# Developmental Approaches to Treatment of Young Children with Autism Spectrum Disorder

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**Keywords**

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Children with autism/autism spectrum disorder (ASD) demonstrate impairments in social, language, motor, and usually cognitive domains of development, and they often have some stereotyped and repetitive behaviors, with symptom patterns that may change considerably across their lives. In 1972, Rutter classified autism as a developmental disorder and the field began to appreciate the value of a developmental approach to evaluation and treatment (Ozonoff and Rogers 2003; Rutter 1972). Autism is now understood as a developmental disorder of neurobiological origin (National Research Council (NRC) 2001) and is defined as a "pervasive developmental disorder," a term that emphasizes "the pervasiveness of difficulties across various domains of development as well as the important developmental aspects of these conditions" (Koenig et al. 2000).

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Taking this developmental perspective one step further, Gillham et al. (2000) argued for a developmental operational definition of ASD that considers the range of syndrome expression within a developmental context, which categorical definitions of ASD fail to do. The (American Psychiatric Association 2013) revisions of the diagnostic criteria for ASD in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders do, in fact, move to a single spectrum disorder that considers the severity of each individual's symptoms in the core domains and specifically recognizes the importance of the child's developmental level when considering a child's ability to develop and maintain relationships. (The terms "autism" and autism spectrum disorder (ASD) will be used interchangeably in this chapter.)

Not only have the definition and the etiology of autism evolved to include a developmental perspective over time, but developmental approaches to treating autism in young children have developed as well. Schopler and Reichler (1971) created an early "developmental therapy"—now the TEACCH approach, defined later—to treating autism in young children. This treatment model focused on the unique impairments of each child

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and viewed parents as the "most effective developmental agents for their children" (Schopler and Reichler 1971, p. 99). Many other developmental approaches to treating autism in young children have been created since that time, and more and more studies are being conducted to determine the efficacy of these approaches.

In fact, treatment recommendations by the NRC for efficacious ASD interventions include several explicitly developmental considerations: beginning soon after diagnosis, including *developmentally appropriate* activities to meet identified objectives, being intensive with 25 h or more of treatment each week, working toward meeting *individualized goals* in a planful way, *including the family* by incorporating a parent training component, including ongoing program evaluation and *assessment of the child's developmental progress,* and including opportunities for the child to be in *inclusive settings* (emphasis added; NRC 2001).

The main purpose of this chapter is to provide the reader with a review of the empirical work published on the major developmental treatment approaches for young children with autism to assist with selection of appropriate, empirically supported interventions for young children with ASD and their parents.

## Defining Developmental Approaches to ASD Treatment

In the field of early autism intervention, there is not yet agreement about the criteria that comprise the definition of a developmental approach. The hallmarks of developmental approaches described in the literature are twofold: the application of the principles of developmental science within the intervention, and the use of typical developmental sequences as the framework for assessment and program planning (Corsello 2005; Rogers and Ozonoff 2006; Rogers and Wallace 2011; Vismara and Rogers 2010; Wetherby and Woods 2008; Wieder and Greenspan 2001). Some previous reviews of developmental approaches to ASD treatment only consider the incorporation of developmental science as the integral component (e.g., Ospina et al. 2008); however, the majority of reviews and experts in the field of autism intervention include both criteria.

Developmental approaches base assessment and treatment program planning on sequences of typical child development. In doing so, they recognize the uniqueness of each child's developmental profile and learning needs and create a framework for individualized program planning. Developmental approaches can be applied systematically, via assessing, developing learning objectives, and systematically teaching skills in the sequence in which typically developing children learn (Vismara and Rogers 2010).

Developmental approaches also typically embrace attachment theory and science concepts concerning the importance of high quality adult–child relationships marked by adult sensitivity and responsivity to children's cues for optimum child learning. Developmental approaches are typically constructionist models of child learning, in which children's spontaneity, initiative, interests, and motivations are encouraged and reciprocal social interactions are considered critical opportunities for learning. Adults support and encourage rather than direct child learning.

Previous reviews of treatment approaches for young children with ASD have conceptualized a dichotomy between behavioral approaches and developmental approaches (Ospina et al. 2008; Pajareya and Nopmaneejumruslers 2011). Behavioral approaches stem from the science of learning, whereas developmental approaches stem from developmental science. The dichotomy between behavioral and developmental approaches is appropriate if one is only considering behavioral approaches in their pure form (i.e., discrete trial training based upon applied behavior analysis (ABA) as described by Lovaas in his 1987 seminal paper). However, most community-based programs utilizing discrete trial training and applied behavior analysis (ABA) now incorporate many additional components that could be considered "developmental," including a focus on developmental prerequisites to speech and language (e.g., joint attention and gestural communication) and the use of developmental skills inside discrete teaching (Lifter 2008).

Children's learning can often be validly interpreted through both the lenses of ABA and developmental science. It has been well demonstrated that infants (as well as children and adults) are both operant learners and respondent learners. The fact that certain developmental skills emerge in an ordered fashion and build on prior abilities nevertheless assumes that learning is occurring as children master new developmental skills, and that both operant and respondent processes are at work. As representational capacities develop, they provide additional tools for learning but the laws of operant and respondent learning apply to representations as well as to sensory motor behavior, as is so clearly seen in phobias and obsessive compulsive disorders. Thus, developmental growth and operant learning are not separate in nature, and their separation in early intervention for ASD is likely working against us.

## Methods for Systematic Literature Review

A number of comprehensive research reviews have reported the efficacy of different ASD treatment approaches (e.g., Eikeseth 2009; McConachie and Diggle 2007; Odom et al. 2010; Ospina et al. 2008; Rogers 1998; Rogers and Vismara 2008; Rogers and Wallace 2011; Smith 1999; Vismara and Rogers 2010; Wallace and Rogers 2010; Warren et al. 2011). Of particular importance to note is Wetherby and Wood's (2008) review that focuses specifically on developmental approaches to treating autism in infants and toddlers. The current chapter will build upon Wetherby and Wood's review by including studies for children up to 5 years of age.

Although the National Association for the Education of Young Children (NAEYC) has defined the "early childhood period" as birth to 8 years of age (Bredekamp and Copple 1997), the following literature review includes studies of approaches for infants, toddlers, preschoolers, and children of kindergarten age, before children are participating in autism treatments designed for "school-aged" students.

This review was conducted using a systematic strategy developed a priori. A list of developmental approaches was compiled by collecting the names of treatment approaches reviewed in the ASD treatment efficacy review articles and chapters cited in the beginning of this section. In addition, we entered the following combinations of keywords into the psychological, educational, and medical search engines PSYCINFO, ERIC, and PUBMED: "*developmental treatment*" or "*developmental approaches*" or "*developmental intervention*" combined with either "*autism*" OR "*ASD*." This search strategy primarily identified treatment approaches that have been "branded" with a consistent treatment name and have an accompanying treatment manual (e.g., Rogers and Vismara 2008).

Once the names of the major developmental treatment approaches were identified, the third author reviewed the list to ensure that it was comprehensive. This resulting list of ten treatment approaches was used in our secondary search. The secondary search included a separate search for peer-reviewed journal articles within each treatment approach. The name of the treatment approach was entered as a keyword along with the keywords "*autism*" or "*ASD*." A limitation of this search strategy was that treatment studies conducted before the treatment approach was formally named were unlikely to show up in the results; consequently, these studies are likely to be omitted from this review. The advantage of using treatment names in the search criteria is that studies reviewed reflect the branded treatment approach and treatments that have been branded are further along in their own development and are more likely to be administered in a consistent manner from one study to the next.

The next step in our review involved excluding studies that did not meet our inclusion criteria. We excluded studies in which the minority of subjects was in the targeted age range. In addition, we excluded papers that were descriptive rather than data based, so that only studies exploring the efficacy of the treatment approach were included in our final analysis. Finally, we excluded papers that had not been published in peer-reviewed journals.

Each treatment approach identified in the systematic search was reviewed on two levels. First, the research studies for each approach and the accompanying treatment manual (if applicable) were read to determine, on a global level, how many developmental components each treatment approach encompassed (see *Review Level 1* below). Next, each study that met search criteria was reviewed using Nathan and Gorman's (2002, 2007) criteria for establishing empirical support (see *Review Level 2* below). Each of these levels of review is described in detail below.

## Review Level 1: Identification of Developmental Components of Treatment Approaches

In order for an intervention approach to be considered "developmental" and included in this review, the approach need only be self-identified by its creators as developmental. Thus, several approaches that some have considered developmental are not covered here because they were not self-identified as being so, including the EarlyBird Programme, LEAP, Son-Rise, the Walden Program, Pivotal Response Training, and the Scottish Centre for Autism Preschool Treatment. There were several additional commonalities among the developmental approaches, and we indicated the presence or absence of these as well in our review.

1. *Following the sequence of typical development:* While much has been debated in the field regarding developmental delay versus developmental deviance in autism (Carpenter et al. 2002), developmental treatment approaches generally reference typical developmental sequences when planning intervention. They consider the unique developmental difficulties expressed by children with autism and then tailor treatment to meet each child's individual developmental profile and strengths (Burack et al. 2001; Wetherby and Woods 2008).
2. *Using principles of developmental science:* Developmental treatment approaches generally incorporate the knowledge gleaned from developmental science to inform the intervention (Burack et al., 2001). For example, approaches may take into account current research on typical language development to inform the contexts or the functions in which language development is targeted and the strategies used to facilitate language development for young children with ASD.
3. *Relationship based:* Developmental treatment approaches are often delivered in the context of meaningful interpersonal relationships between adult and child and the quality of adult–child relationships is often directly considered in the treatment approaches (Greenspan and Wieder 1997; Sandall et al. 2000; Stern 1985).
4. *Child-centered:* Developmental treatment approaches are often child-centered and reciprocal. The child is often viewed as an active (not passive) participant in his/her learning (Piaget 1954). Often, either the parent or the therapist follows the child's lead in delivering the intervention by honoring the child's choices and interests (Mastergeorge et al. 2003; Siller and Sigman 2002), or the child and adult share control, interact reciprocally, and co-construct activities (Rogers and Dawson 2010; Siller and Sigman 2002).
5. *Play based:* Developmental treatment approaches are often play based, as play is the context in which young children typically learn (Lifter 2008; Rogers 2005; Vygotsky 1978).

The presence or absence of these components in each of the developmental approaches reviewed in this chapter is noted in Table 20.1. In addition, the following features of each treatment approach were also considered and included in this table:

a. *Is the treatment comprehensive or targeted?* Comprehensive treatment approaches address multiple domains of development for children with ASD (Eikeseth 2009; Odom et al. 2010; Rogers 1998; Stansberry-Brunsnahan and Collet-Klingenberg 2010; Vismara and Rogers 2010; Wetherby and Woods 2008). In contrast, targeted approaches focus on supporting "pivotal developmental behaviors," "foundational behaviors" (Mahoney and Perales 2003, 2005), or "developmental precursors" (Schertz and Odom 2007), such as attention, persistence, interest, initiation, cooperation, joint attention, imitation, symbolic play, or affect, which are core deficits that are believed

**Table 20.1** The developmental components of ASD treatment approaches—six core criteria and three additional considerations

| Developmental approach | 1. Sequence of typical development? | 2. Principles of developmental science? | 3. Relationship based? | 4. Child-centered? | 5. Play ased? | A. Comprehensive or targeted? | B. Delivered by therapists, parents, or both? | C. Delivered in a naturalistic setting or a clinic-based setting? |
|---|---|---|---|---|---|---|---|---|
| Denver Model/Early Start Denver Model (ESDM) | Y | Y | Y | Y | Y | Comprehensive | Both | Both |
| Developmental Individual-Differences, Relationship-based (DIR/Floortime) | Y | Y | Y | Y | Y | Comprehensive | Both | Both |
| Hanen's More than Words | Y | Y | Y | Y | Y | Targeted (communication/language) | Parents | Naturalistic |
| Joint Attention Mediated Learning (JAML) | Y | Y | Y | Y | Y | Targeted | Parents | Naturalistic |
| Joint Attention and Symbolic Play Engagement Regulation (JASPER) | Y | Y | Y | Y | Y | Targeted | Both | Clinic based |
| Relationship Development Intervention (RDI) | Y | Y | Y | Y | | Comprehensive | Parents | Naturalistic |
| Responsive Education and Prelinguistic Milieu Teaching (RPMT)/Milieu Teaching | Y | Y | | Y | Y | Targeted (communication/language) | Both | Naturalistic |
| Responsive Teaching (RT) | Y | Y | Y | Y | Y | Comprehensive | Parents | Naturalistic |
| Social Communication, Emotional Regulation, and Transactional Support (SCERTS) | Y | Y | Y | Y | Y | Comprehensive | Both (and teachers) | Naturalistic (preschool classroom) |
| Treatment and Education for Autistic and related Communication Handicapped Children (TEACCH) | | Y | Y | Y | | Comprehensive | Both | Both |

to have cascading effects upon cognitive, language, and social-emotional development (Koegel et al. 1989; Mundy et al. 1990).

b. *Is the treatment delivered by therapists, parents, or both?* The inclusion of parents in a developmental treatment approach is a critical part of the relationship-based focus. In addition, training parents to deliver the intervention during daily routines often means that the intervention can be implemented at younger ages and at more intensity (Mahoney and Perales 2003, 2005; McConachie and Diggle 2007; Prizant et al. 2003; Schertz and Odom 2007; Wetherby and Woods 2006).

c. *Is the treatment delivered in the child's natural setting or is it delivered in a clinic setting?* Many developmental treatment approaches focus on implementing the intervention in a child's natural environment, a requirement of the Individuals with Disabilities Education Improvement Act of 2004, Part C (e.g., home, childcare center, or preschool; Prizant et al. 2003; Wetherby and Woods 2006; IDEA 2004). However, other approaches focus on first teaching skills in a highly structured learning environment and then working with the child to generalize these skills to other more complex, naturalistic settings (Dawson and Osterling 1997). Regardless of the teaching environment, the goal of all early intervention approaches for young children with autism is to increase the child's ability to actively and meaningfully participate in his/her family and community environments (Sandall et al. 2000).

## Review Level 2: Criteria for Establishing Empirical Support for Treatment Efficacy

In addition to considering the developmental components of each treatment approach, we critically analyzed efficacy studies using Nathan and Gorman's (2002, 2007) criteria for establishing empirical support. Following Rogers and Vismara's (2008) review on comprehensive ASD treatments, we have added additional criteria to those of Nathan and Gorman. The criteria are as follows:

**Type 1 studies** Prospectively designed randomized clinical trials that include blind assessments, inclusion/exclusion criteria, state-of-the-art diagnosis, adequate sample sizes to power the analysis, and clearly described statistical methods. In addition, we expect Type 1 studies to include measures of treatment fidelity to determine the degree to which the treatment delivery adheres to the treatment model (Rogers and Vismara 2008; Stansberry-Brusnahan and Collet-Klingenberg 2010).

**Type 2 studies** Clinical trials with a comparison group, and single-subject designs in which there is clear experimental control over the dependent variable. Type 2 studies have some significant flaws, but the overall study design is such that the data can still be used to answer the study question, therefore providing useful information regarding the effectiveness of the intervention.

**Type 3 studies** Studies with significant methodological flaws, including studies with pre/post designs without a control group, single-subject studies with designs that do not clearly demonstrate experimental control over the dependent variable, and studies with retrospective designs.

**Type 4 and 5 studies** Secondary analysis articles (not included in this review).

**Type 6 studies Case reports (not included in this review).** To establish inter-rater reliability on the Nathan and Gorman (2002, 2007) criteria, both the first and second author independently rated 20% of the studies. Inter-rater reliability for classification of study type was 100%. Reliability for the seven criteria (randomization, inclusion and exclusion criteria, use of standardized diagnostic batteries, comparison group, blind assessors, treatment of fidelity, and use of a treatment manual) was 82.5%. All disagreements were a result of the case in which one rater assigned a "+/−" rating and the other either a "+" or a "−" rating only.

Given the large number of studies available for some treatment approaches, we decided to limit the papers to at most three per approach and to prioritize Type 1 and Type 2 studies if they were available. Table 20.2 provides an overview

**Table 20.2** Criteria for establishing empirical support for treatment efficacy (Nathan and Gorman (2002, 2007)

| Author(s) and Year | Sample | Outcome measures | Treatment procedures | Findings | Nathan and Gorman (2002, 2007) criteria |
|---|---|---|---|---|---|
| *Denver Model/Early Start Denver Model (ESDM)* | | | | | |
| Rogers et al. 2006 (Denver Model) | 10 ss, aged 20–65 mos.; all male; all nonverbal | Collected within 3 weeks of last tx session: ADOS, SCQ, MSEL, VABS–Interview Edition, CDI, intervention hx, play-based speech probes; collected during weekly tx sessions: speech samples; collected at 3 mos. | Single-subject design (A-B-A) using randomization to either Denver Model or PROMPT; 12 weekly 1-h sessions; for Denver Model condition, parents were present and active in sessions, and were expected to deliver treatment objectives 45 min/day; for PROMPT condition, parents observed sessions via video, and were expected to work on children's word development 30 min/day | No differences in acquired lang. skills by group; by end of tx, 8/10 children used 5+novel, functional words spontaneously and spoke multiple times per hour | Type 2 study:<br>+RCT,<br>+Blind assessments,<br>+Incl/excl criteria,<br>+Standardized dx battery,+Comparison group,<br>+Tx fidelity,<br>+Tx manual |
| Vismara et al. 2009 (ESDM) | 8 ss, aged 10–36 mos., seven had diagnosis of autism; one child diagnosed with autism at 18 mos. at conclusion of tx but showed significant signs consistent with autism at time of enrollment | Coding of parent–child play and therapist-child play for number of spontaneous functional verbal utterances and imitative acts; ADOS and MSEL; CBRS; ESDM Fidelty Scale for parent implementation of model | Nonconcurrent multiple baseline design; parents attended 1-h clinic visit/week for 12 weeks to receive one-on-one parent training in ESDM | Child's production of spontaneous functional verbal utterances increased w/ parent and therapist once tx began; 7/8 children demonstrated consistent increase in imitative behaviors; number of children's spontaneous verbal utterances showed largest gain once parents met ESDM fidelity; 7/8 parents acquired mastery of ESDM techniques at fidelity level of 85% or above by 6th tx session and maintained through follow up | Type 2 study:<br>−RCT,<br>+/-Blind assessments (not blind to tx, but blind to order of session),<br>+Incl/excl criteria,<br>−Standardized dx battery,<br>−Comparison group,<br>+Tx fidelity,<br>−Tx manual |

**Table 20.2** (continued)

| Author(s) and Year | Sample | Outcome measures | Treatment procedures | Findings | Nathan and Gorman (2002, 2007) criteria |
|---|---|---|---|---|---|
| Dawson et al. 2010 (ESDM) | 48 ss, aged 18–30 mos.; 3.5 males for every 1 female in study; diagnosed with ASD or PDD-NOS; stratified randomization on basis of composite IQ at entry | Collected at study entry and then at the end of 1 year of tx and 2 years of tx: ADI-R, ADOS, MSEL, VABS-Interview Edition, RBS | Randomized to either ESDM group or A/M community tx group; ESDM condition included: 2-h session with trained therapist 2X/day 5 days/week for 2 years (actual mean h = 15.2 h/wk), parent training 2X/mo and were expected to use ESDM strategies during daily activities (actual mean h = 16.3 h/wk), multidisciplinary team, individualized tx objectives; A/M community condition included: comprehensive diagnostic evaluations, referral to community providers for intervention commonly available in the community (actual mean h of individual tx = 9.3 h/wk) (actual mean hrs of group tx = 9.3 h/wk) | At end of 2 yrs. of tx ESDM group showed significantly improved cognitive ability (MSEL) mostly due to receptive and expressive language improvements and significantly improved adaptive behavior (VABS) when compared to A/M group; children in the ESDM group were more likely to experience a change in diagnosis from autism to PDD-NOS than A/M group | Type 1 study:<br>+RCT,<br>+Blind assessments,<br>+Incl/excl criteria,<br>+Standardized dx battery,<br>+Comparison group,<br>+Tx fidelity,<br>+Tx manual |
| *Developmental Individual-Differences, Relationship-Based Model (DIR/FLOORTIME)* | | | | | |
| Hilton and Seal 2007 | 2 ss, aged 2 yrs; monozygotic twin brothers | CBCS; coded videos of sx for communication and behavior data; mother's journal recorded tx sessions and perceptions of child progress | One twin received DIR and one received ABA; each received 2 1-h weekly sessions administered by clinicians; 16/18 sessions each; both also received speech therapy 2X/wk | Slight gain in communication composite score for ABA child and slight loss for DIR child; contrasted gains and losses in 6 of 7 CSBS subscales; coded behavioral data showed increase in number and duration of crying episodes in ABA child, but none in DIR participant | Type 3 Study:<br>+RCT,<br>+/-Blind assessments (-for CSBS, +for video coding);<br>−Inc/excl criteria,<br>−Standardized dx battery,<br>+Comparison group,<br>−Tx fidelity,<br>+Tx manual |

**Table 20.2** (continued)

| Author(s) and Year | Sample | Outcome measures | Treatment procedures | Findings | Nathan and Gorman (2002, 2007) criteria |
|---|---|---|---|---|---|
| Pajareya and Nopmaneejumruslers 2011 | 32 ss, aged 2–6 yrs of age; all met DSM-IV criteria for autistic disorders; 8:1 male to female ratio | Primary outcome measure: FEAS; CARS; and FEDQ | Added new DIR/Floortime tx to see if there would be additional benefits over routine clinical care; stratified random assignment based on age and symptom severity; control group got typical treatment as usual in Thailand (20–40 h of ABA), experimental group got supplemental DIR Floortime tx administered to parents (no direct contact with children in this condition); 1 day training workshop + 3 h DVD lecture + 1.5 h one-on-one session, families to deliver 20 h/week of tx at home (actual amount = 15.2 h/wk); | Intervention group showed significantly greater decrease in overall autistic severity w/ CARS; statistically significant gain in FEDQ filled out by parents; parents who added in home DIR/Floortime for 10 h + /week had better tx delivery fidelity than those who did less, but not sig. difference | Type 1 study:<br>+RCT,<br>+Blind assessments,<br>+Incl/excl criteria,<br>−Standarized dx battery,<br>+Comparison group,<br>+Tx fidelity,<br>+Tx manual |
| Solomon et al. 2007 | 68 ss, aged 18 mos to 6 yrs at time of diagnosis with autistic disorder, PDD-NOS, or Asperger's syndrome | FEAS caregiver and child sections; subjective ratings by home consultants on 6 pt scale of Greenspan's functional developmental levels (FDL); parent satisfaction of PLAY project on 4-pt Likert scale | PLAY Project Home Consultation Project = 1 day parent training workshop; 3–4 h/monthly home visits by consultants for parent training, videotaping, and child assessment; parent-led tx for min of 15 h/week; tx given for 1 year | No change in parents' FEAS scores before and after PLAY; increase in child's total and scaled FEAS scores over 1 year period; 45% of children made "good" to "very good" functional developmental progress; overall parent-reported satisfaction with PLAY project was 90% | Type 3 study:<br>−RCT,<br>+Blind assessments,<br>+Inc/excl criteria,<br>−Standardized dx battery,<br>−Comparison group,<br>+Tx fidelity,<br>+Tx manual |

**Table 20.2** (continued)

| Author(s) and Year | Sample | Outcome measures | Treatment procedures | Findings | Nathan and Gorman (2002, 2007) criteria |
|---|---|---|---|---|---|
| *Hanen's More than Words* | | | | | |
| Carter et al. 2011 | 62 ss, aged 15–25 mos.; 51 male, 11 female | At 5 mos. post-enrollment: parent–child free play procedure, ESCS, Parent Interview for Autism-Clinical Version; at 9 mos. post-enrollment: parent–child free play procedure, ESCS, Parent Interview for Autism-Clinical Version, MSEL; VABS Second Edition, ADOS, clinical DSM-IV impression | ss randomized to HMTW or "business as usual" control group; HMTW provided over 3.5 mos., consisting of eight group sxs w/ parents only and 3 in-home individualized parent–child sx; focus on: (a) improved 2-way interaction, b) more mature and conventional ways of communicating, (c) better skills in communicating for social purposes, and (d) improved understanding of lang. | No main effects of HMTW on parental responsivity or children's communication; decent effect sizes for improvements in parental responsivity; treatment effects on child communication gains to 9 mos. post-enrollment that were moderated by enrollment object interest | Type 2 study:<br>+RCT,<br>−Blind assessments,<br>+Incl/excl criteria,<br>+Standardized dx battery,<br>+Comparison group,<br>+Tx fidelity,<br>−Tx manual |
| McConachie et al. 2005 | 51 ss with ASD, 26 parent–child dyads in tx group and 25 parent–child dyads in control group | MCDI; social communication skills from ADOS-G; parent outcome measures on parent tx fidelity, family resources, and stress | 20 weeks of group instruction 1 h/week using the More than Words Program and three home visits | Children in the training group had significantly larger vocabulary size, but no sig. differences in social communication algorithm of the ADOS-G | Type 1 study:<br>+RCT,<br>+Blind assessments,<br>+Incl/excl criteria,<br>+Standardized dx battery,<br>+Comparison group,<br>+Tx fidelity,<br>+Tx manual |
| Prelock et al. 2011 | 4 ss, aged 37–69 mos. | 3–4 mos. post-tx: CSBS DP (both caregiver questionnaire and examiner's observations), MCDI: Words and Gestures or Words and Sentences, parent responsiveness and parent satisfaction questionnaire, MSEL | Single-subject design; orientation session and 8 2.5 h sessions; clinic based; included parents in didactic and interactive manner; parents taught strategies to increase communication opportunities and interaction w/ their children, and parents developed own "to-do-at-home" plans | For 3/4 children, improvements on social and symbolic communicative acts and vocabulary, but not on MSEL; 4th child was tested differently due to his more advanced initial profile–he showed notable improvement on Mullen scores, but scored in average range both pre- and post-tx | Type 3 study:<br>−RCT,<br>−Blind assessments,<br>−Incl/excl criteria,<br>+Standardized dx battery,<br>−Comparison group,<br>−Tx fidelity,<br>+Tx manual |

**Table 20.2** (continued)

| Author(s) and Year | Sample | Outcome measures | Treatment procedures | Findings | Nathan and Gorman (2002, 2007) criteria |
|---|---|---|---|---|---|
| *Joint Attention Mediated Learning (JAML)* | | | | | |
| Schertz and Odom 2007 | 3 ss, aged 20–28 mos. diagnosed with early ASD as dx by the M-CHAT, PDD-ST-II, & ISCQ | Coded video tapes of weekly 10-min parent–child interaction for four joint attention behaviors: (1) focusing on faces; (2) turn taking; (3) responding to joint attention; (4) initiating joint attention; qualitative data from weekly sx, parent interviews, and parent notes | Parent training in families' homes based on JAML manual (4 phases of tx to increase 4 joint attention behaviors); families received between 11 and 16 tx sx over 9–26 weeks | Single-subject, multiple baseline design; changes in child performance were reflected as the number of 10-s intervals during weekly 10-min videos in which the child engaged in four joint attention behaviors; in tx condition, each of 3 toddlers surpassed baseline performance levels for all 4 targeted outcomes; 2 of 3 toddlers demonstrated repeated joint attention by end of tx | Type 2 study:<br>−RCT,<br>+Blind assessments,<br>+Incl/excl criteria,<br>+Standardized dx battery,<br>−Comparison group,<br>+Tx fidelity,<br>+Tx manual |
| *Joint Attention and Symbolic Play Engagement Regulation (JASPER)* | | | | | |
| Kasari et al. 2006 | 56 ss, aged 3–4 yrs. with ASD as dx by the ADOS and ADI-R | MSEL, ESCS, Structured Play Assessment, Reynell Developmental Language Scales, and 15 min. caregiver-child interaction videotaped and coded for child's play behaviors, types of functional and symbolic play acts, and the joint attention skills of the dyad | Direct therapist-child intervention in the clinic focused on either joint attention skills (JA group) or symbolic play skills (SP group); 30 min per day for 5–6 weeks (on average children in the joint attention group received 28.6 sx and the symbolic play group received 34.7 sx; not a significant difference in # of sx); children in all 3 groups were also enrolled in 30 h. of ABA-based hospital early behavioral intervention | Children randomized to 1 of 3 groups: joint attention (JA), symbolic play (SP), or control group; at time of post-tx children in the JA group initiated significantly more showing and responded more to joint attention in the ESCS and more joint attention in caregiver–child play; children in the SP group showed higher levels of play in the ESCS and caregiver–child interaction and more diverse types of play during the caregiver-child interaction than the other two groups | Type 1 study:<br>+RCT,<br>+Blind assessments,<br>+Incl/excl criteria,<br>+Standardized dx battery,<br>+Comparison group,<br>+Tx fidelity,<br>+Tx manual |

**Table 20.2** (continued)

| Author(s) and Year | Sample | Outcome measures | Treatment procedures | Findings | Nathan and Gorman (2002, 2007) criteria |
|---|---|---|---|---|---|
| Kasari et al. 2008 | 56 ss, aged 3–4 yrs. with ASD as dx by the ADOS & ADI-R in original study; 56 ss at 6 mos. post-tx and 53 ss at 12 mos. post-tx | Assessments of joint attention (JA) skills, symbolic play (SP) skills, mother–child interactions, and language development at pre- and post-tx, and at 6 and 12 months post-tx on the MSEL, the ESCS, the Reynell Developmental Language Scales, Structured Play Assessment, and caregiver–child interaction (see Kasari et al. 2006 above for details) | See Kasari et al. 2006 above | Follow-up to Kasari et al. 2006 study above; both JA and SP groups showed significantly greater growth in expressive language over time when compared to the control group; children who begun tx at the lowest language levels showed significantly more improvement in language development in the JA group than the SP or control groups | Type 1 study:<br>+RCT,<br>+Blind assessments,<br>+Incl/excl criteria,<br>+Standardized dx battery,<br>+Comparison group,<br>+Tx fidelity,<br>+Tx manual |
| Kasari et al. 2010 | 38 child–parent dyads; children were aged 21–36 mos. with ASD as dx by an independent clinician; parents' mean age was 34.5 yrs.; no significant differences found between parents in both groups | MSEL; child-caregiver 15 min. play interaction videotaped and coded for: (a) percentage of time in engagement states (collapsed into unengaged/other; object engagement, and joint engagement); (b) play types (functional, symbolic); and (c) frequencies of initiating and responding to joint attention; MSEL collected pre-tx and at 12-mo. follow up; parent–child play interaction was conducted at pre-tx; after 8 weeks of tx or waitlist and at 12-mo. follow up; caregivers also rated on Caregiver Quality of Involvement Scale and adherence to tx protocol | Immediate treatment (IT) group immediately received 8 weeks of tx; 3 sx/week=24 caregiver-mediated tx sx total in a laboratory playroom setting; each sx included direct instruction, modeling, guided practice, and feedback from the interventionist; intervention focused on ten modules for teaching children joint attention and symbolic play | Child–parent dyads randomly assigned to immediate treatment (IT) group or wait-list (WL) control group; the IT group made significant improvements in amount of time in joint engagement, responsiveness to joint attention, and in the diversity of play skills when compared to the WL control group at the 8-week point; Caregivers were rated high on tx fidelity at the end of the 8 weeks of tx; tx-related gains in joint engagement, joint attention responding skills, & types of functional skills were maintained or improved for the IT group after 12 mos. | Type 1 study:<br>+RCT,<br>+Blind assessments,<br>+Incl/excl criteria,<br>+Standardized dx battery,<br>+Comparison group,<br>+Tx fidelity,<br>+Tx manual |

**Table 20.2** (continued)

| Author(s) and Year | Sample | Outcome measures | Treatment procedures | Findings | Nathan and Gorman (2002, 2007) criteria |
|---|---|---|---|---|---|
| *Relationship Development Intervention (RDI)* | | | | | |
| * *No research studies that meet Nathan and Gorman (2002, 2007) Type I, 2, 3, studies* | | | | | |
| *Responsive Education And Prelinguistic Milieu Teaching (RPMT)/Milieu Teaching* | | | | | |
| Hancock and Kaiser 2002 | 4 ss, aged 35–54 mos.; 3 male, 1 female | Collected throughout tx and follow-up: frequency of total child utterances, spontaneous child utterances, total use of targets, frequency of targets used spontaneously, # of different word roots used, and MLU; collected shortly after last tx session & last follow-up session: SICD, PPVT-R, Expressive One-Word Picture Vocabulary Test-Revised, parent satisfaction questionnaire | Therapist-implemented "enhanced milieu teaching"; single-subject, multiple baseline design; part of larger study which randomized children to different txs; children randomly assigned to a specific number of baselines; tx consisted of sessions 2x/wk for 15 min/session; clinic-based; follow-up period of 1x/mos., 15 min sessions for 6 mos.; parents did not observe sessions | All children showed positive increases for specific target language use, maintained across the 6 mos. follow-up; positive lang. effects generalized to interactions w/ mothers at home for 3/4 children; variable results across children for standardized measures | Type 2 study:<br>−RCT,<br>−Blind assessments,<br>+Incl/excl criteria,<br>+Standardized dx battery,<br>−Comparison group,<br>+Tx fidelity,<br>−Tx manual |
| Kaiser et al. 2000 | 6 ss, aged 32–54 mos.; all male | Collected throughout tx and follow-up: frequency of total child utterances, spontaneous child utterances, total use of targets, frequency of targets used spontaneously, number of different word roots used, and MLU; collected shortly after last tx session and last follow-up session: SICD, PPVT-R, Expressive One-Word Picture Vocabulary Test-Revised, parent satisfaction questionnaire | Parent-implemented "enhanced milieu teaching"; single-subject, multiple baseline design; part of larger study which randomized children to different txs; children randomly assigned to a specific number of baselines; parent training consisted of sessions 2x/wk for 45 min./session; clinic-based; follow-up period of 1x/mos., 15 min. sessions for 6 mos. | Parents learned to implement procedures and maintained them over follow-up period, but at lower rates than during active tx; positive effects for use of communication targets for all children and on complexity and diversity of productive language for most children; effects generalized to home setting for 4/6 children; improvement on standardized assessments for 5/6 children | Type 2 study:<br>−RCT,-Blind assessments,<br>+Incl/excl criteria,<br>+Standardized dx battery,<br>−Comparison group,<br>+Tx fidelity,<br>−Tx manual |

**Table 20.2** (continued)

| Author(s) and Year | Sample | Outcome measures | Treatment procedures | Findings | Nathan and Gorman (2002, 2007) criteria |
|---|---|---|---|---|---|
| Yoder and Stone 2006 | 36 ss, aged 21–54 mos.; 31 male, 5 female | After 6 mos. and 12 mos. (6 mos. after tx ended): free-play session w/ examiner (scored for frequency of nonimitative spoken communication acts and number of different nonimitative words spoken) | Compared "responsive education and prelinguistic milieu teaching" to PECS; 3 20-min sessions/wk for 6 mos. (1:1 w/ therapist); parent offered up to 15 h. of training; clinic-based; designed to facilitate intentional communication for the primary pragmatic functions of commenting, requesting, and turn taking | At 6 mos., PECS group more successful in increasing number of nonimitative spoken communication acts and number of different nonimitative words used; at 12 mos., exploratory analysis showed that growth rate of number of different nonimitative words faster in PECS group for children who began tx w/ high object exploration, but opposite for children who began w/ low object exploration | Type 2 study:<br>+RCT,<br>−Blind assessments,<br>+Incl/excl criteria,<br>+Standardized dx battery,<br>+Comparison group,<br>+Tx fidelity,<br>+Tx manual |
| *Responsive Teaching (RT)* | | | | | |
| Mahoney and Perales 2003 | 20 ss with autism or PDD-NOS; mean age of 32 mos, with 80% of ss under 36 mos at time of enrollment; 12 male | videotaped mother-child interactions coded with CBRS and MBRS, social-emotional functioning from ITSEA and TABS | Tx 1X/week of center-based tx and mean hour of 2.5 h/day of in-home parent-delivered tx for 8–14 mos.; tx focused on reciprocity, contingency, shared control, affect, and matching of pace during play and daily routines | Pre-post design; 80% of mothers demonstrated significant increase in maternal responsiveness and affect. This increased responsiveness was associated with children's increased social-emotional functioning (engagement, cooperation, joint attention, and affect) | Type 3 Study:<br>−RCT,<br>−Blind assessments,<br>−Incl/excl criteria,<br>−Standardized dx battery,<br>−Comparison group,<br>+Tx fidelity,<br>+Tx manual |
| Mahoney and Perales 2005 | 20 ss with PDDNOS; 20 ss with other DD; 12–54 mos with 85% of children under 36 mos at time of enrollment; 62% males | Developmental Rainbow, TBPA, videotaped mother–child interactions coded with CBRS and MBRS, social-emotional functioning from ITSEA and TABS | 1 h/week of parent–child sx at home or at center with early intervention specialist for 1 year; approx. 15 h/wk of parent-delivered tx (parent report); tx focused on cognitive, communication, and social-emotional functioning influenced by parental responsiveness | Pre-post design; significant increases in maternal responsiveness; significant increases in children's communication, cognitive, and social-emotional functioning; PDDNOS group showed greater gains in development; child outcomes were related to maternal responsiveness | Type 3 Study:<br>−RCT,<br>−Blind assessments,<br>−Incl/exl criteria,<br>−Standardized dx battery,<br>−Comparison group;<br>+Tx fidelity,<br>+Tx manual |

**Table 20.2** (continued)

| Author(s) and Year | Sample | Outcome measures | Treatment procedures | Findings | Nathan and Gorman (2002, 2007) criteria |
|---|---|---|---|---|---|
| *Social Communication, Emotional Regulation, and Transactional Support (SCERTS)* | | | | | |
| Wetherby and Woods 2006 (preliminary study: Early Social Interaction Project) | 35 ss total: 17 ss; 12–24 mos. of age; with significant red flags for ASD and a provisional clinical diagnosis of ASD; 18 ss in contrast group; 25–36 mos. with "suspected" ASD diagnosis | MSEL; VABS; ADOS; video taped behavior sample coded with CSBS DP | Two home visits per week for 1 year by trained interventionists with focus on increasing communication during daily routines & participation in parent-child FIRST WORDS playgroup for 9 weeks during tx year | Quasi-experimental, one-group pretest-posttest design with a no-treatment contrast group at post only; significant increases in 11 of 13 social communication measures of the CSBS DP, including initiating and responding to joint attention; at post tx group and contrast group were comparable on communicative means and play, but contrast group had significantly poorer performance on all other social communication measures | Type 3 Study:<br>−RCT,<br>+Blind assessments,<br>+Incl/excl criteria,<br>+Standardized dx battery,<br>+/-Comparison group (only posttest),<br>+Tx fidelity,<br>−Tx manual |
| *Treatment and Education for Autistic And Related Communication Handicapped Children (TEACCH)* | | | | | |
| Short 1984 | 15 ss; 2.3–7.5 yrs (mean 4.7 yrs.); 12 boys and 3 girls; all met Rutter's 4 criteria (1978) for diagnosis of autism | (1) Behavioral observation coding for parental and child behavior; (2) semi-structured maternal interview on family stress in relation to child w/ autism; (3) questionnaire on effects of child problems on family; (4) parental questionnaire on effects of tx | Tx group compared to wait period control; tx=4 mos. 29 days; wait period=1 mo 29 days; tx=TEACCH 6-8 sx of 60–90 min/each | Parental guidance and appropriate child behavior were significantly greater during tx period than during wait period; reductions of inappropriate child behavior and family stress were not significantly different in tx period than wait period | Type 2 Study:<br>−RCT,<br>+Blind assessments,<br>+/-Incl/excl criteria,<br>-Standardized dx battery,<br>+/−Comparison group,<br>−Tx fidelity,<br>−Tx manual |

**Table 20.2** (continued)

| Author(s) and Year | Sample | Outcome measures | Treatment procedures | Findings | Nathan and Gorman (2002, 2007) criteria |
|---|---|---|---|---|---|
| Ozonoff and Cathcart 1998 | 22 ss; 2–6 yrs of age; 18 boys; 4 girls; all diagnosed with autism | PEP-R; CARS | Tx group = therapist & parent designed tx plan; 10 weeks of 1 h/TEACCH-based home program services with trained graduate students + 1 h clinic visit/week at beginning & gradual decrease to 1 sx/2–3weeks toward end; 1/2 h of tx by parents/day; control group = community tx as usual | Tx group improved significantly more than control group on PEP-R subtests of imitation, fine motor, gross motor, and nonverbal conceptual skills, and overall PEP-R scores | Type 2 Study:<br>− RCT,<br>− Blind assessments,<br>− Incl/excl criteria,<br>− Standardized dx battery,<br>+ Comparison group,<br>− Tx fidelity,<br>− Tx manual |

#=number, *mos* months, *wk* week, *yr* year, *bx* behavior, *dx* diagnosis, *hx* history, h hour, s second *tx* treatment, *sx* session, *sig*. significant, *ss* subjects, *ASD* Autism Spectrum Disorder, *PDD-NOS* Pervasive Developmental Disorder-Not Otherwise Specified, + present in the study, – absent in the study, *incl/excl criteria* inclusion/exclusion criteria, *A/M* assess and monitor HMTW Hanen's More than Words, and PECS Picture Exchange Communication System and DD Developmental Delay, min minute and RCT randomized control trial, FEAS Functional Emotional Assessment Scale, FEDQ Functional Emotional Developmental Questionnaire and SICD Sequenced Inventory of Communication Development

*ADI* Autism Diagnostic Interview, *ADOS* Autism Diagnostic Observation Scale, *CARS* Childhood Autism Rating Scale, *CBRS* Child Behavior Rating Scale, *CSBS DP* Communication and Symbolic Behavior Scales Developmental Profile, *ESCS* Early Social-Communication Scales, *ISCQ* Infant Social-Communication Questionnaire, *ITSEA* Infant Toddler Social Emotional Assessment, *M-CHAT* Modified Checklist for Autism in Toddlers, *MBRS* Material Behavior Rating Scale, *MCDI* MacArthur-Bates Communicative Developmental Inventory, *MLU* mean length of utterance, *MSEL* Mullen Scales of Early Learning, *PEP-R* Psychoeducation Profile Revised, *PDD-ST-II* Pervasive Developmental Disorders Screening Test-II,*RBS* Repetitive Behavior Scale, *TABS* Temperament and Atypical Behavior Scale, *TBPA* Transdisciplinary Play Based Assessment, *VABS* Vineland Adaptive Behavior Scale

of the main features of each study reviewed, including the sample, outcome measures, treatment procedure, findings, and Nathan and Gorman (2002, 2007) study type representing methodological rigor.

Following Table 20.2 is a brief description of the main tenants of each treatment approach, including a summary of the developmental components of each approach. A review of the selected efficacy studies that met the search criteria for each approach follows. Next is an overall summary of the empirical evidence for developmental treatment approaches for young children with autism, including a discussion of study limitations. The chapter concludes with recommendations for the future, both in terms of additional efficacy and effectiveness studies, as well as the development or modification of treatment approaches to meet the developmental needs of younger children with autism.

## Developmental Approaches

### Denver Model and Early Start Denver Model (ESDM)

The Denver Model, created in the 1980s at the University of Colorado Health Sciences Center, is a developmental approach for preschool education for children from 2 to 5 years of age with autism (Rogers et al. 1986; Rogers 2005). The Denver Model is administered to small groups of young children with autism in a classroom setting for 4–5 h per day, 12 months a year. The core features of the Denver Model include: (a) an interdisciplinary team that implements a developmental curriculum addressing all domains for each child's individual needs; (b) a focus on interpersonal interactions and engagement; (c) a focus on reciprocal, functional and spontaneous use of imitation, facial expressions, and objects; (d) an emphasis on verbal and nonverbal communication; (e) a focus on the cognitive aspects of play; and (f) the importance of developing partnership with parents (Dawson and Rogers 2010, p. 15). The Denver Model strongly emphasizes social relationships by using positive affect in social interactions as a motivator for children to pay attention to others and engage in social interactions, by assigning each child to a primary teacher, by fostering peer relationships, and by modeling and prompting social behaviors (Rogers et al. 2001). Families are integral to the Denver Model programs. Parents of children attending the Denver Model programs are encouraged to observe and participate in their children's classroom. In addition, parents are given a chance to discuss their child's development or other issues related to parenting a child with ASD during their weekly one-on-one consultation with a child psychologist or psychiatrist or during monthly parent support group meetings with other families in the program.

The Early Start Denver Model (ESDM) is a comprehensive early developmental intervention for children as young as 12 months of age with ASD. ESDM was designed by Rogers and Dawson (2010), and is based upon the Denver Model. At the heart of ESDM are the empirical knowledge base of infant-toddler learning and development and the effects of early autism. ESDM is typically provided in the home by trained therapists and parents during natural play and daily routines. However, current studies are examining group delivery in preschools and childcare centers. The aim of ESDM is to increase the rate of development in all domains for children with ASD and to simultaneously decrease the symptoms of autism. In particular, this intervention focuses on boosting children's social-emotional, cognitive, and language skills, as development in these domains is particularly affected by autism. ESDM also uses a data-based approach and empirically supported teaching practices that have been found to be effective from research in ABA. ESDM fuses behavioral, relationship-based, developmental, and play-based approaches into an integrated whole that is individualized and standardized. Teaching objectives are based on the *Early Start Denver Model Curriculum Checklist*, a play-based assessment tool that lists behaviors in each developmental domain in the order in which they occur in typical development. In ESDM, a primary therapist, supported by an interdisciplinary team comprised of occupational therapists, speech pathologists, child psychologists, behavior analysts, physicians, and special

educators, assesses the child and identifies developmental objectives to target during intervention. Parents learn to deliver ESDM by using the play-based interactive approach to embed learning opportunities into their daily routines with their children. In intensive delivery of ESDM, each child receives direct intervention one-on-one from members of a team of trained ESDM interventionists, as well as from his or her parents.

Both the Denver Model and the ESDM meet all five criteria of a developmental approach to treating young children with autism. The creators of these approaches self-identify the treatments as "developmental." Treatments are based on a typical developmental framework, follow the principles of developmental science, are delivered in the context of relationships, are child-centered and play based. Both approaches are comprehensive. Whereas the Denver Model is administered primarily in a therapeutic preschool setting by trained teachers and specialists, the ESDM is administered in the clinic and at home by trained intervention therapists guided by an interdisciplinary team. Both approaches include a parent training component with an expectation that parents use the techniques with their children during daily play activities and caregiving routines at home.

There are a handful of studies published in peer-reviewed journals that report the efficacy of the Denver Model before it was officially called by this name (Rogers et al. 1986, 1987; Rogers and Lewis 1989; Rogers and DiLalla 1991). Consequently, the systematic search criteria of this literature review resulted in only one efficacy study of the Denver Model, as described in Table 20.2. In 2006, Rogers and colleagues reported a Type 2 study using a single-subject study design that included the randomization of a sample of ten nonverbal male subjects from 20–65 months of age to either the Denver Model treatment group or the PROMPT treatment group, which is a neurodevelopmental approach for speech production disorders. Each group received 12 weekly 1-hour therapy sessions and 1 hour of parent-delivered intervention at home each day. After the 12 weeks of treatment, there were no significant differences in the acquired language skills of each group, as eight of the ten children used five or more new words spontaneously. In addition to comparing two different treatment methods, this study also considered the profiles of the children that responded best to both treatments; these "best responders" had mild to moderate symptoms of autism, and better motor imitation and joint attention skills when compared to children who did not respond as well to either treatment method.

Two studies investigating the efficacy of ESDM are described in Table 20.2, one of which is a Type 2 study because it had single-subject design and one that is a Type 1 randomized control trial (Nathan and Gorman 2002, 2007).

The Type 2 study of the efficacy of ESDM (Vismara et al. 2009) included a sample of eight subjects ranging from 10 to 36 months of age with diagnoses of ASD at some point during the treatment. Each parent–child dyad received 12 weeks of one-on-one coaching using the ESDM model. Parents achieved ESDM treatment fidelity by the sixth treatment session and children demonstrated positive changes in social communication behaviors, such as imitation and spontaneous verbal utterances. Together, these two single-subject studies demonstrate that parents can learn to use ESDM when interacting with their young children over the course of 12 parent-coaching sessions. Children in these studies demonstrated associated increases in social communicative behaviors during parent–child play over the course of the parent training; however, because of the study designs, causal relationships between implementation of ESDM and child outcomes cannot be assumed.

The final ESDM study included in this review is a Type 1 study, a randomized, controlled trial that evaluated the efficacy of intensive ESDM treatment (Dawson et al. 2010). Forty-eight children diagnosed with ASD between 18 and 30 months of age were randomly assigned to either the ESDM group or the community treatment group. The children in the ESDM group received intervention by trained therapists within 2-hour sessions occurring twice per day for 5 days per week for 2 years (on average, ESDM children received 15.2 hours of ESDM and 5.2 hour of additional community therapy per week). In addition, parents were trained and asked to use ESDM strategies during daily

activities (reporting on average 16 hours per week). The control group reported receiving an average of 9.1 hours per week of individual therapy and an average of 9.3 hours per week of group intervention (e.g., inclusive preschool programs). At the end of the 2-year period, children in the ESDM group showed significant improvements in IQ, language, and adaptive behavior when compared to children who had received treatment from the community, even though the groups differed little on the average number of hours of intervention received over the 2-year period. Additionally, children who received ESDM were significantly more likely to have improved diagnostic status than the children in the community treatment group.

## Developmental Individual-Differences, Relationship-Based (DIR/Floortime) Model

The Developmental Individual-Difference, Relationship-Based (DIR/Floortime) Model, created by Greenspan and Wieder (Wieder and Greenspan 2001), is a comprehensive intervention for infants, toddlers, and preschoolers with ASD. This developmental intervention aims to "reestablish the developmental sequence that went awry" (Greenspan and Wieder 2007, p. 189). It considers each child's current developmental level of emotional functioning, biologically based individual differences in sensory processing, relationships with parents and caregivers, as well as the child's context of family and culture. The primary goal of this approach is to facilitate a child's sense of self as an intentional being in the context of relationships and to build the child's cognitive, language, and social capacities. This model includes a nine-step formal assessment process, including consultation with a multidisciplinary team and the child's parents, to determine how biological, maturational, environmental, and social factors contribute to a child's competencies and symptoms. In particular, the DIR/Floortime model is designed to help a child progress through six functional emotional developmental levels (FEDLs). A child's FEDL refers to how he/she is able to integrate all of his/her capacities (motor, cognitive, language, spatial, and sensory) to carry out emotionally meaningful goals (Greenspan and Wieder 2007). The six FEDLs, from simplest to most complex, are as follows: (1) sharing attention and regulation; (2) engagement and relating; (3) two-way intentional affective signaling and communication; (4) long chains of co-regulated emotional signaling and shared social problem solving; (5) creating representations or ideas; and (6) building bridges between ideas, including logical thinking (Greenspan and Wieder 2006).

The cornerstone of the DIR intervention is Floortime sessions, which are unstructured play sessions in which the adult (therapist, educator, or parent) follows the child's lead in interactions with the goal of building warm, trusting relationships that encourage shared attention, interaction, and communication; these relationships become the context for the child to progress through the six FEDLs. Oftentimes, the therapist works with the child's parents and educators to help them to develop the skills to facilitate Floortime play sessions. Comprehensive DIR/Floortime interventions include additional activities and therapies (e.g., speech, sensory integration, occupational or physical therapies, peer play dates, biomedical interventions, nutritional counseling, and family consultation or counseling), which are selected to meet each child's developmental profile and each family's needs.

The DIR/Floortime Model contains all five components of a developmental approach to treating young children with autism. The DIR/Floortime model focuses on the development of social and emotional functioning in the context of close relationships. Although this approach focuses on social-emotional development, this method was designed to be comprehensive, as it also aims to increase the integration of a child's motor, cognitive, language, spatial, and sensory capacities. Therapists work together with parents either in the clinic, at home, or in the child's educational setting so that parents and teachers learn strategies to help the child function at his/her highest developmental level.

Three studies on the efficacy of the DIR/Floortime Model are described in Table 20.2. The first study reviewed included a unique design by

Hilton and Seal (2007) in which 2-year-old twin brothers with ASD were each randomly assigned to DIR treatment or ABA treatment. After approximately 17 sessions, the behavioral data coded with the Communication and Symbolic Behavior Scales (CSBS) revealed that there were increases in the number and duration of crying episodes in the ABA child but not in the DIR child. There was also a slight gain in communication composite score for the ABA child and slight loss for the DIR child. This study is considered a Type 3 study (Nathan and Gorman 2002, 2007).

The second DIR/Floortime Model efficacy study was conducted by Solomon et al. (2007). This study examined the efficacy of the PLAY Project Home Consultation Project, in which the parents of the 68 subjects (ranging from 18 months to 6 years of age at the time of their diagnosis) were trained with the DIR/Floortime Model. Parents were asked to implement the model for 15 hours per week for 1 year. Pre- and post parent–child interactions were videotaped and coded by blind raters using the Functional Emotional Assessment Scale (FEAS). Although parents' ratings did not change from pre to post, approximately 45 % of the children made "good" to "very good" functional developmental progress, as defined by the FEAS. Although the results of this pilot study are promising, this study did not include a control group and had significant methodological limitations, so it is rated in this review as a Type 3 study (Nathan and Gorman 2002, 2007).

The third study reviewed on the efficacy of the DIR/Floortime Model is a Type 1 study of a randomized control trial of 32 subjects from 2 to 6 years of age (Pajareya and Nopmaneejumruslers 2011). Children were randomly assigned to a preschool as usual group or to a group receiving both preschool and a home-based intervention based on the DIR/Floortime Model. Parents who received the DIR/Floortime home-based intervention implemented this model for an average of 15.2 hour per week for 3 months. After 3 months, children were assessed with the FEAS, the Childhood Autism Rating Scale, and the Functional Emotional Questionnaires. Overall, children who received the additional home-based DIR/Floortime interventions demonstrated significant gains over the children who did not receive this added component. Because this is a Type 1 study, the evidence of treatment efficacy for the DIR/Floortime Model demonstrated by this study is stronger than the previous two studies reviewed. Additional randomized control trials that compare the DIR/Floortime Model to other developmental treatment models would strengthen the evidence base for this approach.

## Hanen's More than Words

Hanen's More than Words is a parent training program that is designed to teach parents strategies to increase children's communication via enhancing parents' responsivity to children's attention and communication attempts. These strategies are designed to be used during everyday routines with young children diagnosed with autism, and are focused on helping children reach four goals: improved two-way interaction, more mature and conventional ways of communicating, better skills in communicating for social purposes, and improved understanding of language. Intervention is aimed at improving parent–child interaction, and focuses on teaching parents how to structure everyday routines in a manner that is sensitive to the child's developmental level, how to provide appropriate verbal and nonverbal responses to children's communication, and how to provide multiple opportunities for children to respond. The intervention involves eight group sessions with parents only, as well as three in-home sessions with parents and children (Carter et al. 2011; Sussman 1999).

More than Words contains all five of the components of a developmental approach to treating children with ASD. It takes children's developmental level and principles of developmental science into account and is relationship based, child-centered, and play based. It is targeted, focusing on communication and social interaction, and is carried out by parents in naturalistic settings.

There are three studies investigating More than Words described in Table 20.2, two of which are rated as Type 2 studies and one which is rated

as a Type 1 study (Nathan and Gorman 2002, 2007). Overall, studies show mixed results in terms of child outcome due to the intervention. For example, Carter et al. (2011) conducted a randomized control trial investigating More than Words in a sample of 62 children with autism, aged 15–24 months. Children were assigned to either the experimental treatment or to a control group consisting of community treatment. Researchers found no main effects of More than Words on parents' responsivity several months after enrollment, as measured by a partial interval coding system of parent–child free play videos, although they did find medium effect sizes. In addition, there were no main effects of treatment on children's communication. The intervention did, however, facilitate communication in children who had exhibited low levels of object interest at the beginning of treatment. Similarly, in a single-subject design conducted by Prelock et al. (2011) involving four participants aged 37–69 months, three of the four children showed improvements in social and symbolic communicative acts and vocabulary, but not on a standardized developmental test (Mullen Scales of Early Learning; Mullen 1989). McConachie et al. (2005) carried out a randomized control trial in which 51 subjects received a 3-month course of weekly More than Words sessions along with three home visits. The treatment group was compared to a wait-list control group. Children who received the More than Words treatment demonstrated significantly larger vocabulary sizes than those in the wait-list control, even when considering the child's scores at time of recruitment, the diagnostic group, and the interval between assessments. Further research investigating More than Words may help to clarify the mixed outcome results found thus far.

## Joint Attention Mediated Learning (JAML)

There are two "branded" developmental interventions for autism in young children that target improvement of a child's skills in initiating and responding to joint attention—Joint Attention Mediated Learning (JAML) and Joint Attention Symbolic Play Engagement and Regulation (JASPER, see next section), since deficits in joint attention are unique to autism. Both of these interventions target building this skill, as joint attention is a developmental precursor to social learning, and therefore has a cascading effect on many areas of a child's development (Schertz and Odom 2007).

JAML (Schertz 2005), is a manualized treatment approach focused on the developmental foundations of joint attention. The five parent-mediated learning principles include: (1) focusing—helping the child to learn by focusing his/her attention; (2) giving meaning—helping the child to understand the meaning of objects or activities by expressing emotion; (3) expanding—helping the child expand his/her understanding by labeling, pointing out salient features or events, and making connections; (4) encouraging—encouraging the child's learning by creating optimal and achievable challenges and by acknowledging his/her success; (5) organizing and planning —helping the child learn by structuring activities and daily routines into predictable sequences of events. In addition, JAML suggests strategies for parents to use to help their children develop social-communication skills in four areas: (1) focusing on faces, (2) turn-taking, (3) responding to joint attention, and (4) initiating joint attention.

JAML meets all five requirements of a developmental approach to treating young children with ASD. The developmental sequence of joint attention is based on typical development and is supported by developmental theory and research. It is relationship based, as it is a model that focuses on learning in the context of the parent–child relationship. Likewise, it is child-centered and play based, as parents are coached to follow their child's lead in play activities by joining their child's play instead of introducing a parent-initiated play theme for the child to follow. As mentioned earlier, JAML is a targeted approach focused on increasing the child's joint attention abilities, which have a cascading effect on social learning in all other domains. The JAML approach is primarily a parent-coaching model and

activities are to be conducted in naturalistic settings, such as the child's home.

One Type 2 study on the JAML approach is reported in Table 20.2. Schertz and Odom (2007) explored the effectiveness of the JAML approach through a single-subject multiple baseline design. The sample included three subjects diagnosed with ASD between 20 and 28 months of age. Parent–child dyads were videotaped for 10 minute play sessions during a baseline period and during each week of treatment. Videos were coded for the number of 10-second intervals in which the child was engaged in one or more of the four joint attention behaviors: (1) focusing on faces, (2) turn taking, (3) responding to joint attention, and (4) initiating joint attention. Parent–child dyads received between 11 and 16 in home parent-coaching sessions over a 9–26 week period. Each of the three toddlers surpassed baseline performance levels of displays of all four joint attention behaviors during parent–child play in comparison to baseline levels. The addition of some Type 1 studies on the efficacy of this approach would add to the evidence base for JAML.

## Joint Attention and Symbolic Play Engagement Regulation (JASPER)

Whereas JAML focuses primarily on joint attention, JASPER focuses on joint attention and also includes a focus on developing the symbolic play skills, another known deficit of young children with ASD. JASPER is a targeted intervention on these two developmental skills, which impact children's social and communication development. The JASPER approach was developed by Connie Kasari and colleagues at the University of California Los Angeles, and has evolved alongside 10 years of studies on using this approach with children under the age of 3 years. Although JASPER was originally administered by trained interventionist working directly with the children in a laboratory setting, more recent studies include a parent-mediated intervention. JASPER incorporates behaviorist principles in conjunction with developmentally informed practices. The treatment is individualized to meet the developmental needs of each child, and the intervention is structured around the typical developmental sequences of joint attention and symbolic play (Kasari et al. 2010). Consequently, intervention goals for each child stem from the child's initial developmental assessments. The parent-mediated model of JASPER is organized around ten learning modules: (1) setting up the environment; (2) allowing the child to initiate an activity; (3) playing within established routines; (4) facilitating and maintaining states; (5) scaffolding and engagement state; (6) facilitating joint engagement; (7) allowing the child to initiate communication; (8) recognizing and responding to the child's joint attention skills; (9) imitating and expanding language; and (10) generalizing skills to other routines. JASPER is typically administered in a laboratory setting by a trained interventionist, with the goal of skill generalization to the child's natural environment.

JASPER meets all five components of a developmental approach to treating young children with autism. The creators of these approaches self-identify the treatments as "developmental." JASPER also uses behaviorist principles in conjunction with principles from developmental science. Treatments are based on typical developmental sequences for joint attention and symbolic play, and are delivered in the context of relationships with an interventionist or the parent. JASPER is a child-centered and play-based model. As previously mentioned, this approach is a targeted intervention, focusing on joint attention and/or symbolic play skills. JASPER can be administered by trained interventionists in a laboratory setting or through parent-mediated intervention with a focus on generalizing the skills to the child's natural environment.

There are three studies investigating the JASPER approach described in Table 20.2, all of which are rated as Type 1 studies (Nathan and Gorman 2002, 2007). Kasari et al. (2006) conducted a randomized controlled intervention study of joint attention intervention, symbolic play intervention, and a control group (It is important to note that the Kasari et al. 2008 study is a follow-up study of the sample from the Kasari et al. 2006 study). The sample consisted of 58

children diagnosed with autism between 3 and 4 years of age. All 58 children were also enrolled in 30 hour a week of an ABA early behavioral intervention in a hospital setting. The 58 children were randomly assigned to a joint attention group, a symbolic playgroup, or a control group. Joint attention and symbolic play interventions were conducted in one-on-one therapist-child sessions for 30 min per day for 5 to 6 weeks. Pre- and post-intervention samples of child's joint attention skills, play skills, and parent–child interactions were collected. At post-intervention, children in the joint attention group initiated more showing behaviors and responded to joint attention bids from communication partner significantly more than children in the symbolic playgroup and the control group. In addition, children in the symbolic playgroup demonstrated more diverse types of symbolic play and higher play levels in both the structured play assessment and the mother–child interaction than children in either of the other groups. This study demonstrates the specificity of intervention targets (joint attention or symbolic play). In 2008, Kasari and colleagues followed up this sample to determine if there were differences between groups in language development 12 months after the end of treatment. This follow-up study found that children in both the joint attention group and the symbolic playgroup had showed significantly higher levels of language development a year after treatment ended than the control group. In addition, children who had the lowest language levels at the beginning of treatment showed greater gains in language development if they were randomized to the joint attention group.

The third study on the JASPER approach reported in this review is also a Type 1 randomized control study. This study differs from the first two studies in that the intervention consisted of a parent-mediated joint engagement intervention (Kasari et al. 2010). The 38 child–parent dyads were randomly assigned to an immediate treatment (IT) group or a wait-list (WL) control group. Children in the study were between 21 and 36 months of age and all had a diagnosis of ASD. Children in the IT group immediately received 8 weeks of treatment occurring three times per week in a laboratory playroom setting. During treatment sessions, the interventionists covered topics focused on increasing children's joint attention and symbolic play and coached the parent through direct instruction, modeling, guided practice, and feedback. All parent–child dyads were videotaped during a play interaction at time of enrollment, at the 8-week mark, and again after 12 months. Children in the IT group made significant improvements in the amount of time they spent in joint engagement, responsiveness to joint attention, and in the diversity of their play skills when compared to the WL group after the 8 weeks of treatment. In addition, parents in the IT group displayed high fidelity to the JASPER treatment approach. One year after the end of treatment, the IT group's gains were maintained or improved when compared to the WL group, indicating that this short-term, parent-delivered intervention can have lasting effects on children's joint attention and play skills. The rigorous methods in these three Type 1 studies on the efficacy of the JASPER approach in improving joint attention, play skills, and language in young children with ASD provide promise for this approach, however, replication studies with larger sample size would strengthen these findings.

## Relationship Development Intervention (RDI)

Relationship Development Intervention (RDI) is a parent-delivered intervention for children diagnosed with ASD. It attempts to address the difficulties in perception, cognition, and emotion that children with ASD often face (Gutstein et al. 2007). More specifically, the goal of RDI is to improve the child's social skills, adaptability, and self-awareness. The six objectives of the intervention are to improve: (1) emotional referencing, (2) social coordination, (3) declarative language, (4) flexible thinking, (5) relational information processing, and (6) foresight and hindsight (Autism Speaks 2011a). The intervention relies heavily upon the relationship between parents and their children, and utilizes a guided participation approach through which parents learn

to perceive and scaffold opportunities for their child to respond in more flexible and thoughtful ways and to engage more successful social exchanges. The comprehensive intervention is delivered in a naturalistic setting, as parents are trained to create and capitalize upon teaching opportunities in the child's everyday environment and activities (Gutstein and Sheely 2002).

RDI contains four of the five criteria for a developmental approach to treating children with ASD. The treatment is heavily dependent upon the relationship between parents and children—in fact, this component is central to the intervention's delivery. Other adults do not work directly with the children in this intervention; instead, they serve only to train parents in the theory, principles, and components of the intervention, as well as to help parents develop the program and discuss children's treatment goals. RDI does follow the sequence of typical development, and is conducted in a naturalistic environment.

There are no research studies investigating RDI that meet our search criteria. While one study emerged in our electronic searches (Gutstein et al. 2007), the mean age of subjects within the study was over 5 years. Further research investigating RDI for toddlers and preschoolers with ASD is warranted.

## Responsive Education and Prelinguistic Milieu Teaching (RPMT)/Milieu Teaching

RPMT/milieu teaching is a naturalistic behavioral intervention that uses specific behavioral teaching strategies such as prompting, shaping, chaining, and reinforcement to teach language skills to young children with autism (Schreibman and Ingersoll 2011). The intervention capitalizes upon a child's intention to communicate and systematically provides both models of language and communication as well as naturally related social consequences for language and communication attempts. Like Pivotal Response Training (PRT), RPMT/milieu teaching follows the child's lead and focuses on his moment-to-moment interests in order to increase motivation and opportunities for communicative learning. A typical milieu teaching procedure begins with the child's verbal or nonverbal request, after which the parent or therapist follows a specific sequence of prompts to help elicit language (e.g., modeling). Following the eliciting prompts, corrective prompts are used as needed, and then the parent or therapist reinforces the child's attempt by providing positive feedback and accessing the child's requested object while providing expansion of the child's utterance (Kaiser et al. 2000).

RPMT/milieu teaching contains four of the five components of a developmental approach to treating children with ASD. It applies principles of developmental science to teach language to children at a level appropriate to them. In addition, it is child-centered and play based, focusing heavily on following a child's lead in order to help elicit naturally occurring communicative attempts. Although it is a targeted intervention, focusing on communication and language, both therapists and parents can provide the intervention and it can be easily applied in a naturalistic environment.

Three studies investigating RPMT/milieu teaching are described in Table 20.2, all of which are rated as Type 2 studies (Nathan and Gorman 2002, 2007). Although, in general, we excluded studies investigating mixed interventions (e.g., PRT mixed with Picture Exchange Communication System (PECS)), we included studies investigating enhanced and modified versions of pure milieu teaching. Of the three studies investigating milieu teaching, two investigate enhanced milieu teaching, which incorporates environmental arrangement to promote child engagement with activities and communication partners, as well as responsive interaction techniques to build social, conversational interaction and to model new language forms, into pure milieu teaching procedures to prompt, model, and provide consequences for the use of new language forms. Both of these are single-subject, multiple baseline studies, involving four and six participants, respectively (Hancock and Kaiser 2002; Kaiser et al. 2000). Hancock and Kaiser (2002) investigated therapist-delivered enhanced milieu teaching provided to three males and one female aged 35–54 months in a clinic for 24 15-min sessions,

and found that although there were variable results across children for standardized measures, all children showed positive increases for specific target language use. These positive language effects generalized to interactions with mothers at home, although mothers did not observe treatment sessions, for three of the four participants. In contrast, Kaiser et al. (2000) investigated parent-implemented enhanced milieu teaching for six males aged 32–54 months. Parents were trained in 24 45-min sessions, and researchers found positive effects for use of communication targets for all children and for complexity and diversity of produced language for most children, as well as generalized effects to the home environment for four of the six participants and improvements on standardized measures for five of the six participants.

The third study investigating RPMT/milieu teaching utilized responsive education and prelinguistic milieu teaching, which mirrors pure milieu language teaching but focuses instead on teaching children prelinguistic goals, such as the use of gestures, nonword vocal use, and gaze use (Yoder and Stone 2006). This randomized control trial included 36 participants aged 21–54 months and compared the use of RPMT to PECS, providing treatment for a maximum of 24 total hours across a 6-month period. After 6 months, participants in the PECS group were more successful in increasing the number of nonimitative spoken communicative acts and the number of different nonimitative words used. After 12 months, at follow-up, exploratory analysis indicated that the growth rate of the number of words was faster in the PECS group for children who began treatment with high object exploration, but opposite for children who began with low object exploration (Yoder and Stone 2006).

Overall, research investigating RPMT/milieu teaching is scarce. Much of the existing research relies on single-subject designs, and the one study utilizing a randomized control design yielded mixed results. Further research investigating RPMT/milieu teaching for toddlers with ASD, especially that involving additional subjects and control groups, is warranted.

## Responsive Teaching (RT)

The responsive teaching (RT) curriculum, created by Mahoney and MacDonald (2005), is a parent-mediated developmental intervention. The RT curriculum focuses on teaching parents to use responsive interaction strategies to address their children's individualized developmental needs in the domains of cognition, communication, and social-emotional functioning (Mahoney and Perales 2003). There are 19 predefined pivotal intervention objectives designed to target these developmental domains. Each of these objectives was chosen because there is empirical support that maternal responsiveness affects these child behaviors, which in turn impact development in each domain. The model is primarily a parent-coaching model, with a series of intervention topics that cover 70 RT Strategies based on the following dimensions of responsive interaction: reciprocity, contingency, shared control, affect, and match (Mahoney and MacDonald 2005). In addition, RT intervention topics help parents and teachers understand how each of the pivotal intervention topics contributes to their child's development (Mahoney and MacDonald 2005). These RT Strategies are to be incorporated into parents' or teachers' daily routines with the children in their care in order to maximize each child's developmental potential. The RT model is thoroughly described and outlined in a treatment manual (Mahoney and MacDonald 2005).

The RT curriculum contains all five criteria of a developmental approach to treating young children with ASD. It is based on sequences of typical child development, is supported by developmental theory and research, and is relationship based, child-centered, and play based. Although this model is based on strengthening the 19 pivotal intervention objectives, this approach is considered to be comprehensive, as together these objectives target the main developmental domains. The RT approach is focused on parent coaching in naturalistic settings.

There are only two studies on the efficacy of the RT that meet our search criteria, both of which are rated as Type 3 studies because they

have pre-post designs (Nathan and Gorman 2002, 2007). Both of these studies were conducted by Mahoney and Perales. In 2003, Mahoney and Perales conducted a study on the effects of RT intervention on the social-emotional functioning of a convenience sample of 20 children with ASD who received a mean of 31 h of parent–child intervention over the course of a year. From pre- to post-intervention, mothers demonstrated significant improvements in responsiveness, and these changes in maternal responsiveness accounted for 25 % of the variance in changes in the social-emotional functioning of the children.

The second study (Mahoney and Perales 2005) was conducted with a sample of 50 parent–child dyads. Twenty of the children had pervasive developmental disorders (PDD) and 30 had other developmental disabilities (DD). Parent–child dyads received weekly RT sessions for approximately 1 year. Children's social-emotional functioning and overall development and parents' level of responsivity before and after receiving the RT intervention were compared. Overall, parents in both groups showed significant increases in their levels of responsiveness as measured in parent–child play interactions. Both groups of children made significant developmental progress, with children in the PDD group showing significantly greater developmental progress than children in the DD group, although this was related to the fact that parents in the PDD group demonstrated greater positive changes in responsiveness from pre- to post-intervention than did parents in the DD group.

Because both of these studies are based on a quasi-experimental pre-post design, the evidence base for the efficacy of RT would be strengthened by future research that meets the Nathan and Gorman criteria for a Type 1 study.

## Social Communication, Emotional Regulation, and Transactional Support (SCERTS)

The SCERTS model of ASD intervention aims to enhance communication and social-emotional abilities of children through a comprehensive curriculum supported by a multidisciplinary team (Prizant et al. 2003). This approach targets the following core developmental challenges faced by children with ASD: social communication, emotional regulation, and transactional support. Transactional support is a unique component of the SCERTS model and refers to the learning supports that professionals provide to a child across daily activities in their natural settings, as well as to the interpersonal supports provided to the child's family, teachers, and community members to maximize the child's ability to be successful in all contexts and with all interactional partners (Prizant et al. 2006a). The SCERTS manual focuses primarily on implementing this model with preschool-age children and with children in the primary grades; however, this is a life-span model. Children supported by SCERTS often attend inclusive preschool settings where they can learn with and from typically developing children in a naturalistic educational context. The teaching strategies in this model aim to directly target skills during naturally occurring, everyday routines so that learning happens both in meaningful and purposeful activities and so that children are motivated to initiate communication in these activities. In addition, SCERTS includes educational and emotional supports for families, as well as support for teamwork within the child's professional team (Autism Speaks 2011b). The creators of SCERTS identify its strength as "…the integration of understanding a child in the context of his or her family and daily activities and the transactional impact of people and learning supports that become critical influences on the child's development in everyday experiences" (Prizant et al. 2006b, pp. 1–2).

SCERTS contains all five components of a developmental treatment approach for young children with autism. The model's treatment goals and teaching strategies are derived from research and literature on the development of children with and without disabilities. In addition, SCERTS has a strong focus on learning in the context of relationships with familiar caregivers to enhance social interactions and regulation. The teaching in SCERTS is child-centered as it follows the child's focus of attention, and is also play based.

In addition to these five developmental components, the SCERTS Model is comprehensive, as it focuses on all areas of child development, specifically concentrating on the developmental challenges of children with ASD. Children being treated via SCERTS usually attend an inclusive preschool setting. In addition, parents are taught to administer the model during daily interactions at home and in the community.

To date, there are no treatment studies on SCERTS that meet the search criteria for this review; research investigating the efficacy of SCERTS for young children with ASD is needed. However, the SCERTS model shares many of the same theoretical and pragmatic foundations as the Early Social Interaction (ESI) Project by Woods and Wetherby (2003), as the ESI Project informed the development of the SCERTS model. The ESI Project incorporates the recommendations of the NRC (2001) for toddlers with ASD by focusing on a parent-implemented model that embeds naturalistic teaching strategies in everyday routines.

In a Type 3 study of the preliminary effects of the ESI Project, Wetherby and Woods (2006) aimed to evaluate the effects of an ESI parent-implemented intervention on social communication outcomes. This preliminary study had a quasi-experimental pre-post design with a contrast group at time of post only. The treatment group consisted of 17 toddlers who were identified as having significant red flags for ASD and were consequently given a provisional clinical diagnosis of ASD before their second birthday. These 17 parent–toddler dyads received a year of treatment consisting of two home visits per week for 12 months in which a trained interventionist worked with parents to meet each child's individual needs within typical daily routines in the natural environment. In addition, all 17 of these children attended 9 weeks of the FIRST WORDS Project parent–child playgroup. The treatment group displayed significant increases in 11 of 13 social communication measures of the Communication and Symbolic Behavior Scales Developmental Profile (CSBS DP), including initiating and responding to joint attention. A contrast group consisting of 18 children between the ages of 2 and 3 years who were suspected of having ASD but had not yet received any treatment were videotaped for a CSBS DP behavior sample (all of the contrast group children were diagnosed with ASD at 36 months of age). The posttreatment group and the contrast group were comparable on communicative means and play, but the contrast group had significantly poorer performance on all other social communication measures.

However, this study design has limitations, one of which is that the differences between groups at post cannot be attributed solely to the treatment, as groups were not randomly assigned and no data was collected for the contrast group before these children were 24 months of age, so it is possible that the groups may not have been comparable at the start. In spite of these limitations, the promising results of the ESI Project have influenced the development of the SCERTS model. More rigorous studies of both the ESI Project and the SCERTS model are needed to truly understand the efficacy of these approaches in treating young children with ASD.

## Treatment and Education of Autistic and Related Communication Handicapped Children (TEACCH)

TEACCH, developed in North Carolina by Schopler and colleagues in the 1970s, is an approach to treating individuals with ASD throughout their life span (Marcus and Schopler 2007). TEACCH is a comprehensive treatment method in that it aims to improve many different areas of an individual's development. Treatment goals and plans are based on each child's strengths, interests, and needs within the context of relationships and the community. This approach does not, however, use typical developmental sequences to guide intervention, as "skills and behaviors are targeted for their functional utility for the individual's future, rather than coming from lists of the typical developmental sequences" (Mesibov et al. 2005, p. 37). TEACCH incorporates traditional behavioral techniques (such as prompting, shaping, and reinforcement), neo-behavioral approaches (such as incidental teaching and functional behavioral

analysis), as well as developmentally appropriate practices (Mesibov et al. 2005). The educational strategies in TEACCH are referred to as structured teaching, and capitalize on the strengths and interests of each child and address the difficulties experienced by individuals with autism that affect their learning. In this way, structured teaching strategies often include options for children to process information visually and structured environmental supports to assist children in choosing, engaging in, and making sense of daily activities. TEACCH programs are typically classroom-based programs; however, home-based programs are also available. In both options, parents are trained as co-therapists so that learning can continue in the home setting during daily interactions and routines.

TEACCH meets three of the five criteria of a developmental treatment approach for young children with ASD. The treatment is not based on sequences of typical child development (Mesibov et al. 2005), but the approach is informed by developmental science and the science of learning. It is administered in the context of relationships and is child-centered, as it is individualized based on each child's strengths, interests, and areas of difficulty. However, TEACCH is not play-based, as children are first taught new skills via one-on-one structured instruction. TEACCH is a comprehensive treatment approach, as it focuses on many areas of development. Therapists, trained teachers, and parents administer TEACCH in classrooms and at home. Although TEACCH first teaches children in a highly structured environment, we considered this approach as being offered in both structured and naturalistic settings, as it includes a plan for generalization to naturalistic settings with less structure and includes a home-based component.

There is much efficacy research on the TEACCH approach, including studies all over the world and studies focusing on different components of the model, but many of the studies were conducted on older children and/or adults (see Mesibov and Shea 2010). The two studies reviewed here and described in Table 20.2 were selected because they fit the age range, they span the history of the approach, and they focus on the effects of the comprehensive model and not just on one component of the model. Both of these studies are rated as Type 2 studies (Nathan and Gorman 2002, 2007). Short (1984) compared the amount of parental guidance and stress, as well as appropriate and inappropriate child behavior during a pretreatment wait period to a posttreatment period. All fifteen parent-child dyads (child mean age of 4.7 years) received approximately 5 months of TEACCH intervention, totaling approximately six to eight sessions of 1–1.5 hour of treatment. At the end of treatment, there was a significant increase in the amount of parental guidance and appropriate child behavior during a parent–child interaction. However, the amount of inappropriate child behavior and reported parental stress were not significantly different after the treatment period.

The second Type 2 study by Ozonoff and Cathcart (1998) explored the effectiveness of a TEACCH-based home intervention program for 22 children with autism (2–6 years of age). The first 11 child–parent dyads to enroll in the study received 10 weeks of 1 hour TEACCH-based home program by trained interventionists. In addition, these 11 dyads received a 1-hour clinic visit each week at the beginning of the study, gradually decreasing to one visit every 2–3 weeks. The second 11 dyads received community treatment as usual. In comparison to the community control group, the treatment group improved significantly on the subtests of imitation, fine motor, gross motor, and nonverbal conceptual skills of the Psychoeducational Profile Revised (PEP-R), and in overall PEP-R scores. Although the treatment groups were matched on age, autism severity, initial PEP-R scores, and time interval between pre- and posttesting, groups were not randomly assigned.

Both studies reviewed here demonstrating promising effects of the TEACCH intervention model, however more rigorous study designs including randomized control groups are necessary to yield conclusive results on the efficacy of this intervention. The review of these two studies should be considered in light of the breadth of research that exists on the TEACCH approach.

## Conclusion

Developmentally based intervention approaches for young children with ASD are widely known and widely used, in the USA and in many other countries. While the empirical evidence for many of these approaches has lagged behind interventions coming from ABA, this situation is changing due to the enormous increase in emphasis and funding for interventions for the very youngest children with ASD. There are now real choices to be made between empirically based approaches coming from ABA and from developmental science. However, setting these up as dichotomous approaches is more heuristic than real, since developmental approaches that use thoughtful teaching practices are very likely using clear antecedent-behavior-consequences and put parentheses around (ABCs) and careful prompting, shaping, chaining, and fading in their teaching practices, whether they use that language or not. Similarly, early intervention programs developed out of ABA are incorporating concepts (e.g., play and joint attention) from developmental science as they develop curricula for infants and toddlers (Stahmer et al. 2011). It is very likely true that the most effective intervention approaches of the future will bring together the science of learning and the science of child development to individualize interventions and build from the latest empirical findings. While our review attempted to gather information on the field of developmentally based intervention approaches, we were hampered by the lack of a standard definition of a "developmental approach."

Some intervention models that appear to include many components of a developmental approach do not consider themselves to be "developmental," and others that many would not consider particularly developmental label themselves as such. Hopefully interventions that expressly include programmatic aspects derived from developmental science will begin to use the term "developmental," and those that describe themselves as developmental will explicitly state what aspects of their approach come from developmental science. Both professionals and parents would benefit considerably from this kind of "truth in advertising." In this paper, we have offered a definition of a developmental approach; time will tell whether this is of use to the field.

A second aspect of this review that needs comment is the number of "namebrand" intervention approaches that we included. It is interesting that there are so many comprehensive intervention approaches for very young children, and so few for older children, youth, and adults. The availability of comprehensive, branded programs with packaged curricula, assessment tools, and prescribed teaching methods likely reflects the relative homogeneity of very young children with ASD compared to teens or adults with ASD. A developmental curriculum for infants and toddlers with ASD can be modeled from developmental curricula for typically developing infants and toddlers in daycare and nursery school settings. By the time children with ASD are school aged and older, the range of functioning levels, skills, needs, and associated problems is so vast that aspects other than age become the most important "grouping" criteria for developing teaching programs. The fact that very young children with ASD have relatively similar needs for learning speech and language, play skills, social exchanges, nonverbal communication, and early cognitive-perceptual representations allows for comprehensive curricula to be developed. These intervention packages are often quite helpful to parents and early interventionists who are not autism researchers and who need to have help to integrate the vast amount of research that has been conducted on early development and learning in ASD. "It can be quite helpful to the intervention field when a brand-name intervention provides empirically derived efficacy data for its approach and a well-written treatment manual for the public that specifies both the content to be taught (the curriculum) and the teaching procedures to be used" (Rogers and Vismara 2008, p. 31). In addition, the presence of a well-described intervention approach facilitates research efforts. When core issues like curriculum, teaching practices, fidelity of implementation measures, and data collection systems are already defined by the developers, research efforts and replications are much easier to organize. However, by limiting

our review to well-studied developmental intervention approaches, by definition we could not review interventions in the beginning of their development, or interventions that grew out of a set of studies in which the developing approach was not yet named. By the time this chapter is in print, there will likely be new additions to the group of empirically based developmental practices. Thus, a review paper like this can never be completely contemporary. There is always a need to search for new papers in order to stay abreast of the field.

In terms of strength of the evidence, we have very few high quality efficacy trials, and no effectiveness trials, of these developmental approaches to early autism. While behaviorally based interventions for early ASD also have few high quality group efficacy studies, there are a plethora of high quality single-subject designs demonstrating experimental control of the dependent variables in the behavioral literature. The lack of a parallel body of work in the developmental interventions likely attests to a previous lack of emphasis on measurement and experimental rigor on the part of developmental interventionists. The current, and welcome, emphasis on empirically based interventions requires intervention studies of all approaches to consider the underlying causal mechanisms, specify expected outcomes a priori, and incorporate high quality measurements into examination of proximal and distal outcomes, as well as fidelity of implementation measures. While developmentalists tend to think of developmental progress as occurring at a different level than day-to-day behaviors, developmental changes are reflected in child behavior changes, and developmental progress can be measured in frequency counts (see Kasari et al. 2006, 2010; Vismara and Rogers 2008; Vismara et al. 2009 for excellent examples). The child development literature is rich with examples of straightforward measures to examine developmental constructs (the Strange Situation comes to mind). Relying on distal standardized test scores as the only critical outcome measures prevents interventionists from examining proximal behavioral probes that can show short-term change and that can allow for greater use of single-subject designs, which are much easier, faster, and cheaper to carry out than controlled group studies. Greater use of high quality single-subject designs would add considerably to the accumulation of evidence for efficacy of developmental approaches. We must find faster ways of moving intervention studies from the lab into the community. Without knowing results from community use of these intervention models, we have no grounded advice to give to families or community practitioners. Studies in community settings need to examine implementation fidelity as well as child and family outcomes in order to help us know how to transfer these approaches from university staff to community groups, and what to expect.

The previously common use of community treatment groups or wait-list groups as comparison subjects is becoming a more and more difficult design for researchers to implement. One reason for the difficulty is the steadily increasing availability of more early intervention services in communities, especially those communities in which a university autism research group might be operating. In some communities, public services are providing the same types of high quality interventions that universities want to test. In a recent study of our own, the community comparison group of 1-year-olds was receiving twice as much intervention as our experimental group! In addition, we have very limited ways of characterizing and comparing community services to experimental services, other than by name brands and number of hours. Such information conveys little about the actual type and frequency of learning opportunities that children receive (Warren et al. 2007), the kind of information that is needed in order to understand what children are actually receiving. Wait-list designs have been considered unethical by some reviewers, since it requires families to wait for interventions rather than beginning them immediately. It is also considered unethical by many to ask families to refrain from beginning additional services during experimental trials.

These kinds of design difficulties indicate a need to move to designs that compare different treatments (as in Yoder and Stone 2006) so that

all children quickly receive interventions that are expected to help them. Thus far, we have only discussed designs that examine one type of treatment. However, it is well known that there are good responders and poor responders, in some proportion, in every treatment, and studying one intervention only does not help us understand individual responses to different treatments. Laura Schreibman has been a leader in discussing this issue and carrying out initial studies (Sherer and Schriebman 2005; Schriebman et al. 2009, Schreibman et al. 2011). Studies like hers that examine child predictors of response to one or another treatment, and those that use SMART designs or decision trees within the study (Lei et al. 2012; Sandall et al. 2011) and repeated randomization to various treatment arms, are paving the way for the kinds of studies that the field needs—those that address individual intervention needs of individual children and change the intervention according to progress data in order to maximize treatment response (i.e., Response To Intervention [RTI] approaches).

The need for infant intervention models is now on the horizon, thanks to the work of the infant sibling researchers and early detection researchers. We now have community parents bringing infants to the clinic by 6 months of age with worries about ASD, and some of these children are very worrisome. What are we to do? To "wait and see" is frightening to families who are concerned about ASD and buy into the importance of earlier intervention. To "act now" is very difficult without studies, approaches, curricula, and manuals appropriate for this age. We need to rise to these challenges and develop interventions for risk signs of ASD. Fortunately, there are many high quality studies from the non-autism infant intervention literature from which to draw from initial ideas about how and why (see Wallace and Rogers 2010 for a review). Carefully controlled studies are critical for this group, since we have no idea what these "early signs" mean, and what they foretell, for infants below 12 months of age.

In closing, the gap between treatments derived from ABA and those derived from developmental theory is closing as children with ASD are coming in for services at younger and younger ages, and therapists need to treat children as young as 12–15 months of age. The gap is also being closed as interventionists realize that the models are not necessarily dichotomous. Developmental skills can be taught with the learning tools from ABA, and careful, ongoing skill measurement can occur within developmental approaches. The call for empirically supported interventions brings to the table empirical findings from many fields, and the increasing use of interdisciplinary teams in ASD treatment brings professionals together to work as a unit with a wide range of empirically based practices from which to draw. Early intervention is very fertile ground within which to develop, test, and disseminate transdisciplinary treatment approaches for ASD.

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