Evidence-Based Practices for Young Children with Autism:

Contributions for Single-Subject Design Research

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The purpose of this article was to examine the scientific evidence provided by single-subject design studies that supported effective intervention and educational practices for young children with autism. A review of the literature from 1990 to 2002 revealed 37 studies that meet the inclusion criteria. Research studies primarily employed multiple-baseline experimental designs and provided strong evidence for effectiveness through multiple replications of treatment effects. Practices supported by this research were classified into three groups. Practices with *well-established* evidence of effectiveness were adult-directed teaching and differential reinforcement. *Emerging and effective practices* included peer-mediated interventions, visual supports, self-monitoring, and family member involvement in the intervention. Practices that were *probably efficacious* included positive behavior support, videotaped model, and children's choices and/or preferences incorporated in learning tasks. For many of these practices, additional evidence may be provided by group design studies and single-subject design studies in which older children with autism were participants.

Heightened interest in identification of evidence-based practices for young children with autism is pushed by two parallel influences. First, the increase in the number of young children identified as having autism and requiring early intervention/early childhood special education (EI/ECSE) services creates a need for school districts, teachers, and families to identify educational practices that are effective. Second, the field of education is now placing greater emphasis on identifying practices that have scientific evidence for their effectiveness (Shavelson & Towne, 2002). Researchers who have employed single-subject research methods (Kazdin, 1982) have contributed knowledge about practices for young children with autism. The purpose of this article is to identify practices for young children with autism that are supported by the single-subject design scientific literature.

Although disagreement exists about whether there has been an increase in the prevalence of autism or autism spectrum disorders in the United States (Fombonne, 2001), the number of young children identified as autistic who are receiving special education services is clearly increasing. The U.S. Department of Education (2001) reported that the number of school-age children with autism receiving special education services rose from in 10,135 in 1991–1992 to 53,675 in 1998–1999. This increase of about 500% may be compared to the overall increase of 26% during the same period for all children with disabilities. With this increase has come additional and substantial pressure on local districts to provide services that are proven to be effective (Sperry, Whaley, Shaw, & Brame, 1999). In many cases, parents and advocates have identified a single program, the discrete trail training model program developed by Lovaas and colleagues (Lovaas, 1987; McEachin, Smith, & Lovaas, 1993), as the only approach that has any evidence of effectiveness for young children with autism. The demonstrated effectiveness of this program has in turn placed great pressure on teachers and administrators to provide discrete trial training in their programs or present clear evidence that the other educational practices that they are providing to young children with autism and their families are indeed effective.

Spurred in part by the sociopolitical context, the National Academy of Sciences (NAS) created a committee to identify educational practices for young children with autism that have scientific evidence of effectiveness (National Research Council, 2001). Comprehensive program models and individual intervention techniques are two classifications of practice the committee identified as having scientific evidence of effectiveness. Comprehensive program models combine a set of components to form a model. The evidence of effectiveness for these models ranged from modified randomized group design studies (Lovaas, 1987) to chart reviews of children who had received a treatment (Greenspan &

Wieder, 1997). The committee identified that the following program components were common to many of the program models:

1. intervening as early as possible,
2. providing an intense intervention,
3. actively involving families,
4. training staff,
5. assessing children's progress,
6. using a systematic and clearly planned curriculum,
7. establishing a highly supportive environment,
8. providing individualized intervention, and
9. supporting transition to kindergarten (National Research Council, 2001).

Individual intervention techniques are a specific practice or strategy for working with children with autism and/or their families. The NAS committee organized its review of these techniques by developmental content areas, which included communication, social development, adaptive behavior, cognitive development, and problem behavior. In their examination of the strength of supporting evidence that underlies individual practices, the committee rated the quality of scientific evidence for each content area, but the method for calculating this quality index was not clearly articulated.

Concomitant with this increase in interest in educational practices for young children with autism is the educational community's clear emphasis on using scientific research to substantiate the effectiveness of practices. To examine the state of scientific research in the general field of education, NAS created a different committee of scientists and educators (Shavelson & Towne, 2002). In their deliberations, the NAS committee adopted several guiding principles. They proposed that scientific research consisted of (a) conducting an empirical investigation, (b) linking findings to a theory of practice, (c) using methods that permit direct investigation, (d) providing a coherent chain of reasoning, and (e) replicating and generalizing across studies (Shavelson & Towne, 2002). The com-

mittee also specified that there were three relevant scientific questions in educational research: (a) What is happening (i.e., descriptive research)? (b) Does it have an effect (i.e., causal relationship)? and (c) What led to the effect (i.e., processes or mechanisms that underlie the effect)?

To determine the effectiveness of intervention or educational practices for young children with autism, the causal question of whether an intervention has an effect is the most relevant. To address this question, researchers must use an experimental design to tightly control for extraneous variables that might account for changes that occur in the dependent or outcome variables for children when an intervention or teaching approach is applied. In the literature on educational practices for young children with autism, researchers often use single-subject design research methodology to determine the effectiveness of individual practices (National Research Council, 2001).

Unfortunately, Shavelson and Towne's (2002) report omitted any mention of single-subject methodology, although the methodology is clearly experimental and designed to address the question of effectiveness (i.e., the causal question). Professional organizations, such as Division 12 of the American Psychological Association (APA; Lonigan, Elbert, & Johnson, 1998), Division 16 of APA (Kratochwill & Stoiber, in press), Division for Early Childhood of the Council for Exceptional Children (CEC; Smith et al., 2002), and Division for Research of CEC (Horner et al., 2003), and individual researchers summarizing the literature (e.g., Wolery & Garfinkle, 2002) have incorporated single-subject design literature into their reviews and have established standards for evidence from studies using this methodology. For example, Division 12 of APA created the Task Force on Promotion and Dissemination of Psychological Procedures (Lonigan et al., 1998), which established criteria for efficacious practice. According to this APA Task Force criteria, practices should be judged "well-established" if a large series of single-case designs

($n > 9$) (a) used good experimental design, (b) compared the intervention to another treatment or condition, (c) had a treatment manual, and (d) described participants clearly. A practice could be classified as "probably efficacious" if a smaller set of studies ($n > 3$) met the criteria just described.

To establish recommended practices in early childhood special education, the Division for Early Childhood of CEC established the Recommended Practices Task Force, which conducted an exhaustive review of the research literature on EI/ECSE practices published from 1990 to 1998. Of the 835 studies meeting the inclusion criteria, 184 studies (22%) employed single-subject design. To summarize evidence for effective practice from the single-subject literature, Odom and Strain (2002) coordinated a review of methodology and individual practices for young children with a range of disabilities, identifying practices that were well-established and probably efficacious (i.e., using Lonigan et al.'s [1998] criteria).

The purpose of this article is to summarize the scientific evidence from the single-subject design literature that substantiates the effectiveness of practices for young children with autism. In this article, we analyzed the single-subject design articles initially identified in Odom and Strain's (2002) review and more recent articles from the literature and summarized the strength of evidence for individual practices.

Method

Articles Included in the Review

Articles selected for this review met several inclusion criteria. First, they had to have been published in a peer-reviewed journal. Second, they had to employ single-subject designs that contained at least one demonstration of the functional relationship between the independent and dependent variable (i.e., AB designs were not included; Kazdin, 1982; Tawney & Gast, 1984). Third, at least 50% of the child participants in the study had to be

identified as having autism, an autism spectrum disorder, or a pervasive developmental disorder not otherwise specified. Fourth, at least 50% of the children had to be younger than 6 years of age. If a study included at least one child younger than 6 years, but more than 50% of the children were older, it was included if the younger children responded to the intervention in the same way as the older children. This occurred for three studies, and one study was eliminated because the young children responded differently than the older children.

From the original Odom and Strain (2002) database, 15 studies were identified in which children with autism were participants. To update the literature search, the 1999 to 2002 issues of all journals in which these original studies appeared were hand-searched for articles meeting the inclusion criteria (see Note). In addition, the 1999 to 2002 issues of the following journals were hand-searched because the authors knew that the journals published articles related to children with autism: *American Journal on Mental Retardation, Journal of Autism and Developmental Disorders, Journal of Emotional and Behavioral Disorders, Journal of Positive Behavior Interventions,* and *Focus on Autism and Other Developmental Disabilities.* The completed search generated 22 articles that met inclusion criteria. Thus, 37 articles served as the basis for this review.

Coding Procedures

All single-subject research studies were coded using Forms A and B. Form A provided a generic description of the articles (see Smith et al. [2002] for a description of Form A) and was used uniformly across all articles in the Recommended Practices Task Force database. Form B–Single Subject Specialized Coding Sheet was used for all single-subject design articles. This form was developed by Odom and Strain (2002), modified for this study, and tested with a sample of single-subject design studies. For the Form B evaluation, the following features of the single-subject methodology were coded or rated:

1. the type of single-subject design,
2. whether the study took place in a group/integrated setting or in an individual/therapeutic and separate setting,
3. whether the agent of intervention was an adult or a peer,
4. how many replications of the intervention effect occurred, and
5. a narrative description of the dependent variable(s) and independent variable(s).

Eight additional items were designed to produce an index of outcome believability by rating each study on design features that indicated high-quality, rigorous single-subject studies. The quality design features and their associated rating schemes were as follows:

- Independent variable assessment: *Occurred* = 1; *Did not occur* = 0
- Fidelity of intervention, if implementation of the independent variable was assessed: *High* = 3; *Medium* = 2; *Low* = 1
- Evidence of improvement over time: *Yes* = 1; *No* = 0
- Intervention maintenance assessed: *Yes* = 1; *No* = 0
- Evidence of intervention maintenance across time: *Yes* = 1; *No* = 0
- Intervention generalization assessed: *Yes* = 1; *No* = 0
- Evidence of intervention generalization: *Yes* = 1; *No* = 0
- Type of generalization: cross setting, participants, and/or behavior
- Social validity of procedures assessed: *Yes* = 1; *No* = 0
- Evidence for social validity of procedures: *Yes* = 1; *No* = 0
- Social validity of outcomes assessed: *Yes* = 1; *No* = 0
- Evidence for social validity of outcomes: *Yes* = 1; *No* = 0

In addition, after these ratings were completed, the coders summarized any practice that was supported by the data presented in the article.

The first and second authors trained three graduate students to code single-subject design studies. First, coders read the definition for the coding items and then completed a practice article with the first author. Next, they coded a practice article independently, and when they reached an 85% agreement level, they began coding articles that had been assigned to them. During the study, for intercoder agreement purposes, 32% of the articles were also independently coded by the first author. Intercoder agreement was calculated by dividing the number of agreements (i.e., complete agreement on an individual item) by the total number of agreements and disagreements and then multiplying this number by 100. Intercoder agreement was 89% for Form A and 75% for Form B.

Results

Participants and Setting

Demographic information for participants in the reviewed studies appears in Table 1. As previously noted, 37 studies were included in this review, involving a total of 105 participants, with an average of 2.84 participants per study. Some studies actually involved more children during intervention (e.g., peer-mediated studies), but only the target children who received an intervention and for whom data were collected were considered participants. About 76% of the participants were boys, which reflects the demographics of the autism population. The average age of participants was 58 months. Aside from developmental information, authors provided limited information about other demographics, such as ethnic/racial identification, family context, and socioeconomic level. The studies took place in a variety of settings. Most occurred in an inclusive classroom or in the home, with a smaller number of studies occurring in segregated classrooms, clinics, or other settings (e.g., the community).

Methodology and Data Collected

To document a functional relationship (i.e., experimental control) between the independent and dependent variable, researchers used a range of experimental designs. In nearly 67% of the studies, they employed multiple-baseline or multiple-

probe designs. Withdrawal of treatment and reversal designs were used less often, and only one alternating treatment design was used. In a few instances, authors used a combination of experimental designs to address multiple questions. The number of designs was greater than the number of articles because some contained multiple studies. Studies contained an average of 3.83 replications of treatment effects. In addition, the mean rating of the clear demonstration of improvement of participants across phases of the study was 2.84 out of 3.0.

All investigators reported collecting quantitative, primarily observational data as dependent variables for the study, and all provided acceptable evidence for interobserver agreement of the measures. Assessment of the independent variable (i.e., fidelity of treatment) only occurred in 32% of the study. Yet, when fidelity of treatment data were collected, a high level of fidelity was reported (2.91 out of 3.0).

Maintenance of treatment effects was assessed in slightly more than a third of the studies, and in all of these cases, the studies provided evidence that the treatments maintained over periods that ranged from a few weeks to several months. Assessment of the generalization of treatment effects occurred more often, in 41% of the studies, with 100% of the studies reporting evidence of generalization. Most often, generalization across settings was assessed, with a smaller number of researchers assessing generalization across people and behaviors.

Social validity was assessed infrequently. Only three researchers reported an assessment of the social validity of procedures (i.e., the acceptability of treatment), although all provided strong evidence for social validity when it was assessed. Social validity of outcomes for participants was assessed in eight studies, and 75% of those studies reported positive evidence for the social importance of the treatment effects.

Practices Investigated and Evidence for Effectiveness

During the initial review of articles, coders wrote a short description of the

TABLE 1
Participant Characteristics, Settings, and Design Features of the Single-Subject Design Studies

Participants/setting/design features	n^a
Participants	
# per study	2.8
Age in mos. (M)	58
Gender (% boys)	76
Setting	
Integrated class	15
Home	13
Clinic	4
Segregated class	3
Other	8
Design type	
Multiple baseline probe	25
Withdrawal of treatment	5
Reversal	2
Alternating treatment	2
Other	4
Number of replications (M)	3.78
Treatment fidelity	
Assessed	12 (32%)
Rating (M)	2.91
Maintenance measured	13 (35%)
Generalization	
Measured	15 (41%)
Across setting	12
Across people	6
Across behaviors	4
Other	2
Social validity	
Procedures	3[b]
Outcomes	8[c]

[a]Number of studies, unless otherwise specified. [b]100% found evidence. [c]75% found evidence.

practice, intervention, or treatment when there was empirical evidence of its effectiveness in the study. This empirical support was defined as the authors' having demonstrated a functional relationship between the practice and the dependent variable. The first and third authors then conducted a content analysis (Johnson & LaMontagne, 1993) of the coders' descriptions. Descriptions were transcribed onto note cards; in some studies, support for more than one practice was provided, resulting in using multiple note cards for an individual study. After all cards were sorted into similar conceptual classes, the authors reviewed the studies within each classification and modified the conceptual classification, collapsed categories, or resorted cards.

From this content analysis, 11 categories of practice, with differing amounts of empirical support, were identified. Using a Theme X Study Matrix (Miles & Huberman, 1994), we outline the source of support for each set of practices in Table 2. Definitions for these categories appear below along with a brief description of the literature.

Adult-Directed Teaching Strategies. Practices in which an adult prompted, provided a scaffold for, or provided an explicit model for a child's behavior were grouped in this category. These strategies were antecedent to the child engaging in the desired behavior or skill. For example, Williams, Donley, and Keller (2000) used verbal modeling to teach young

TABLE 2
Evidence-Based Practices and Articles in the Review

Study	Adult-directed	Diff. rein.	Peer-med.	Visual supports	PBS	Self-mon.	Video model	Mod. task	Family involvement
Bainbridge & Myles (1999)							X		
Baker (2000)								X	X
Bellon et al. (2000)	X								
Carter (2001)								X	
Charlop-Christy et al. (2002)	X	X		X					
Drasgow et al. (1998)		X							
Drasgow et al. (2001)		X							
Ducharme et al. (1994)								X	
Dunlap & Fox (1999)		X			X				X
Frea et al. (2001)				X					
Goldstein & Cisar (1992)	X								
Goldstein et al. (1992)			X						
Grindle & Remington (2002)		X							
Jahr (2001)	X								
Keen et al. (2001)					X				
Koegel et al. (1998)		X							
Kohler et al. (1995)	X	X	X						
Kohler et al. (1990)		X							
Krantz & McClannahan (1998)	X			X					
Laushey & Heflin (2000)			X						
Lorimer et al. (2002)				X	X				
Love et al. (1990)	X								
Matson et al. (1993)	X			X					X
McGee et al. (1992)			X						
Morrison et al. (2002)				X		X			
Nuzzlo-Gomez et al. (2002)		X							
Odom & Watts (1991)			X			X			
Sainato et al. (1992)			X			X			
Schreibman et al. (2000)							X		
Shabani et al. (2002)	X								
Shearer et al. (1996)						X			
Shipley-Benamou et al. (2002)							X		
Smith & Camarata (1999)	X								
Stiebel (1999)				X					X
Taylor & Harris (1995)	X								
Williams et al. (2000)	X	X							
Young et al. (1994)	X	X							

Note. Adult-directed = adult-directed teaching strategies; Diff. rein. = differential reinforcement; Peer-med. = peer-mediated interventions; PBS = positive behavior support; Self-mon. = self-monitoring; Video model = videotape modeling; Mod. task = modification of task characteristics.

children with autism to ask questions about hidden objects. Bellon, Ogletree, and Harn (2000) used a set of scaffolding techniques (e.g., questions, expansions, elaborations) and storybook reading to promote spontaneous language use. In an innovative study, Shabani et al. (2002) used a vibrating pager to remotely administer a tactile prompt for initiating communication with adults. Included in this group of strategies was time-delayed prompting, in which prompts are systematically faded to promote generalization of learned responses

(e.g., Taylor & Harris, 1995). Goldstein and Cisar (1992) and Krantz and Mc-Clannahan (1998) taught children to learn scripts for sociodramatic play and conversation, respectively, using adult-redirected techniques that were faded as children learned the tasks.

Differential Reinforcement. Differential reinforcement techniques are defined by adults' planning rewards to be provided when children use a skill being taught and not provided when the skill is not used. A variety of reinforcement

techniques were grouped in this classification. For example, Drasgow, Halle, and Ostrosky (1998) differentially reinforced children's use of words, rather than nonverbal behaviors, to acquire desired objects, which resulted in both acquisition and generalization across objects. Nuzzolo-Gomez, Leonard, Ortiz, Rivera, and Greer (2002) differentially reinforced children's use of toys and books as a strategy for also decreasing stereotypic behavior. Extending contingencies to the group, Kohler et al. (1995) arranged positive consequences

for the entire peer group in the classroom (i.e., an interdependent group contingency) when children with autism engaged in social interaction with peers.

Peer-Mediated Intervention. In peer-mediated interventions, typically developing children are taught to engage children with autism to promote the use of desired communicative and social behaviors. For example, Goldstein, Kaczmarek, Pennington, and Shafer (1992) taught peers three classes of behaviors to be directed to children with autism, which led to increases in communicative interaction. Laushey and Heflin (2000) designed a class-wide peer buddy program, in which multiple children in the class learned to be a peer buddy and support the social interaction of the children with autism. McGee, Almeida, Suzler-Azaroff, and Feldman (1992) taught peers to use an incidental teaching approach to increase the reciprocal social interactions of children with autism.

Visual Supports. Visual supports are visual cues that may prompt or remind children to engage in a behavior or prepare them for another activity. Visual supports may include activity schedules that are graphically represented, the *Picture Exchange Communication System* (PECS; Bondy & Frost, 1994), or other visual cues. For example, Charlop-Christy, Carpenter, Le, LeBlanc, and Kellet (2002) taught children with autism to use PECS and noted increases in social-communication behavior and decreases in problem behavior. Morrison, Sainato, BenChaaban, and Endo (2002) taught children with autism to follow visually displayed schedules of activities in the classroom and documented independent transitions across activities. To promote self-initiated verbalization, Matson, Sevin, Box, Francis, and Sevin (1993) used a picture cue that was systematically faded to promote maintenance of the desired responses.

Positive Behavior Support. Positive behavior support is a group of procedures designed primarily to address the problem behaviors of children with autism. The procedures include functional assessment, prevention of problem behavior, and differential reinforcement of alternative behaviors that replace the problem behavior. Dunlap and Fox (1999) described an individualized support model incorporating all of these elements and its effects on children with autism engaging in serious problem behavior. Lorimer, Simpson, Myles, and Ganz (2002) used functional assessment and the social stories techniques developed by Gray and Garland (1993) as a prevention technique to reduce the problem behavior of a child with autism. Keen, Sigafoos, and Woodyatt (2001) used functional assessment to determine the functions of children's prelinguistic behavior and taught functional communication behaviors, which lead to more frequent communication.

Self-Monitoring. Self-monitoring involves children assessing their own behavior and using the information to support a newly learned skill. Correspondence training is a form of self-monitoring in which a child reports his or her own behavior to an adult who is also monitoring the child's behavior and agreement between the two reports is reinforced. Sainato, Goldstein, and Strain (1992) and Odom and Watts (1991) used correspondence training strategies to support peers' social initiations and facilitative strategies with children with autism. Shearer, Kohler, Buchan, and McCullough (1996) taught young children with autism to monitor their own social interactions with peers and found increases in social interaction similar to a comparison condition in which adults provided prompted and reinforced interactions.

Videotape Modeling. In videotape modeling interventions, a child watches videotapes of positive examples of peers or him- or herself engaging in a behavior that is being taught (Haring, Kennedy, Adams, & Pitts-Conway, 1987). This method has also been called *video priming* (Schreibman, Whalen, & Stahmer, 2000). Although it is most often used with older children with autism, three studies reported its use with young children. Shipley-Benamou, Lutzker, and Taubman (2002) used an instructional videotape modeling technique to teach functional living skills; Bainbridge and Myles (1999) used video priming to teach toilet training; and Schriebman et al. (2000) employed a videotape modeling technique to reduce disruptive behavior during transitions.

Modification of Task Characteristics. In this classification, the nature or features of tasks are based on preferences of the children with autism. To promote the language skills and social interactions of young children with disabilities, Carter (2001) designed a range of learning tasks that allowed children with autism to make choices about the activities in which they would participate and found greater performance in the choice than in the no-choice condition. Durcharme, Lucas, and Pontes (1994) embedded "problem learning tasks" within a task in which a child with autism engaged readily and did not have problem behaviors and found a reduction in problem behavior. To promote play between children with autism and their siblings, Baker (2000) designed play activities that incorporated the ritualistic behaviors and special interests of children with autism.

Family Involvement. Several intervention models directly involved family members in the intervention. The positive behavior support intervention model developed by Dunlap and Fox (1999) directly involves family members in planning the intervention and provides support for implementing the intervention. To promote the use of augmentative communication in the home, Stiebel (1999) used a problem-solving intervention based on home routines to teach parents to support their child's communication. As mentioned previously, Baker (2000) involved siblings in play activities to promote the play of children with autism.

Discussion

When strictly limited to reviewing those studies in which (a) participants were

mainly younger than 6 years of age and identified as autistic or on the autism spectrum and (b) researchers were able to convincingly demonstrate experimental control, the literature on EI/ECSE practices for young children with autism appears to be relatively restricted but emerging. In the initial search of the literature from 1990 to 1998, only 15 studies were identified; however, from 1999 to 2002, 22 additional studies that met the inclusion criteria were identified. This recent trend suggests that the single-subject design literature on effective practices is expanding rapidly.

The interpretation of scientific evidence in this study was conservative and perhaps unduly limited. Some practices identified in this study may have additional support from group experimental studies (e.g., Lovaas, 1987). Also, some practices have substantial evidence of effectiveness with young children with autism from studies published before 1990. In addition, some practices reviewed here have considerable evidence for slightly older children with autism (Horner, Carr, Strain, Todd, & Reed, 2002) and for young children who have other disabilities (Odom & Strain, 2002). Because of the relatively limited literature, researchers, teachers, administrators, and/or parents may need to become familiar with the literature on interventions used with children having different disabilities in order to establish or bolster confidence in specific techniques for young children with autism.

Well Established
    Adult-directed interventions
    Differential reinforcement of
       desired behavior

Emerging and Effective
    Peer-mediated intervention
    Visual supports
    Self-monitoring
    Involving families

Probably Efficacious
    Positive Behavior Support
    Videotaped modeling
    Moderating characteristics of tasks

FIGURE 1. Level of evidence for practice.

The quality of the single-subject research design methodology for studies in the emerging database has both strengths and weaknesses. On the whole, researchers have provided rigorously controlled experimental evidence of effective practices. They provided demonstrations of experimental control repeatedly (i.e., an average of 3.83 replications per study) and, generally, found clear effects for treatments. Nonetheless, methodological improvements could strengthen this database. Only 32% of the researchers measured fidelity of treatment, although when they assessed it, they discovered that the integrity of the intervention was quite high. Similarly, 35% of the researchers measured maintenance and 41% measured generalization. Again, when these dimensions of child performance were assessed, most provided clear evidence. Hence, previous criticisms that behavioral intervention lacks evidence for generalization and maintenance are not well founded, at least for this database. A more accurate criticism is that the majority of researchers either are not assessing maintenance and generalization or are assessing but not reporting the results. Unfortunately, social validity, an especially important feature of single-subject design research, was assessed even less often. A future recommendation for researchers in this area is that they incorporate these important features into their designs to produce the highest quality of research (Wolery & Dunlap, 2001). In fairness to autism researchers, a similar criticism and recommendation has been directed toward EI/ECSE researchers, who work with a larger range of children with disabilities (Odom & Strain, 2002).

Despite criticism (i.e., research can always be improved), studies reported in this review provide very important scientific evidence about EI/ECSE for young children with autism. Lonigan et al. (1998) proposed two levels of evidence, which they identified as *well established* (i.e., more than nine studies support the practice) and *probably efficacious* (i.e., at least three studies support the practice). In the existing database, several practices were in the evidentiary midrange between these two descriptors, in that they

were supported by at least six single-subject design studies. We chose to group these into an *emerging and effective* classification (see Figure 1).

Types of Interventions

Well Established. Two groups of intervention techniques met the criteria for a well-established level of effectiveness. Both groups might be viewed as the tried-and-true practices in the field. Adult prompting is a technique with decades of supporting research, as is differential reinforcement. Both are fundamental elements of discrete trial training, and in fact several researchers (e.g., Grindle & Remington, 2002; Jhar, 2001) discussed working in a discrete trial format. However, these two traditional intervention techniques are also being used in naturalistic contexts (Smith & Camarata, 1999); are being broadened to include conceptual approaches such as scaffolding, which is more often discussed in the cognitive literature (Bellon et al., 2000); and are being systematically withdrawn after children acquire desired behavior or learn the desired skill (Taylor & Harris, 1995).

Emerging and Effective. Techniques having an emerging and effective level of support (4–6 studies) have already become or are emerging as important features of many children's programs. Peer-mediated interventions to support children's social behavior, which have a long history (e.g., Strain, Shores, & Timm, 1977), received support from studies conducted in the 1980s (Odom, Hoyson, Jamieson, & Strain, 1985; Odom & Strain, 1986; Strain, 1983), which may be why only a few studies have been published in the last decade. Recent studies have focused on designing features that teach peers and provide support for them to engage in interactions with children with autism independent of teacher involvement (e.g., Kohler et al., 1995; Odom & Watts, 1991) and designing procedures that could be implemented across the school day and with multiple peers (Laushey & Heflin, 2000).

Visual supports, such as graphic or photographic activity schedules and PECS, have become standard practice in many programs for young children with autism, and single-subject design studies provide evidence of their effectiveness (Charlop-Christy et al., 2002). Similarly, innovative procedures for teaching children to use self-monitoring and self-evaluation techniques (Shearer et al., 1996; Morrison et al., 2002) have extended the intervention methods available to teachers. Although it has long been a program feature of many comprehensive intervention models, researchers using single-subject design are documenting the value of having parents and other family members involved in intervention practices that occur in the home and community (e.g., Baker, 2000; Love, Matson, & West, 1990).

Probably Efficacious. Although garnering less support from the literature, probably efficacious practices are valuable for teachers. Positive behavior supports have an extensive empirical basis of support for older children with autism and developmental disabilities (Horner et al., 2002), and from the single-subject design literature, evidence for young children with autism is emerging. Using the power of videotaped and televised images to provide models of appropriate behavior also has modest support for young children with autism but produces promising results for some children (Schreibman et al., 2000). A very important direction for designing intervention programs is to embed choice and child preferences in instructional tasks. Researchers have only recently begun to systematically document the importance of this intervention feature (Baker, 2000; Carter, 2001), but it will certainly be a direction for the future.

Conclusions

An interesting trend exists in this literature. The well-established intervention techniques represent the traditional approaches to behavioral treatment for young children with autism. The approaches can be traced back to their roots in the 1960s pioneering work of Lovaas, Baer, Risley, and other applied behavior analysis researchers. In many ways, these represent past effective treatments for children with autism. The techniques with accumulating evidence may well represent the "cutting edge" interventions in the current decade. Current researchers use prompting and reinforcement, but they also design interventions that are more precisely tailored to the characteristics and preferences of the child, implement interventions in naturalistic contexts, involve cognitive capacities by building self-monitoring into intervention procedures, and make use of the advances in technology and the power of observational learning through the use of videotaped models. These intervention variations may well be the future directions for effective, scientifically based practice for young children with autism.

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