

The Early Start Denver Model

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2016

Superheroes social skills training, Rethink Autism internet interventions, parent training, EBP classroom training, functional behavior assessment: An autism spectrum disorder, evidence based (EBP) training track for school psychologists

US Office of Education Personnel Preparation Project: H325K120306

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Autism Spectrum Disorder (ASD) is a condition characterized by deficits in social interaction and communication and restricted, repetitive behaviors or interests present from a young developmental age (American Psychiatric Association, 2013). Currently, the Center for Disease Control (CDC) estimates that approximately 1 in 68 children will be diagnosed with autism, a rate which has nearly doubled in the past decade. The CDC recommends that all children be screened for autism when they are 18 months old, and again when they are 24 months old (Center for Disease Control and Prevention, 2016). Given the possibility of diagnosis at such a young age, early interventions specifically targeted towards toddlers with autism are increasingly prevalent.

The goal of many early interventions is to capitalize on the high levels of brain plasticity during infancy and toddlerhood in order to reduce symptoms of autism by altering the trajectory of brain development. The Early Start Denver Model (ESDM) is one such intervention, which aims to treat the core symptoms of autism by altering the underlying brain structure and functions in young children with autism in order to more closely resemble the development of neurotypical children. Because children with autism are naturally less socially-oriented, without intervention they have less opportunities to engage in activities that will build neural pathways in the same way as typically developing children. The ESDM aims to provide young children with autism with opportunities to interact socially and practice specific skills in order to change the development of the brain. According to the developers of the Early Start Denver Model, every single activity a young child with autism engages in serves to either build a brain that is more socially oriented, or more object oriented. The activities and techniques used in this intervention

address some of the core social deficits often seen in children with autism in order to promote social development (Rogers & Dawson, 2010).

Theoretical Background

The Early Start Denver Model was developed by Sally Rogers, Ph.D. and Geraldine Dawson, Ph.D. It is considered a comprehensive naturalistic developmental behavioral intervention, meaning it is implemented in a natural setting and utilizes a variety of behavioral techniques such as natural contingencies to teach a comprehensive set of developmentally appropriate skills (Schriebman et al., 2015). The Early Start Denver Model was developed as an extension of the Denver Model, an intervention for children with autism between the ages of 24-60 months. The theoretical background and intervention techniques of the Early Start Denver Model closely resembles that of the Denver Model, but incorporate activities and intervention techniques that are tailored towards a younger developmental level. Like the Denver Model, the ESDM is a naturalistic model (i.e., skills are taught in the child's natural environment and practiced through play) that incorporates some teaching techniques from Applied Behavior Analysis. The ESDM is a comprehensive intervention, meaning it targets multiple developmental domains including receptive communication, expressive communication, social skills, play skills, cognitive skills, fine motor skills, gross motor skills, and adaptive behavior skills. Skills within each of these domains are categorized by developmental level according to when neurotypical children develop each skill, and are taught sequentially. Finally, the intervention focuses on building strong, positive relationships with adult caregivers in order to promote social development (Rogers & Dawson, 2010).

In addition to drawing from the Denver Model, the ESDM is rooted in a number of other perspectives on autism intervention, all of which focus on aspects of social engagement and

natural reinforcement. Rogers and Pennington's Model of Interpersonal Development in Autism (1991) hypothesizes that children with ASD naturally lack the ability to imitate – a skill present in typically developing children from birth – which subsequently affects the development of social milestones. Accordingly, the ESDM emphasizes imitation as a keystone skill which is first developed and then used as a technique to teach other skills. The Social Motivation Hypothesis of Autism states that children with ASD lack sensitivity to social reward, causing a lack of interest in social activities, which leads to isolation and poor social skills. The ESDM focuses on incorporating frequent positive social interactions into intervention sessions as a way to increase the salience of social rewards, subsequently increasing the child's motivation for social interaction (Rogers & Dawson, 2010).

Additionally, the Early Start Denver Model uses some Applied Behavioral Analysis (ABA) techniques in order to teach children new skills. The field of ABA works to understand how elements of a person's environment influence his or her behavior, and ABA intervention techniques aim to manipulate environmental factors in order to evoke desired behaviors. The use of ABA techniques to teach children with autism was pioneered by Ivar Lovaas, who believed that these children would learn skills more easily through the use of simplified instruction, intensive teaching (i.e., 25 or more hours per week) and increased reinforcement for performing skills correctly. Lovaas developed discrete trial training (DTT), in which skills are broken down into small steps and taught one at a time in discrete trials (e.g., teaching sessions with a clear beginning and ending in which skills are practiced repeatedly and rewarded; Schreibman et al., 2015). While DTT has been found to be effective in teaching skills (Schreibman, 2005), it is criticized by some as an unnatural way to teach skills in which children are overly dependent on adult prompts and reinforcement. Additionally, some critics note that while it is effective for

teaching skills, these skills do not always generalize to the child's natural environment (Schreibman et al., 2015).

In response to these criticisms of DTT, other ABA techniques emerged that rely less upon extrinsic reinforcement and adult-directed activities. The Early Start Denver Model specifically draws upon one such form of ABA, Pivotal Response Training (PRT). PRT is a method of teaching that aims to increase a child's motivation to engage socially by providing natural rewards for demonstrating skills during social interactions. Because the ESDM is a naturalistic model, it aims to teach skills as naturally as possible, mirroring how they would be performed in a day-to-day context. Accordingly, PRT teaching techniques strive to consider the child's choice of activities and objects when creating learning opportunities rather than having adults pre-plan all learning activities. Additionally, in PRT and the ESDM, interventionists avoid the use of extrinsic rewards such as edibles to reinforce behavior. Rather, the child is reinforced socially through positive interactions with the adult and by being able to choose preferred activities and toys (Schreibman & Pierce, 1993; Rogers & Dawson, 2010).

Intervention Overview

The Early Start Denver Model intervention is typically delivered to toddlers with autism in 1:1 intensive therapy sessions. Children generally begin the intervention between the ages of 1-3 years, and continue treatment until they are 4-5. Rogers and Dawson recommend that the child participates in at least 15-20 hours of therapist-led intervention per week in addition to practicing skills with caregivers at home. Each intervention session typically lasts about one hour. In addition to a lead therapist, each child is assigned a multidisciplinary treatment team that is available for consultation during assessment and goal setting. Because the ESDM aims to practice skills in a natural context, intervention sessions are typically delivered in the child's

home, but they may also occur in a clinical setting. The intervention begins with a skills assessment (known as the Curriculum Checklist) to identify which developmental skills the child has mastered and which skills should be targeted during treatment. The child is reassessed every 12 weeks to gauge his or her developmental level in all domains and to monitor progress. Based on the results of the Curriculum Checklist assessment, the child's treatment team selects learning objectives for the child, and breaks these objectives down into specific teaching steps that are targeted during play-based therapy sessions (Rogers & Dawson, 2010).

The ESDM Treatment Team

Every child who participates in the Early Start Denver Model is assigned to a multidisciplinary team that establishes the child's learning objectives and monitors the child's progress. Team members may include a clinical, developmental or educational psychologist, a physician, a special education professional, a speech and language pathologist, an occupational therapist, an ABA specialist, and family members who receive training and direct supervision by these professionals. From the treatment team, one member is identified as the lead therapist. The lead therapist is in charge of running all individual therapy sessions with the child, and other team members are available for consultation as needed, particularly during goal-setting and assessment sessions. Providing each child with a multidisciplinary treatment team helps support treatment planning and ensures that all treatment providers share common goals, as well as making sure that each child's unique needs are comprehensively addressed (Rogers & Dawson, 2010).

In order to be a certified Early Start Denver Model therapist, there are a number of prerequisite qualifications and training requirements potential therapists must meet. First, to become an ESDM therapist, professionals must have an educational degree beyond a Bachelor's

degree (e.g., MA, Ph.D., SLP or OT), and must already work regularly with 12-48 month old children with autism as part of an interdisciplinary team. Professionals who meet these requirements are eligible to begin the ESDM training process (UC Davis MIND Institute ESDM Training Program).

In order to complete this training process, professionals must purchase and read the Early Start Denver Model Training Manual. Next, they must attend two ESDM training workshops – first the introductory workshop, and then the advanced workshop. In the introductory workshop, applicants will learn about the background, principles, and assessment and intervention procedures used in ESDM. The advanced workshop builds upon topics covered in the introductory workshop, and includes opportunities for interactive hands-on practice using intervention techniques with real children. Professionals practice the techniques they have learned in small groups under the direct supervision of certified ESDM therapists. During this workshop, professionals are provided with coaching and feedback, and learn more about how to establish individual learning objectives for clients (UC Davis MIND Institute ESDM Training Program).

Upon successfully completing both workshops, participants submit an official application for supervision. After being assigned an ESDM training supervisor, the applicant will submit practice materials to their supervisor for review and feedback. These practice materials include a completed ESDM curriculum with written objectives for a child across at least three developmental domains. Upon receiving feedback from his or her supervisor, the applicant will then submit a detailed plan for teaching the approved objectives and identify how the acquisition of these steps will be monitored with data. Next, the applicant will send a 30-minute unedited video clip demonstrating his or her implementation of the ESDM intervention using the

established learning objectives and teaching steps, along with data from the session and a self-rated fidelity form. If the applicant and supervisor both rate the video and accompanying data sheet at 80% fidelity or higher (using the ESDM Fidelity Checklist, a tool that monitors the fidelity of ESDM technique use), the video will count as one of two official submissions. If the video does not meet these standards, the supervisor will provide up to two rounds of feedback and guidance, allowing the applicant to try again. Supervisors rate the applicants according to the developmental appropriateness of their curriculum and chosen learning objectives, the steps for teaching objectives, the accuracy of data and scoring, and the fidelity of ESDM technique use. After successfully completing this first video submission, the applicant must submit a second video with learning objectives, teaching steps and data for a new child. If this second submission meets fidelity requirements, the applicant will be certified as an official ESDM therapist (UC Davis MIND Institute ESDM Training Program).

In addition to the clinical treatment team, parents and family play a large role in the ESDM treatment model. Parents play an instrumental role in establishing which goals they want their child to work on, and their opinions are valued when the therapist develops learning objectives. Parents also play an important role during assessments, as they can provide valuable information about skills which the child may be performing at home that are not observable during the assessment. Additionally, training parents to use ESDM techniques outside of formal therapy sessions serves to maximize child growth. The ESDM is considered an intensive treatment model, and recommends that children receive a minimum of 15 hours of intervention per week. By training parents to deliver the intervention on their own, the dose of intervention can substantially increase. This allows children to continue practicing skills in their natural environment during daily activities, another key goal of the ESDM (Rogers & Dawson, 2010).

Additionally, the active involvement of parents in treatment planning and intervention provision helps parents become better advocates for their children. This is particularly important when a child transitions out of the Early Start Denver Model, but is helpful whenever parents need to communicate their child's goals and developmental abilities to other treatment providers.

Finally, research has found that parents who are actively involved in the intervention process have reported greater feelings of self-efficacy, and children maintain gains made during the intervention for a longer period of time (Marcus, Kuncze & Schopler, 2005).

Getting Started: ESDM Assessment

The first step in the Early Start Denver Model intervention is to assess the child's developmental level in a variety of domains. This provides the treatment team with information about what skills the child already possesses, skills that are beginning to emerge, and skills that are beyond the child's current developmental level. From the results of the assessment, the team will select skills for the child to begin working on in intervention sessions. The tool used to assess each child's development is called the Curriculum Checklist. In the Curriculum Checklist, skills are categorized into several domains: receptive communication, expressive communication, social skills, imitation, joint attention, play skills, cognitive skills, fine motor skills, gross motor skills, and adaptive behavior skills such as eating, dressing, grooming and chores (Rogers & Dawson, 2010).

Each of these categories is further broken down into four levels, based on the age when typically developing children acquire the skills within each domain. The developmental levels are as follows: Level 1 corresponds with skills developed between 12-18 months of age, Level 2 corresponds with skills developed between 18-24 months, Level 3 corresponds with skills developed between 24-36 months, and Level 4 corresponds with skills developed between 36-48

months. Skills within each domain and developmental level are listed in the order they are typically acquired, though each individual child may develop skills in a different order. When selecting teaching objectives for a child, the child should have mastered all of the skills within one developmental level before targeting skills in the next level of the domain, even if the child begins to spontaneously demonstrate some skills in the next level. However, a child's skill level may vary across different domains (e.g., the child may be working on Level 1 imitation skills and Level 2 receptive communication skills, Rogers & Dawson, 2010).

To better understand how these skills are broken down for assessment, we can look at the example of expressive communication skills. At Level 1, a child would be expected to use a goal-directed reach to request, vocalize with intent, ask for help by handing an object to an adult, take turns vocalizing with a communication partner, and point (both proximally and distally) to request a desired object, among other skills. Some Level 2 expressive communication skills include using target signs or gestures with vocalizations to express meaning, producing 6-10 single words within the context of familiar routines, spontaneously producing multiple words associated with a play routine, spontaneously labeling objects and pictures, vocalizing with varied intonation during songs and other activities, and shaking head to indicate "no" and nodding to indicate "yes." Level 3 expressive communication skills include producing two- to three-word combinations for a variety of communicative intentions (e.g., requesting, greeting, refusing, etc.), labeling actions in pictures and books, commenting and requesting on his or her location (e.g., up, down, in, out), commenting and requesting using possessive words (e.g., mine, yours), consistently using other people's names to get their attention, naming some colors, and responding appropriately to "what" "where" and "who" questions. Finally, Level 4 expressive communication skills include describing object functions (e.g., answering "what do you do with

a fork?”), consistently speaking in three- to four-word utterances, describing a recent experience using three- to four-word sentences, using the past tense appropriately, answering the telephone appropriately, and asking for clarification if he or she does not understand what is said, among other skills (Rogers & Dawson, 2010). As seen in the above example, skills build in complexity as the ESDM developmental level increases.

Children are assessed using the Curriculum Checklist every 12 weeks in order to monitor progress and understand their developmental level. The Curriculum Checklist is administered during an interactive, play-based session, which allows for multiple skills to be observed during a short period of time. During the assessment, the therapist engages the child in a play activity of the child’s choosing, pausing every few minutes to note behaviors observed on the checklist in each domain. The therapist should note skills on the Curriculum Checklist that were clearly performed at mastery level, as well as skills that the therapist attempted to evoke but the child did not perform. The therapist should also take a moment to note which skills have yet to be assessed, and choose new objects and play activities that will facilitate the observation of those skills. Generally, the administration of the Curriculum Checklist takes from 1-1.5 hours. In addition to the therapist-led play session, parents may provide information about behaviors that cannot be observed during the session (e.g., bedtime routine or some hygiene activities), as well as any relevant information from other professionals such as the child’s teacher. Following the assessment session and the parent report, each skill on the Curriculum Checklist is marked as passing (P or +) if the child can consistently perform it at mastery level, pass-fail (P/F or +/-) if the child performs the skill inconsistently, or failing (F or -) if the child is unable to perform a skill successfully or it is never exhibited. For each skill, the Curriculum Checklist Item Description specifies the level of response required to receive a passing mark. Passing items are

skills that are performed at the mastery criteria consistently in a variety of environments with multiple people. Using the data from the Curriculum Checklist, the therapist will then speak with the family and the treatment team to determine learning objectives for the child to work on during subsequent therapy sessions (Rogers & Dawson, 2010).

Learning Objectives

The Early Start Denver Model suggests that therapists and families select two to three learning objectives from each domain covered in the Curriculum Checklist. Typically, objectives are chosen based on skills the child performs inconsistently, or skills just beyond those that have been mastered, but should also take into consideration the parents' goals for their child and input from other professionals involved in the child's care. When selecting skills to target, the ESDM manual recommends that a child completes most skills in a developmental level before moving on to skills in the next level of a given domain. Children work on the selected objectives for 12 weeks, at which time they are reassessed using the Curriculum Checklist to monitor progress. Accordingly, when selecting objectives it is important to consider whether it could be reasonably expected that the child would master the target skills within a three month period.

Because the Early Start Denver Model is a comprehensive intervention, it recommends selecting a balanced number of objectives across all learning domains rather than emphasizing some domains over others. Rather than focusing on specific target areas, the intervention aims to promote each child's overall development. If learning targets are selected based exclusively on a child's areas of weakness, progress is likely to slow down and the child, family, and treatment team may experience increased frustration. Similarly, if targets are selected based only on a child's strengths, important skills may be neglected, and the disparity between the child's strengths and weaknesses can be accentuated. By selecting a balanced list of objectives across all

domains, the family and ESDM therapist can help maintain motivation and maximize the child's overall development (Rogers & Dawson, 2010).

After a child's learning objectives have been established, they are written in a specific way to maximize clarity. Written objectives contain four main components: A specific antecedent or stimulus that will evoke the target behavior, an observable and measurable target behavior, criterion defining objective mastery, and criterion defining generalization of the objective. The first component of the written objective, the antecedent, is what will occur immediately before the target behavior and serve as a stimulus to cue that behavior. It is important to specify the antecedent in the written objective because it will tell the interventionist what stimuli to use in order to evoke the desired behavior. Additionally, by choosing what the antecedent will be, the interventionist can train the child to respond to the same stimuli that cues that behavior in typically developing children. The second component of the written objective, the target behavior, is the specific skill that is being taught. It is important that the written behavior be observable (so that the interventionist can see how and when it is being performed) and measurable (to determine how frequently and accurately it is being performed). The third component of the written objective, mastery criterion, serves to make sure skills are taught at the appropriate level of achievement and helps to precisely determine whether the child has passed or failed the skill. Because the goal is to pass objectives within 12 weeks, the interventionist should consider the child's typical learning rate when determining mastery criteria. This specific criterion may specify the number of skills learned (e.g., writing the first six letters of the alphabet), the latency of response (e.g., the child will respond to their name by turning their head within one second), the duration of the response (e.g., the child will play independently and appropriately with toys for five minutes), or the level of prompting required to successfully

perform the behavior (e.g., the child will imitate body movements with no physical prompting). The final component of the written objective, criterion defining generalization, ensures that the child will generalize learned skills to their everyday life. As a general rule, generalization criteria specifies that the skill will be performed in two or more settings, with two or more people, using two or more sets of materials (Rogers & Dawson, 2010).

Teaching the Objectives

Once a child's learning objectives have been defined, each target skill should be broken down into smaller steps using task analysis. These smaller steps are then taught to the child to ensure that he or she learns each target skill thoroughly. Once skills have been broken down into smaller components, the components can be taught in one of two ways: in a behavior chain or a behavior bundle (Rogers & Dawson, 2010). Behavior chains are a chain of behaviors that occur in a specific order. For example, when teaching a child to brush his or her teeth, the child must get out the tooth brush and tooth paste, unscrew the toothpaste lid, squeeze toothpaste onto the brush, lift the brush to his or her mouth, etc. These steps occur in a specific order, and the sequence remains the same every time the skill is performed. When teaching skills in a behavior chain, the skill can be taught by having the child master the first step first, then work forward in sequential order (forward chaining), or by mastering the final step and working backwards (backward chaining). Unlike behavior chains, behavior bundles are behaviors that co-occur within an activity to complete the objective, but do not have to occur in a specific order (Rogers & Dawson, 2010). For example, when a child asks for an object, there are many communicative behaviors that may occur such as looking back and forth between the object and caregiver, gesturing, and making noises or using words. These behaviors are all part of the larger skill of asking for the object, but do not need to occur in a specific order. When teaching an objective via

behavior bundle, the components of the skill are taught individually but do not need to be mastered sequentially.

When learning objectives have been established and broken into smaller steps, the ESDM therapist will find ways to incorporate teaching moments into play sessions in order to teach and practice the skills. When teaching new skills, the therapist may use a variety of behavioral teaching techniques including prompting, shaping, and fading. Because the play sessions aim to be driven by the child's interests, the therapist will have an idea of what skills to target and attempt to flexibly incorporate those skills into whatever activity the child chooses. Because of this, each play session is different and may not cover all objectives, though the therapist should target several skills during each session. At times, the therapist may manipulate the environment to help evoke particular behaviors by setting out materials or suggesting activities that will facilitate the practice of certain skills, but the child's interests should still guide the session (Rogers & Dawson, 2010).

A key teaching strategy in the Early Start Denver Model is the use of joint activities. A joint activity is an activity in which two partners are engaged with each other in the same activity, attending to the same objects or working together. The goal of joint activities in ESDM is to engage the child in activities that provide practice opportunities for target skills, and to develop a positive relationship with the child in which the adult makes activities more interesting and socially rewarding. Each therapy session lasts about an hour, during which time the therapist engages the child in several different joint activities that each last a few minutes. During each session, the therapist should aim to alternate between object-focused and partner-focused sensory-social joint activities. During object-focused activities, the adult and child attend to the same objects, using the materials to create a common play theme. During object-focused joint

activities it is important to continuously weave in social opportunities such as imitation, turn taking, and communication so that the child is interacting with the therapist and not simply focusing on the object. During partner-focused or sensory-social joint routines, the child's attention is focused exclusively on a social exchange with the other person rather than on an object. Examples of sensory-social routines include songs like "itsy bitsy spider" or social games like "peekaboo" that involve facial expression, gesture, vocalization, and attention towards a partner. While some sensory-social routines may use objects to facilitate the activity, the focus of the joint activity is on the social exchange rather than the object. During each therapy session, it is important to alternate object-focused and partner-focused joint activities, because each activity facilitates the performance of different target skills. While partner-focused sensory-social routines focus on language, communication, social and play skills, object-focused routines facilitate opportunities to practice cognitive and motor skills (Rogers & Dawson, 2010).

A typical ESDM session begins when the child demonstrates interest in a particular object or activity. The adult follows the child's lead, and finds ways to incorporate learning objectives and ESDM teaching strategies into joint play activities. The adult should position them self in front of the child so the therapist's face and body are visible to the child. This helps increase the opportunity for social interaction, and allows the therapist to capture the child's attention and use imitation. Throughout the session, the adult strives to make the activities highly social and rewarding. This is important both to increase the child's social behavior, and to make the adult's presence serve as a reinforcer when the child engages socially and performs target skills. The therapist may do this by elaborating on child-initiated activities and making activities more interesting by adding narration or sound effects. Additionally, the therapist can use incidental teaching by observing what materials the child wants and withholding them until the

child indicates appropriately for what he or she wants using gesture or vocalization. This serves to both evoke particular behaviors from the child and establish the adult's presence as helpful and reinforcing. The adult can also control materials and increase social interaction through turn-taking, in which they take the play object from the child and say "my turn," use the object to demonstrate a skill, then hand it back to the child and state "your turn!" During all activities, the therapist should also maximize opportunities for the child to use both verbal and nonverbal communication. This can be done by controlling materials or modeling vocabulary or gesture and having the child imitate (Rogers & Dawson, 2010).

Data Tracking

During therapy sessions, therapists take data on learning objectives to monitor the child's progress. Therapists use the Daily Data Sheet, which is similar to the Curriculum Checklist assessment form. The Daily Data Sheet includes columns listing the task-analyzed steps for each learning objective, the date the step was started, and the date the step was passed. The date started column refers to the first session in which the therapist begins to teach the skill step, and the date passed column refers to the first session in which the child performs the skill at mastery level as defined by the written objective. In addition to the start date and passed date, each objective step has several corresponding columns in which the therapist indicates the child's performance of the skill during a session. Data is marked in these columns the same way as in the Curriculum Checklist, with a + for passing, +/- for inconsistent performance, and – for inadequate performance. If a therapist does not have the opportunity to probe a skill during the session, the data column should be left blank (Rogers & Dawson, 2010). As an alternative to collecting data on paper during ESDM sessions, a third-party developer released an app for android devices to facilitate data collection. The app is called Mobile Data Collection ESDM,

and it provides an electronic template of the Daily Data Sheet that can be filled out on a hand-held electronic device.

During a one-hour ESDM session, therapists pause approximately every 15 minutes to record data. Because the therapist is engaged in highly social play activities with the child, recording data each time a behavior is probed or performed would be disruptive to the interaction. When the therapist pauses the session to record data, he or she should make sure the child has engaging materials and can occupy them self independently momentarily. During this time, the therapist scans over the Daily Data Sheet and records data for skill steps that were observed, and for those that the therapist attempted to evoke but the child did not perform. The therapist also takes this time to review which objectives have not yet been taught or practiced during the session in order to target these skills during subsequent activities. The therapist should also consider which steps are currently being targeted, and which steps have been recently mastered, and probe both to ensure that mastered steps are maintained. Finally, the Daily Data Sheet includes a column for the therapist to code the child's behavior during the session, with codes indicating whether the child demonstrated severe behavior problems, mild behavior problems, some behavior problems, no problem behavior but difficulty staying on task, compliant behavior, or above average performance (Rogers & Dawson, 2010).

When the session is completed and the Daily Data Sheet has been filled out, the data is then transferred to the Data Summary Sheet, which contains data for each objective over multiple sessions. Examining the child's performance over time on the Data Summary Sheet can help the therapist decide when to move on to new teaching steps for an objective (typically when a child performs a skill at passing level over three consecutive sessions). Additionally, the Data Summary Sheet includes space for the therapist to record what level of prompting was required

in order for the child to perform a skill step (full prompt, partial prompt or minimal prompt), whether the child refused to perform the step even with full prompting, and whether the skill was acquired at mastery level (Rogers & Dawson, 2010).

Troubleshooting

If a child demonstrates persistent disruptive behavior during therapy sessions that interrupts learning, the Early Start Denver Model suggests using positive behavior supports to manage such behaviors. Rather than using consequences to punish unwanted behaviors, the ESDM advocates for controlling the environment to minimize the opportunity for such behaviors, and for teaching children appropriate alternative behaviors. For example, to eliminate disruptive stereotypic behaviors involving an object, the therapist might take the object from the child when it is being used inappropriately, model the appropriate use, then return it to the child and provide reinforcement when they imitate its correct use. If the object continues to be disruptive, the therapist may simply remove it from the play area. Ideally, when the therapist sets up the environment in a way that minimizes distractions and positions his or her body appropriately near the child, disruptive behaviors will be minimized. For more severe and dangerous behaviors, it may be necessary to have a behavior analyst complete a functional analysis to gather information about why the behavior is occurring. Understanding the purpose of the behavior allows the treatment team to identify a more appropriate replacement behavior to teach the child that will still allow the child to get his or her needs met without engaging in the unwanted behavior. It is also important to ensure that the child receives high levels of positive attention both during sessions and in his or her daily life, as children with problematic behaviors may receive more negative attention over time. Providing adequate positive attention helps

maintain motivation and minimize a child's desire to act out in order to gain adult attention (Rogers & Dawson, 2010).

If a child is not making adequate progress in the Early Start Denver Model, there are a few things that can be adjusted. The ESDM defines "adequate progress" as measurable progress on acquisition skill steps reflected by improvements shown on data sheets every three to five days for children receiving 20 or more hours of therapy per week, or every one to two weeks for children receiving less intensive therapy. If the treatment team determines that a child is not progressing adequately on one or more skill steps, there are three things that can be adjusted. The first element is the strength of reinforcement the child receives. While the ESDM avoids the use of extrinsic reinforcers such as edible rewards for skill performance, activities and interactions with the therapist should be intrinsically reinforcing and fun for the child. When a child does not demonstrate adequate progress, the therapist should evaluate how intrinsically reinforcing the task is. If a task has low intrinsic reinforcement (e.g., cleaning, getting dressed, etc.), the first option should be to provide increased social reinforcement from the therapist. If that is insufficient, the therapist can try pairing the social reinforcement with an extrinsic reinforcer (ideally something related to the activity). Alternately, the therapist can try immediately following that activity with one the child enjoys, such as playing with a preferred toy or singing a song. The next element that can be adjusted to support the child's progress is the teaching structure, or the level of structure in a therapy session. This can be done by probing skills more frequently, and decreasing the amount of materials and activities within a session in order to focus more intensely on a specific skill. Finally, if adjusting reinforcement and teaching structure has not helped the child progress, the therapist may consider adding visual supports to help the child better understand the task. This may involve using a visual schedule or template, video

modeling, or other form of visual aid to present the expected skill. The ESDM considers the addition of visual supports to be a last resort, because the ultimate goal of the intervention is to have children perform skills naturally in their daily environment. Because of this, the ESDM avoids providing children with additional stimuli (such as the visual support) that they may depend on to perform tasks in the future. It can also be time consuming to teach the child how to use the visual support, which detracts from the time that could be spent teaching other skills (Rogers & Dawson, 2010).

Transitioning out of the Early Start Denver Model

Ideally, a child transitions out of the ESDM treatment when he or she is old enough to attend Kindergarten. However, families may choose to remove their child from treatment if the child fails to make adequate progress even after modifying the intervention, or if a family decides the program is not a good fit. When a child has been receiving the ESDM intervention for several months or years and approaches transition age, the child's family and treatment team create a transition plan together. If parents do not already have treatment providers outside of the ESDM treatment team, the team should make appropriate referrals for new providers. The family and ESDM treatment team then interface with these new providers about the child's developmental level, progress and goals in order to maintain the child's learning trajectory and maintain skills that have been learned. Additionally, it may be necessary to set up an IEP meeting and discuss the child's learning objectives with the school. Finally, the ESDM team generally remains available to the family for a set period of time following the child's transition to consult as needed (Rogers & Dawson, 2010).

Early Start Denver Model Adaptations

In addition to the intensive individual delivery format of the Early Start Denver Model, the intervention has been adapted for delivery in group format and through parent training. As noted earlier, the ESDM intervention suggests that parents be trained in using ESDM techniques at home with children in order to maximize each child's learning opportunities. Typically, parents use ESDM techniques in addition to the intensive 1:1 sessions with a certified ESDM therapist. Additionally, the intervention can be adapted for use with a group of children. One major benefit of the group delivery format is that children with autism have the opportunity to interact socially with same-aged peers, a skill not practiced in individual therapy. In the group delivery format, children typically receive 15 or more hours of therapy per week, as in the individual format. Children are assessed using the Curriculum Checklist and have individual learning objectives which are targeted through group sessions as well as some individual therapy sessions. The group schedule rotates weekly, with all children participating in the same set of activities for several consecutive days. This is to ensure that all children have adequate opportunities to practice skills and engage in activities, as some children will learn more quickly than others in the group. Throughout the day, activities last approximately 10 minutes, and are rotated to target various developmental domains. During group activities, therapists should elicit active participation from all children in the group, and aim to provide individual learning opportunities for each individual child approximately every 30 seconds. Because of this, there are generally multiple trained staff involved in group sessions. Data is recorded for group sessions the same way as in individual ESDM therapy; following each activity therapists pause to fill in data sheets for all children and review learning objectives to target in the next activity.

Staff also meet weekly to review each child's progress and learning objectives (Rogers & Dawson, 2010).

Early Start Denver Model Research

In 2016, Waddington et al. published a systematic review of 15 studies (involving 12 separate cohorts of participants) of the Early Start Denver Model intervention involving 209 children with autism with an average age of 60 months. The review considered the design of the studies, the quality of the methodological rigor, and participant outcomes. The studies considered delivered the ESDM intervention through parent training, therapist training, intensive one-on-one therapist-child intervention combined with parent training, and group intervention. Study designs included two randomized controlled trials, two quasi-experimental multiple-group comparisons, four quasi-experimental one-group comparisons, three multiple-baseline across participant designs, and one case study. Studies were evaluated using *The Evaluative Method for Determining Evidence-Based Practices in Autism* as strong, acceptable, or weak. While the majority of these studies reported at least some positive outcomes for the majority of participants as well as high treatment integrity, Waddington et al. concluded that the results of many of these studies should be considered with caution as a result of weaknesses in their methodological rigor. Of the 12 separate study groups, six studies were rated as strong, one study was rated as adequate, and eight studies were rated as methodologically weak, resulting in reduced certainty of evidence. Studies were rated as weak due to the absence of a control group, inadequate statistical power, failure to replicate the experimental effect, insufficient baseline data, or too few high quality indicators. The results of this review suggest that the Early Start Denver Model has the potential to be a promising early intervention for children with autism, but there is a need for additional research of higher quality.

As part of their review, Waddington et al. examined moderators leading to better outcomes for participants. While several of the studies identified outcome moderators, there was little consistency between studies, and some of the results were contradictory. Rogers et al. (2012) found that increased intervention hours, younger pre-treatment age, and nonsocial orienting were predictors of better outcome. However, Vivanti et al. (2013) found no correlation between these variables and participant outcome. Instead, this study found imitation skills, functional object use, and goal understanding to be predictors of positive outcome. However, Rogers et al. (2012) did not find imitation skills to be a positive outcome moderator. The conflicting nature of these results further supports the need for additional ESDM studies to better evaluate the intervention as a whole, as well as outcome moderators. Below, ESDM studies rated as methodologically strong by Waddington et al. will be examined further.

In 2010, Dawson et al. published the first randomized controlled trial comparing the Early Start Denver Model to a community treatment control group. In this study, 48 children between the ages of 18-30 months diagnosed with autism or PDD-NOS were randomly assigned to the ESDM or control group. The ESDM group received yearly assessments, 20 hours per week of intervention, parent training in ESDM techniques, parent delivery of ESDM for five or more hours per week, as well as any additional intervention services the families chose. The control group received yearly assessments, autism education, and referral to community resources. Both groups were assessed after one and two years using the Autism Diagnostic Interview – Revised, the Autism Diagnostic Observation Schedule, the Mullen Scales of Early Learning, the Vineland Adaptive Behavior Scales, and the Repetitive Behavior Scales.

After one year, the ESDM group demonstrated significantly more cognitive improvement on the MSEL than the control group (an average score increase of 15.4 compared to 4.4). On

language measures, the ESDM group demonstrated greater average gains than the control group (17.8 point improvement on measures of receptive language compared to 9.8 for the control group), though this difference was not statistically significant. On measures of adaptive skills, both groups made some improvements, but demonstrated slower development than the normative sample. Finally, there was no difference in severity score on the ADOS or RBS for either group.

After two years of treatment, the ESDM group again demonstrated significantly more cognitive improvement on the MSEL, with an average increase of 17.6 points compared to the control group's increase of 7 points. The ESDM group improved 18.9 points on receptive language measures and 12.1 points on expressive language measures, compared to 10.2 and 4 points respectively for the control group. On measures of adaptive skills, the ESDM group showed similar standard scores at year one and year two assessments, indicating a steady rate of development, though still below normative peers. However, the control group demonstrated an 11.2 point decline, indicating delays and an increasing gap from the normative sample. On the ADOS and RBS, neither group demonstrated improvements in severity scores. However, participants in the ESDM group were significantly more likely to have improved diagnostic status after two years of treatment. Seven children in the ESDM group demonstrated improved diagnostic status (from autism to PDD-NOS) compared to one participant in the control group. Two participants in the ESDM group and five participants in the control group met criteria for a more severe diagnosis at the year two assessment. Overall, the results of this study found that participants in the ESDM group were more likely to have greater cognitive and diagnostic improvements than participants in the control group.

Following the initial phase of this study, follow up studies were conducted with the same cohort of participants to examine treatment effects in participants' brain functioning, and to

examine participants' long-term outcomes. In 2012, Dawson et al. followed up with the same group of children and examined their brain activity when presented with social and nonsocial stimuli. Because the goal of the Early Start Denver Model is to alter the underlying brain structure and functioning of toddlers with autism to more closely resemble brain development of neurotypical children, the authors of this study hypothesized that children who had received the ESDM treatment in the original study would demonstrate brain activity that more closely resembled typical brain development than children in the control group. In addition to the original group of participants, Dawson et al. examined the brain activity of 17 typically developing children of the same age as a comparison. Participants in the study were monitored with EEGs while they were exposed to 140 unique color photographs, half showing images of faces, and the other half showing images of toys. The photos appeared in random order on a screen. Dawson et al. hypothesized that neurotypical children and children who had received the ESDM intervention would demonstrate greater cortical activation when looking at social images (faces) than when looking at object images (toys).

Results of the study found that 73% of ESDM participants and 71% of typical children demonstrated higher cortical activation when viewing faces than when viewing objects, compared to only 36% of the comparison ASD group. The ESDM children and neurotypical peers also demonstrated a faster neural response to social stimuli than the ASD control group. Additionally, this study found a correlation between higher levels of cortical activation for social stimuli with higher levels of social engagement as measured by the PDD-Behavioral Inventory Composite Expressive and Receptive Communication indices. However, while there were significant differences between the ESDM group and control group in terms of brain activity,

there was no correlation between these EEG results and measures of IQ, language, or adaptive behavior (Dawson et al., 2012).

In addition to the EEG study, researchers did follow up assessments with the same group of children two years after the original 2010 Dawson et al. study to assess the long term outcomes of treatment. In this follow up study, 39 of the 48 participants were reassessed at age six to measure developmental progress. Researchers also followed up with parents every six months to find out what type of treatments their children had received and at what level of intensity. Participants' intellectual functioning was assessed using the Differential Ability Scales – School Aged Level and the Mullen Scales of Early Learning. Adaptive skills were measured with the Vineland Scales of Adaptive Behavior. Autism symptoms were measured using the ADOS-WPS version and the Repetitive Behavior Scale- Revised. Challenging behaviors were measured with the Aberrant Behavior Checklist. Finally, peer relationships were assessed using the ADI-R parent interview (Estes et al., 2015).

On measures of developmental outcomes, both groups demonstrated continued improvement in intellectual and adaptive functioning. Participants in the ESDM group had slightly higher composite, nonverbal and adaptive scores than the control group, but not at a statistically significant level. On the ADOS and Repetitive Behavior Scale, the ESDM group did have significantly lower average scores, indicating improvements in the core symptoms of autism. Two children in the ESDM group no longer met criteria for an autism diagnosis, while there was no change in the control group, however these changes were considered nonsignificant. There was no significant difference between the groups in terms of challenging behavior. Finally, children in the ESDM group were rated by parents as having slightly better peer relationships than children in the control group, but not at a statistically significant level.

These results show that while the ESDM group showed greater reductions in the core symptoms of autism than the control group, there were no other significant differences between the two groups. However, the authors of this follow up study suggest this may be due to the amount of treatment children received following the initial 2010 study. On average, the control group received 7.5 hours of one-on-one intensive intervention per week, while the ESDM group received an average of only 4.04 weekly hours of treatment. The authors of the study suggest this may indicate that the ESDM group of children demonstrated an increased ability to learn in less restrictive environments as a result of their early intensive intervention experience (Estes et al., 2015).

Group Treatment and Parent Training Research

While there are no studies that directly compare the effectiveness of individual and group delivery formats of the Early Start Denver Model, several studies have found positive outcomes for the group format of the intervention. In a pre-post study of 26 toddlers with autism who received group delivery of the ESDM, Eapen, Crncec, and Walter (2013) found statistically significant improvement in overall cognitive abilities, expressive and receptive communication, and gross motor skills. Additionally, they found a significant decrease in autism specific features among participants. However, the children's overall adaptive behavior did not improve. In a quasi-experimental study of group delivered ESDM, Fulton, Eapen, Crncec, Walter and Rogers (2014) found a significant decrease in maladaptive behavior and a significant increase in cognitive skills. However, they found no significant change in autism-specific features or adaptive behavior. Finally, two additional quasi-experimental studies of group-delivered ESDM treatment both found improvements in cognitive functioning and other developmental domains for participants, but no significant decrease in autism severity (Vivanti, Dissanayake, Zierhut,

Rogers, & Victorian ASELCC Team, 2013; Vivanti et al., 2014). While these studies did report several positive outcomes, it should be noted that all but the 2014 Vivanti et al. study were criticized by Waddington et al. (2016) for demonstrating weak methodological rigor, potentially weakening the validity of their findings.

Several studies also examined adaptations of the Early Start Denver Model in which parents were trained to implement the intervention. In these studies, parents received 60-90 minutes per week of training, coaching, and feedback on their implementation of the ESDM teaching techniques over 12 week periods. Parents then used the skills they learned with their own children at home. Of the six parent-training studies examined in the Waddington et al. (2016) review of ESDM research, all studies reported at least some positive outcomes. Many of these studies found improvements in parent engagement and competency using ESDM techniques, (Vismara, Colombi & Rogers, 2009; Vismara, McCormick, Young, Nadhan & Monlux, 2013; Vismara & Rogers, 2008; Vismara, Young & Rogers, 2012), as well as significant improvements in child imitation abilities (Vismara et al., 2009; Vismara et al., 2012) and language and communication skills (Vismara et al., 2012, Vismara et al., 2013). One parent-training study found an improvement in the child's diagnosis from ASD to PDD-NOS (Vismara et al., 2008). However, as with the group-delivery studies of ESDM, it should be noted that all of these studies were criticized for having methodological weaknesses. Interestingly, the only parent training study that was categorized as methodologically strong (Rogers et al., 2012) found no significant difference between the ESDM parent group and the control group with regard to parent skills or child outcome, though both groups improved from baseline measurements.

Critiques of the Early Start Denver Model

Researchers who have reviewed studies of the Early Start Denver Model agree that there is a need for more studies with improved methodological rigor in order to create a stronger base of evidence to support the intervention (Smith & Iadarola, 2015; Warren et al., 2011; Waddington et al., 2016). Many of the existing studies are considered methodologically weak, and even the best regarded ESDM studies have been criticized. Following the publication of the 2010 randomized controlled trial by Dawson et al., Dr. Eric Fombonne, Canada Research Chair at McGill University, submitted a letter to *Pediatrics* in which he critiqued several aspects of the study. In his letter, Fombonne notes that the study is an important contribution to the field of early autism intervention research and does have many design strengths, including a randomized design, use of a manualized treatment delivered by properly trained therapists, and high treatment fidelity. However, Fombonne also identifies several factors that could threaten the internal and external validity of the study's results. First, Fombonne points out that while some of the gains made by the ESDM group were statistically significant, the magnitude of those gains was moderate. Increases in adaptive scores were due to the participants' increase in age, but the standard scores did not change, meaning there was not a true increase in developmental rate. Most gains were due to language, but other domains showed minimal gains and some declines. Additionally, Fombonne notes that the measurement tools used did not, for the most part, involve direct observation of participants, but rather relied on parent report. Because parents were not blind to which treatment group their children were assigned to, this may have influenced their answers, skewing results. Fombonne also critiqued the study's statistical analysis, pointing out that data was used only for treatment completers, and not participants who dropped out midway through the study, which may have inflated results. He also states that while the study reported

group averages, there was actually a large amount of variation in the scores of ESDM participants. It would be prudent to further examine differences amongst participants to determine moderating factors and characteristics of responders and non-responders to treatment. Finally, Fombonne notes that although participants were randomly assigned to treatment groups, the intensity of intervention differed between the two groups. The ESDM group received a weekly mean of 36.7 hours of treatment, while the control group received a mean of only 18.5 hours per week. Accordingly, the greater improvements experienced by the ESDM group cannot definitively be attributed to the contents of the intervention, but instead may be a result of dose.

Additionally, the intervention has been criticized for its financial cost. Minimal information is available about the contents of the intervention without paying for the Early Start Denver Model Training Manual or paying to attend intervention workshops. The cost of attending ESDM workshops or becoming a certified ESDM therapist can range from hundreds to thousands of dollars, depending on the venue (Best Start Clinic; UC Davis Extensions). The average price of individual ESDM therapy sessions is \$5,560 per month (Autism Speaks: Early Start Denver Model). The restriction of free information about the intervention could make it difficult for a family to decide whether the Early Start Denver Model is an appropriate fit for their needs, and the cost of treatment could be prohibitively expensive for some families.

Conclusion

The Early Start Denver Model is a comprehensive naturalistic developmental behavioral intervention that was developed as a method to alter the developmental trajectory of young children with autism. The goal of the Early Start Denver Model is to help children become more socially oriented and develop other skills through social interactions with adults. The intervention draws upon principles of Applied Behavior Analysis, but aims to teach children

skills in a more naturalistic setting than other forms of ABA therapy such as discrete trial training. The ESDM intervention targets multiple developmental domains at once, and teaches skills based on a child's developmental level in each domain. Children participating in the ESDM are assigned a multidisciplinary treatment team that assesses their progress and establishes individual learning goals, which are targeted during play therapy sessions. During therapy sessions, therapists take data on the child's performance of target skills, which is used to assess each child's progress until they are ready to transition out of the intervention.

The Early Start Denver Model is a relatively new intervention, so the body of research examining its effects is somewhat limited. In reviews of ESDM studies as well as other early intensive behavioral interventions, researchers have found that many of the studies have methodological weaknesses that result in questionable validity. Of the studies that are regarded as methodologically rigorous, many were conducted by the developers of the intervention. The results of these studies were mixed, finding that some children who received the ESDM intervention demonstrated improvement in cognitive, language, adaptive abilities, and diagnosis. However, in controlled comparisons, children receiving ESDM did not demonstrate significantly greater gains than children in control groups in all domains measured. Preliminary findings from ESDM research suggest that while it could be a promising intervention for young children with autism, there is a need for much more research to create a stronger base of evidence to support it. Future research should include more methodologically rigorous studies as well as independent replication, examinations of generalization of skills taught, and direct comparisons of the Early Start Denver Model to other manualized treatments for autism.

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