al., 2010), positioning the correct response closer to the learner (Soluaga et al., 2008).

Leaf et al. (2018) point out that a key challenge in successful prompting procedures is related to clinical judgment; that is, implementers benefit from a structured approach to prompt delivery and prompt fading. A common approach is to structure available prompts into a hierarchy, either organized as least-to-most intrusive or most-to-least intrusive. Selection of the hierarchy (least-to-most versus most-to-least) depends upon the needs, strengths, and assent of the child. Several studies have demonstrated effects of learning efficiency with both approaches; similarly, research approaches differ in a rigid versus flexible approach to implementing prompting procedures (i.e., structured as strict rules or flexible guidelines).

### **Extinction**

Extinction is a procedure in which a given reinforcer is withheld in response to challenging behaviors that have historically resulted in the delivery of that stimulus (Lerman et al., 1996). This procedure allows the child to establish a maintaining consequence (i.e., learning history) with new, more appropriate, and/or adaptive responses. For example, a client may receive caregiver attention by initiating a communicative response, rather than engaging in harmful challenging behavior that would otherwise draw the caregiver's attention.

Recent literature has recommended ethical considerations to be weighed when choosing whether or not to implement extinction (Geiger et al., 2010; Rajaraman et al., 2021). While much of the current body of literature demonstrates that extinction procedures are highly effective at reducing challenging behavior, emerging literature has also demonstrated that challenging behavior may be reduced without extinction procedures (Piazza et al., 1996; Rajaraman et al., 2021; Worsdell et al., 2000). Discussion persists in comparing the potential short-term effects related to efficiency with longer-term effects, particularly those associated with extinction burst and repeated behavioral escalation. Geiger et al. (2010) offered a concise framework for examining the ethics of extinction procedures in their decision model for behavior intervention plans. They guide the behavior analyst to consider whether extinction procedures are ethical, safe, and feasible; they further ask the question of whether the family, client, and environment can tolerate an extinction burst. This is based on conventional literature demonstrating stronger treatment effects when extinction is implemented consistently (Hagopian et al., 1998; Shirley et al., 1997), although emerging literature suggests treatment gains are achievable even with the inconsistent implementation of extinction, so long as a treatment package includes positive reinforcement for functionally equivalent replacement behaviors (Worsdell et al., 2000).

**Functional Communication Training** Functional communication training (Carr & Durand, 1985) is a procedure aimed at reducing challenging behavior, by teaching a replacement communication response that is functionally equivalent (Carr & Durand, 1985). Functional communication training is often paired with the extinction of the challenging behavior targeted for reduction (Shirley et al., 1997), though emerging literature suggests that extinction may not be necessary to eliminate the challenging behavior, so long as the alternative communicative response contacts reinforcement contingencies (Landa et al., *in press*; Worsdell et al., 2000). FCT programs typically require differential reinforcement procedures, wherein an independent response results in higher potency reinforcement than a prompted response, in order to quickly increase independent responding while quickly decreasing instances of challenging behavior (Tiger et al., 2008). Additional common features of individualized programming relate to the selection of the communication modality and systematic approaches to thin and generalize reinforcement contingencies. These and other problem-solving approaches are addressed by Tiger et al. (2008). Per Tiger and colleagues, instructors should choose a communication response that can be prompted and quickly acquired; this may indicate choosing a simpler form of communication initially than the client may be able to exhibit when not escalated, to increase the likelihood that the client will select the replacement response rather than engaging in challenging behavior. For example, the client may speak in short utterances throughout the day but may require a prompted symbol exchange initially in order to quickly acquire the replacement response, with lower response effort than engaging in challenging behavior. Tiger and colleagues also recommend that thinning the schedule of reinforcement (initially beginning with a dense 1:1 schedule for each communicative response, and systematically thinning to a more naturalistic, variable schedule of reinforcement) might be well underway before introducing caregivers as communication partners. This work has been expanded in recent years to incorporate an alternative communicative response, a “tolerance response” when mands are not honored (Ghaemmaghami et al., 2016).

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## The Key Characteristics of an Effective EIBI Program

This myriad of literature identified several important, and perhaps critical components of an EIBI program (Cohen et al., 2006; Eldevik et al., 2006; Kuppens & Onghena, 2012; Peters-Scheffer et al., 2010). Studies examining the effects of EIBI have suggested that EIBI should occur at an early age and before the age of four years old (Cohen et al., 2006; Harris & Handleman, 2000). The intensity of treatment is also an integral component of an EIBI program (Eldevik et al., 2006, 2019; Peters-Scheffer et al., 2010). Finally, EIBI interventions should refrain from using eclectic approaches (Eikeseth et al., 2002; Eldevik et al., 2006; Howard et al., 2005, 2014; Lovaas, 1987; McEachin et al., 1993).

## Early Intervention

The onset of behavioral intervention should occur at an early age (Cohen et al., 2006; Fenske et al., 1985; Harris & Handleman, 2000). Several articles have evaluated the effect of age of onset on outcomes for EIBI (Cohen et al., 2006; Eikeseth et al., 2002; Fenske et al., 1985; Granpeesheh et al., 2009; Harris & Handleman, 2000; Kuppens & Onghena, 2012). For example, Fenske et al. (1985) compared outcomes for a group of children who began intervention before 60 months of age to a group of children after 60 months of age. Fenske and colleagues found that earlier onset of intervention was associated with a positive outcome (i.e., the child was able to remain living at home with parent and was enrolled in a full-time public school). Eikeseth et al. (2002) employed a

comparison-controlled study which evaluated the effectiveness of an EIBI program for slightly older children (i.e., 4- to 7-year-olds). A group of 13 children who received the intensive intervention was compared to a group of 12 children who received intensive, eclectic treatment (Eikeseth et al., 2002). While behavior intervention is effective for individuals older than four (Eikeseth et al., 2002; Fenske et al., 1985; Lovaas et al., 1973), data demonstrate that outcome gains (e.g., general education placement, increased intellectual functioning, and skill development) decrease the more treatment is delayed (Fenske et al., 1985; Granpeesheh et al., 2009). Additionally, young children may have more neural plasticity than older children (Borman & Fletcher, 1999), as well as less complex learning history which may result in more positive outcomes in response to treatment. Granpeesheh et al. (2009) demonstrated a relationship between the number of treatment hours and the age of the child, suggesting that maximizing the treatment hours before the age of seven might lead to larger treatment gains. Therefore, EIBI should be provided as early as possible.

## Intensive Intervention

Studies suggest greater outcomes for individuals diagnosed with ASD with more intensive behavioral intervention (Eldevik et al., 2006, 2019; Peters-Scheffer et al., 2010). Eldevik et al. (2006) retrospectively compared two groups of children that received low-intensity (i.e., 12 h) behavioral treatment. One group received behavioral intervention while the other group received eclectic intervention. Results showed that the behavioral group made larger gains than the eclectic group. However, Eldevik et al. (2006) reported that these gains were minimal when compared to the gains reported in studies that provided a more intensive treatment (i.e., 20–40 h per week; Lovaas, 1987; McEachin et al., 1993; Smith et al., 2000) dosage. In another study, Eldevik et al. (2019) evaluated the effect of EIBI provided in a low-intensity dosage (i.e., 11.1 h per week) compared to EIBI provided in a higher-intensity dosage (i.e., 18.1 h per week). Groups of 21 and 26 children were assigned to each group, respectively. The low-intensity and high-intensity groups were also compared to an additional group of 17 children who received eclectic special education. While the lower-intensity group did better than the special education group on outcome measures on adaptive behavior, ASD severity, and intellectual functioning after one year, the higher-intensity behavioral group performed better than both groups on these same outcome measures. Furthermore, gains in both the low-intensity and higher-intensity groups were less than gains reported in studies that provided a more intensive delivery model.

The National Research Council (2001) recommended a minimum of 25 h per week of EIBI, whereas Green et al. (2002) recommended a dosage of 20–30 h per week. While recommendations regarding dosage differ slightly, most professionals recommend a dosage between 25 and 40 h per week (Cohen et al., 2006; Roane et al., 2016). Additionally, current research provides evidence that a more intensive EIBI dosage yields more promising outcomes (Eldevik et al., 2006, 2019; Peters-Scheffer et al., 2010) and should typically be provided between 25 and 40 h of intervention per week (Reichow et al., 2012, 2018).

## Behavioral Approach

An EIBI program that includes elements from diverse intervention approaches lessens the effectiveness of the intervention (Eikeseth et al., 2002; Eldevik et al., 2006; Howard et al., 2005, 2014; Lovaas, 1987; McEachin et al., 1993). Several studies have examined the effect of eclectic approaches on treatment gains (Eikeseth et al., 2002; Howard et al., 2014; Lovaas, 1987; McEachin et al., 1993). In a seminal EIBI study (i.e., Lovaas, 1987), an EIBI test group received non-eclectic ABA-only

intervention and was compared to an eclectic and non-intensive treatment group. The EIBI group achieved significantly higher gains than the eclectic group (i.e., 47% and 0% achieved the best outcome, respectively). In a later study completed by Eikeseth et al. (2002) wherein a group of 13 children who received behavioral treatment were compared to a group of 12 children who received an eclectic approach, data showed greater improvements (i.e., improved intellectual functioning and greater skill development) for all 13 children who received behavioral treatment compared to the group of 12 children who had received eclectic intervention. Howard et al. (2014) published similar findings in another comparison of behavior analytic and eclectic early interventions. Therefore, an EIBI program should only use principles and procedures derived from ABA.

## Other Factors for Success

Other components have been suggested as critical factors of an EIBI program (Eldevik et al., 2012; Jacobson et al., 1998; Larsson, 2003). While these components have not yet been thoroughly evaluated and further research is needed to understand the importance of these components, many professionals agree that parent involvement, treatment duration, treatment quality, and treatment setting are critical features of an effective EIBI program (Caron et al., 2017; Larsson, 2003; Lovaas, 1981; Moore & Shook, 2001).

### Parent Involvement

Parent involvement has been suggested as an important component of EIBI (Larsson, 2003; Lovaas, 1981). Professionals have claimed that parent involvement in treatment is associated with better outcomes of ABA treatment (Benson et al., 2008; Burrell & Borrego, 2012; Solish & Perry, 2008). Since EIBI is based on the principles and procedures of ABA, it is likely better treatment outcomes in EIBI are also associated with parental involvement. Parent involvement should begin at intake because parents play a valuable role in the development of treatment goals (Leaf & McEachin, 2008). Parents often know their child better than anyone, therefore the parent is more likely to identify goals that are most meaningful to the client. The development of meaningful goals may be correlated with more positive behavior change (Gore et al., 2019). Parents should then be trained to implement the strategies carried out by the EIBI provider so that treatment may occur throughout the child's daily life (Leaf & McEachin, 2008; Lovaas, 1987). Several studies have demonstrated the ability to successfully train parents to implement formal EIBI with their children (e.g., Hastings & Johnson, 2001; McConachie & Diggle, 2007). Additionally, research has shown that parent involvement serves a vital role in generalization and maintenance of treatment (Green, 1996; Lovaas, 1987; Lovaas et al., 1973; McEachin et al., 1993). Therefore, parents should be trained in ABA procedures and involved throughout the duration of their child's EIBI program.

### Duration

While the suggested duration of EIBI varies, a period of one to two years is most commonly recommended (Caron et al., 2017; Jacobson et al., 1998; Makrygianni & Reed, 2010). Since EIBI is comprehensive, adequate time must be provided in order to allow for the development of all skill areas (e.g., social, adaptive, and language). Makrygianni and Reed (2010) conducted a meta-analysis to evaluate the effectiveness of EIBI programs for children with ASD. Makrygianni and Reed (2010) assessed the duration of EIBI as a predictor of outcome and reported on one statistically significant correlation ( $r = 0.898$ ) which showed that EIBI programs were more effective the longer they occurred, when compared to eclectic programs. However, extended treatment duration was not correlated with

significant pre-post differences in child-specific measures. Makrygianni and Reed (2010) concluded that the child progress rate is not necessarily maintained throughout the duration of EIBI and the effectiveness of the program may not be dependent on the EIBI program's duration. However, Makrygianni and Reed (2010) noted methodological inconsistencies across studies (i.e., inconsistencies of when follow-up measures occurred, and in some studies, children had been receiving treatment while others just started treatment). Further research on the impact of duration on the effectiveness of EIBI is needed (Makrygianni & Reed, 2010).

### **Treatment Quality**

Quality of treatment is an important factor for any behavioral intervention (Moore & Shook, 2001). Treatment quality can be impacted by parent and provider training (Eikeseth, 2010; Fava & Strauss, 2011; Makrygianni & Reed, 2010), the comprehensiveness of the program (Eikeseth, 2010; Makrygianni & Reed, 2010), and the extent to which the EIBI program is individualized to the learner (Stahmer et al., 2011).

Instructors and parents should be trained on the theoretical understanding of behavior analysis as well as be clinically trained in intervention procedures (Eikeseth, 2010). Eikeseth (2010) suggested, "A competent EIBI-professional must be able to carry out clinically all of the principles and methods mentioned above, across several children with different levels of learning disabilities" (pp. 241–242). If the individual implementing the intervention is not well-trained the treatment integrity may decrease (Digennaro-Reed et al., 2010). As treatment integrity decreases, the effectiveness (Fryling et al., 2012), and therefore the quality, of treatment may also decrease. Instructor training can be achieved through graduate programming, by achieving board certification in behavior analysis (BCBA; [www.bacb.com](http://www.bacb.com)), or by working in an apprenticeship model under a competent EIBI professional (Eikeseth, 2010; Fava & Strauss, 2011). Parent training can be achieved by using training tools such as manuals and curriculums (e.g., The RUBI curriculum; Bearss et al., 2018) and videos, as well as live training by a competent EIBI professional (Fava & Strauss, 2011).

A quality EIBI program should also target skills across many different domains (i.e., communication, adaptive skills, social and play skills, and motor skills) such as joint attention, manding, responding to social stimuli, matching, and identifying, playing with a variety of items with peers, and initiating and successfully sustaining social interactions, and these skills should be more complex as the child masters earlier skills (Eikeseth, 2010; Fava & Strauss, 2011). The program should also be individualized for the learner and interventions should be tailored to meet the needs of the child (Reichow et al., 2018). This might mean identifying the child's specific areas of strengths and weaknesses and selecting goals, objectives, and teaching strategies based on these strengths and weaknesses as well as ongoing in-the-moment assessment and the use of clinical judgment (Leaf et al., 2016).

### **Treatment Across Settings**

Finally, EIBI should occur across environments (Eldevik et al., 2012, 2019; Fava & Strauss, 2011). Treatment may start in a center-based setting where training is provided in one-to-one, free play, and group formats (Fava & Strauss, 2011). In their review, Fava and Strauss (2011) found that center-based EIBI programs typically follow a rotation between free play, guided group play, and an intensive one-to-one format. Intervention is then transitioned to the home and implemented by a trained parent (Fava & Strauss, 2011). This structure promotes rapid skill acquisition while also increasing opportunities for generalization (Fava & Strauss, 2011). Some models have effectively provided EIBI in other settings such as the school (Eldevik et al., 2012) and the community (Eldevik et al., 2019). Eldevik et al. (2012) and (2019) provided data that treatment gains can be made when EIBI is delivered

in settings other than the center or home but additional staff training and environmental modifications (e.g., space for one-to-one teaching) may be necessary.

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## Populations Represented in the Literature

EIBI is most commonly employed with children with ASD (Cohen et al., 2006; Eikeseth et al., 2002, 2012; Fenske et al., 1985; Lovaas, 1987; McEachin et al., 1993). However, EIBI has been demonstrated to be effective for children diagnosed with pervasive developmental disorders-not-otherwise-specified (PDD-NOS; Matson et al., 2008) and intellectual disability (Smith et al., 1997). Further research is needed to determine the effectiveness of EIBI for other populations such as language disorders, Down syndrome, Prader–Willi syndrome, Fetal Alcohol syndrome, abusive head trauma, and behavioral disorders.

In the area of ASD, EIBI has been evaluated across children of different ages, IQ scores, skill sets, and severity of ASD (Ben-Itzhak & Zachor, 2007; Eikeseth, 2009; Harris & Handelman, 2000). Each of these child characteristics has been demonstrated to be a potential predictor of child outcomes (Ben-Itzhak & Zachor, 2007; Matson & Smith, 2008; Perry et al., 2013). Age of onset of treatment is a predictor of EIBI success (Eikeseth, 2009; Eldevik et al., 2009; Makrygianni & Reed, 2010; Reichow, 2012; Virues-Ortega, 2010). Though marked improvements have been observed across a variety of ages (Eikeseth et al., 2002; Fenske et al., 1985), the amount of treatment gain is closely associated with younger age at the onset of treatment and treatment is likely most effective when started before the age of four-years-old (Granpeesheh et al., 2009; Perry et al., 2013). Another predictor of EIBI success is IQ at onset of treatment (Ben-Itzhak & Zachor, 2007; Harris & Handelman, 2000; Makrygianni & Reed, 2010; Matson & Smith, 2008). While data demonstrate children with varying IQ scores at treatment onset make treatment gains, children with an IQ score of 50 or higher at the onset of treatment achieve greater outcomes as a result of treatment (Matson & Smith, 2008). A final demographic that has been studied and found to be a potential predictor of treatment outcome is a child's ASD severity at the onset of treatment (Ben-Itzhak & Zachor, 2007; Smith et al., 2015). Children who display lower levels of restrictive and repetitive behavior and fewer skill deficits at the onset of treatment may achieve better outcomes (Ben-Itzhak & Zachor, 2007; Smith et al., 2015).

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## Contemporary Outcomes Associated with EIBI

### EIBI Outcomes Summary by Decade

Healy and Lydon (2013) summarized decade-by-decade outcomes associated with EIBI, across numerous group studies. The studies summarized by Healy and Lydon each used a group design, and therefore represent some of the larger sample sizes in applied behavior analytic literature. The summary included key components of the participant's demographic, clinical, and treatment profile, such as ranges for age at intake, intake assessment scores (such as the norm-referenced Vineland-2 and/or IQ scores), dosage of treatment (i.e., hours per week of EIBI or control therapy), and total duration of treatment. Clinical outcomes were reported in skill acquisition across multiple domains of treatment (i.e., communication, adaptive skills, social and play skills, and motor skills), improvement in composite scores of the Vineland-2 or other norm-referenced skills assessment, and/or IQ scores. Absent from the demographic profiles were references to racial or cultural identity, diagnostic criteria outside of ASD (i.e., comorbidities), or indications of socioeconomic status. Also absent from outcome measures were overall indications of social validity/acceptability and quality of life measures.

Many of the studies included in the Healy and Lydon work are described throughout this chapter. In summary, the 21 studies overviewed by Healy and Lydon included participants ranging in mean age from 30 to 79 months old at intake, a mean range of service dosage between 12.5 and 40 h per week (with all but one study averaging a minimum of 15 h per week), and with treatment delivered for a range from 6 months to 3 years. Summary recommendations included beginning EIBI programs prior to 4 years of age and receiving a minimum of 25 h per week for at least 2 years.

Of these studies included in the review, two published follow-up results post-2013 (Howard et al., 2014; Smith et al., 2019). This is particularly significant given that most studies in the behavior analytic literature base examine the efficacy of goals across a relatively short maintenance period (sessions, days, or weeks), and there is a paucity of longitudinal analysis of the effects of early intervention at the individual and group level.

## Critique of Research Design and Call for Analysis of Predictive Variables

Matson and Smith (2008) offered a critical review of the emerging outcomes of EIBI, including favorable client progress, shortcomings in the experimental design in the literature, and opportunity for identification of predictive features of favorable outcomes (i.e., which treatment variables were most effective, and for whom). This review highlighted an opportunity to evolve the literature base to explore, through increasingly rigorous research, variables related to successful outcomes in the treatment of ASD. These variables included age at intake, intake severity level, communication skills, strategies and methodologies used within treatment packages, dosage (i.e., hours per week of service delivered), duration of services, and characteristics of the service provider (e.g., years of experience, training, etc.) (Matson & Smith, 2008). This focus on client and provider characteristics was a particular contribution to the growth of aggregate outcomes work in ABA. Matson and Smith hypothesized the strongest correlations between characteristics and outcomes would be the severity of ASD symptoms, IQ scores, and comorbidities.

### Symptom Severity

Regarding symptom severity, the authors posited that milder symptoms (i.e., lower severity) would be correlated positively with improved outcomes following treatment; this was based on pre-post test data gathered from research subjects who did not receive services. At the time (2008), there was little data to confirm this hypothesis. In studies since published, “no treatment” control is often captured through a randomly assigned waitlist control; that is, a group is randomly assigned to receive treatment at a later date, once the study concludes. There is an opportunity to evaluate the hypothesis posed by Matson and Smith by exploring the statistical analysis of the waitlist control group in these studies, to determine if there was in fact a relationship between lower severity at intake and more favorable developmental trajectory in the control group.

### IQ Scores

Intellectual ability, as measured by IQ scores at intake, was also highlighted as a critical variable correlated to treatment outcomes (Matson & Smith, 2008). The cut-off of 50 points is offered from the studies included in the analysis, with higher intake IQ scores correlated with higher final outcomes at end of treatment (Eaves & Ho, 1996). The lower IQ scores were correlated with “aloofness,” or what may be defined as poor attendance. While it stands to reason that poor attending would function as an initial barrier to progress in short-term EIBI studies, it also begs the question of to what extent intellectual capacity can accurately be assessed, when the client is unable to attend to the assessor. At any rate, the authors noted that lower IQ and higher symptom severity at intake are generally corre-

lated and that it is difficult to determine from the existing literature which characteristics particularly affect treatment outcomes.

### **Comorbidities**

Comorbidities is the third area identified as highly relevant to treatment outcomes. Comorbid psychopathology is high in those diagnosed with ASD, particularly diagnoses of anxiety, depression, and ADHD. However, these are largely unexamined in young children, and symptoms typically emerge later in life. Therefore, the authors conceded that more research is needed to understand the relationship between comorbidities and treatment outcomes in young children.

### **Research Design**

Finally, Matson and Smith (2008) make a compelling case for the necessity of improved methodological rigor in reporting treatment outcomes in the EIBI literature. The article notes that several of the group studies lacked an exhibition of experimental control, due to having no control group (i.e., quasi-experimental design), while several other group designs used control groups that were not randomly assigned. While more rigorous than simple case studies, Matson and Smith maintain that the advancement of the field should rely upon the inclusion of randomized control in future research.

Along with the study design, the authors highlight that the literature base in EIBI does not frequently define precisely the intervention being delivered, and rather describes the services as being “ABA-based,” but without a detailed presentation of specific or manualized methodology, which, the authors assert, was an essential merit of the 1973 Lovaas study. That is to say, the merit was not in the particular strategies used, but in the effect of measuring their efficacy as a defined package, compared to the vast array of studies evaluating a single package component. This is a significant point, as modern practitioners often claim to implement practices based on their understanding of the literature, as they piece together strategies demonstrated as effective across multiple disparate clients in the literature and combine them into a “package” which is not - as a whole - vetted for use with particular client characteristics. This is consistent with the Lechago and Carr commentary and continues to be an opportunity and need for future study.

### **Statistical Analysis and Meta-analysis: Dosage and Duration**

Consistent with literature (Reichow & Wolery, 2009) recommending intensive service levels (i.e., hours of service delivered weekly, or treatment dosage), Linstead and colleagues (2017) conducted a multiple regression analysis of program dosage for a curriculum-supported ABA-based autism intervention across 1468 participants, ages 18 months to 12 years. Linstead’s findings were summarized as providing support for significant treatment effects related to dosage and duration, with the strongest dosage-response relationship in the language and academic learning domains. Similarly, in a meta-analysis of 22 ABA-based studies, Virues-Ortega (2010) analyzed clinical outcomes for 323 participants receiving ABA-based intervention. The authors echoed challenges in interpretation based on a variety of study methods and treatment procedures used, but various statistical analyses of the included studies allowed for interpretation beyond examination of each article in isolation; namely, meta-regression analysis of dosage showed that dosage and duration affect treatment outcomes, with the strongest impact to receptive and expressive language gains. Notably, Virues-Ortega also indicated that the total duration of services was likely a predictive variable of successful outcomes, but stopped short of making a recommendation for a program’s total duration, based on available evidence. These studies offer support for recommendations of intensive intervention for individuals with comprehensive needs.



## Conclusion

Founded by Lovaas et al. (1973) and the UCLA YAP, EIBI is an effective and empirically validated treatment package for achieving promising outcomes for young children with ASD (Cohen et al., 2006; Harris & Handleman, 2000; Harris et al., 1991; Jacobson et al., 1998; Lovaas, 1987). Early EIBI studies were groundbreaking in that they provided an approach that resulted in freedom from restrictive environments (Anderson et al., 1987; Birnbrauer & Leach, 1993; Harris et al., 1991; Lovaas, 1987; McEachin et al., 1993; Smith et al., 1997). Following these early studies, many replications followed, and these replications provided valuable information pertaining to the benefits of early intervention and factors for success such as age and IQ at treatment onset and recommended treatment intensity (Jacobson et al., 1998). However, precise replication and interpretation remain challenging due to vague summaries of group research and a large body of single-subject design, which results in significant variability of treatment packages (Lechago & Carr, 2008; Virues-Ortega, 2010). As a result, research has yet to offer definitive conclusions regarding factors such as the duration of treatment, the impact of parent involvement, and the level of training of instructors and parents. Continued evaluation is also needed across participant demographics such as diagnosis, age, cognitive level, culture, and gender. Additionally, outcome measures that may be more meaningful for the family and the child are needed.

Professionals should continue to evolve EIBI research and practice. Future research may include more group studies, including randomized controlled trials (e.g., waitlist control) that compare packaged approaches. These future studies should include the combinations of evidence-based procedures and the key characteristics outlined in this chapter, in order to build upon the continued success of early studies. In addition, future research should incorporate an ongoing evolution of practice, which includes a focus on topics such as improving cultural responsiveness (Fong et al., 2016; Mathur & Rodriguez, 2021; Miller et al., 2019) and operationalizing assent-based procedures (Morris et al., 2021).

Finally, ongoing evolution in the areas of outcome measurement and individualized treatment selection procedures are recommended. In addition to the clinical outcomes included in many of the studies presented here (e.g., IQ, Vineland Adaptive Scales), researchers should explore expanded measures to reflect the overall impact on quality of life and social validity. As a guiding example, an introductory standard set has been developed by an international working group (International Consortium for Health Outcomes Measurement, n.d.); this set of outcome measures for autism treatments is a compilation of norm-referenced assessments, skills assessments, challenging behavior indexes, and quality of life assessments and serves as a foundational battery of outcomes measures to further demonstrate the value of autism services such as EIBI. Future efforts may also endeavor to expand upon existing knowledge by developing, based on the literature, systematic approaches to identifying key variables in a child's profile in order to guide treatment selection and deliver optimized treatment outcomes.

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