



Current status of intensive behavioral interventions for young children with autism and PDD-NOS

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Abstract

The development of learning based interventions has proven to be an effective means of remediating symptoms of autism and PDD-NOS. The central focus of these effects in recent years has been on early intensive behavioral interventions (EIBI) with preschool children. We use the term EIBI since it is the most often used, and we assume, preferred term. This research appears to be quite promising; however, controversies have arisen regarding who responds best and to what degree. Also, despite the widespread adoption of the notion that these programs result in long term benefits for the autism spectrum disorders child, marked holes in our knowledge, largely due to methodological considerations, are evident. This paper provides a review of existing reviews and data-based EIBI studies with an eye to a specific analysis of strengths, shortcomings, and trends in the data.

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Autism spectrum disorders (ASD) affect as many as 1.5 million people in the United States (U.S.) and constitutes a disorder which is recognized worldwide (Birkan, McClannahan, & Krantz, 2007; Mansell & Morris, 2004; Naoi, Yokoyama, & Yamamoto, 2007; Zachor, Ben-Itzhak, Rabinovich, & Lahat, 2007). The ASD are considered neurodevelopmental in origin, and in the case of one ASD, Rett's syndrome, a specific gene mutation has been identified as the likely cause (Caballero & Hendrick, 2005; Lam, Aman, & Arnold, 2006; Matson & Dempsey, 2007). Despite the physiological basis for etiology, early identification and early intensive behavioral interventions (EIBI), the most commonly used term for these treatments, appears to be the most promising method of remediating symptoms in this highly debilitating and

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resource-intensive set of disorders (Matson, 2007a; Matson & Minshawi, 2006; Matson, Matson, & Rivet, 2008).

EIBI in young autistic children is one of the most visible and intensively studied problems in child clinical psychology today. Characterizing the national concern, a bill was passed on December 19, 2006 by the U.S. Congress entitled *The Combating Autism Act*. The bill, which provides \$1 billion in research funds through 2011, has a focus primarily in early detection and treatment of ASD (Colston, 2006). These political and financial supports underscore the level of interest and attention on the topic.

Due to the rapidly expanding behavioral treatment research base, a number of reviews have periodically been published over the years. One of the first of these was published in 1996 and covered behaviorally based treatments for autism over a 16-year span (Matson, Benavidez, Compton, Paclawskyj, & Baglio, 1996). This paper provided a review of treatments primarily for specific target behaviors. Since that time, behaviorally based procedures have continued to be very popular as witnessed by the number of times this paper has been cited and more specifically with the continued increase in treatment studies on the topic reported in the literature. However, the most recent trend is toward programs that cover a variety of target skills in 20–40 h per week programs with preschool children. These programs are similar to the massed practice methods for toilet training of regularly developing children and intellectually disabled adults previously published (Azrin & Foxx, 1971; Azrin & Foxx, 1974). Aspects of these massed practice methods and those described in the Matson et al. (1996) review were first applied to children with autism by Lovaas (1987). Since then many other studies have appeared. The purpose of this review, then, will be to provide a data driven analysis of strengths, weaknesses, and trends in the early EIBI literature for children with ASD.

1. History

The use of applied behavior analysis in the treatment of autistic children is more than 45 years old. Initially, research involved establishing environmental conditions under which these children would respond, followed by the treatment of disruptive behavior (Ferster & DeMyer, 1961). Wolf, Risley, and Mees (1963), for example, treated the food stealing and temper tantrums of a 3 1/2 year old boy evincing autism with edible reinforcers, shaping by successive approximations, and verbal reprimands. These early studies typically included one or two target behaviors, and as a group of studies, covered a range of behaviors including toilet training (Marshall, 1966), communication (Marshall & Hegrenes, 1970), eye contact (McConnell, 1967), spontaneous language (Matson, Sevin, Fridley, & Love, 1990), phobias (Love, Matson, & West, 1990), self-help skills (Matson, Taras, Sevin, Love, & Fridley, 1990), and establishing functional speech (Risley & Wolf, 1967). Many early studies also incorporated punishment procedures, primarily aimed at challenging behaviors and noncompliance (Lovaas, Schaeffer, & Simmons, 1965; Moore & Bailey, 1973).

A seminal paper in the EIBI literature was by Lovaas, Koegel, Simmons, and Long (1973). Their methodology was a narrative or case study. However, this paper was published more than 30 years ago, and in our opinion, the demonstrated treatment effects were of secondary value to the conceptual framework for early intervention with ASD that they provided. The true significance of the study was the authors' efforts to formulate an overarching treatment of children with autism on a multitude of behaviors including self-stimulation/stereotypies,

echolalia, appropriate verbal behavior, social behavior, appropriate play, intelligence quotient (IQ), and adaptive behavior. Prior to this paper, and in many studies since, ASD children's problems have been treated on a piecemeal basis, typically involving a few very circumscribed behaviors. This approach is not without merit. The primary goal in this latter group of studies has typically been the refinement of a given intervention strategy. Lovaas and associates (1973), however, had a different goal – take existing intervention methods, put them in a package, select a broad group of target behaviors, and treat all of them at once. While it is argued that we are now at a point where additional dependent variables are needed to further advance our knowledge (Matson, 2007b), this 1973 paper was visionary. The manuscript's authors provided a template for EIBI that has endured for decades. We encourage the reader to look at this study if they have not done so previously.

Margolies (1977) also suggest that learning based treatments were the best option for ASD children. He stated that the core symptoms of the disorder should be targeted for intervention. This paper was important since it provided another attempt to lay out many treatment issues that would become the cornerstone treatments and target behaviors for EIBI. As such, his review underscores and reinforces the argument of Lovaas and associates (1973) and did so early on in the evaluation of EIBI. Areas Margolies (1977) reviewed include destructive behavior, tantrums, aggressive and disruptive behaviors, stereotypies/self-stimulation, toilet training, eye contact, imitation, verbal behavior and language skills, peer and social interactions, classroom behavior, and then interestingly, therapy packages. Margolies (1977) noted that “the behavior modifier need not concentrate his full attention on one target behavior at a time” (pp. 260).

Efforts at early intervention have continued for some time now. The data seems to suggest that the amount of research is likely to spike dramatically in the next few years. This trend appears to be motivated by success of behavioral interventions, dramatically increasing federal funding, arguments that early interventions save millions of dollars in long term care, and recent studies showing dramatic increases in the number of children being identified with ASD (Croen, Grether, Hoogstrate, & Selvin, 2002; Jacobson, Mulick, & Green, 1998; Prior, 2003).

Publications on the EIBI topic can be characterized as those reviewing aspects of effective treatment, studies assessing who uses what procedures in real world environments, methodological considerations, and a low rate, but steady stream of direct tests of EIBI methodologies. These topics will be addressed next.

2. Reviews

Summary papers of ASD are of fairly recent origin. Early papers were largely narrative, covering topics such as what autism is, with brief sections describing treatments (e.g., Waters, 1990). As noted, one of the first reviews that looked extensively at treatment characteristics was by Margolies (1977). However, as the literature expanded, reviews became more expansive. Matson et al. (1996), for example, evaluated 251 treatment studies and looked particularly at target behaviors and specific types of behavioral interventions employed. They then discussed what methods were used for what behaviors and discussed trends in the treatment literature. These two early reviews then, demonstrate differing goals for reviews of the ASD studies. In the former case parents, advocates, and others with a strong interest in the topic but with limited professional training were provided with an overview of the field. In the latter type of review, an analytical approach to the field was taken, which

Table 1
Published reviews of the EIBI literature

Schreibman (2000)
Shea (2004)
Smith (1999)
Rogers (1998)
Weiss (1999)
Whiteford (2000)

presumed knowledge of learning theory, current literature on cause, and diagnostic methods. The Matson et al. (1996) paper is generic in the sense that the treatment review was based on a broad range of studies with respect to length of treatment, age of the person with autism, target behaviors treated, venues where intervention occurred, and so on. However, this review of specific factors within treatment studies predates the EIBI reviews and most other treatment reviews of ASD. Thus, the trend appears to be moving toward more specialized reviews within the ASD literature over time. This progression seems to be a natural one. As the literature grows, topics and researchers become more and more specialized. Additionally, there are more reviews of EIBI compared to other ASD intervention topics, which underscores the perceived critical nature of this problem and treatment paradigm in the constellation of ASD interventions.

We located 6 reviews of EIBI published in refereed journals, taken from 18 review papers on treatments for ASD that we evaluated (See Table 1). The remainder of the reviews assessed a very specialized set of skills within ASD such as play or social interactions (Hwang & Hughes, 2000; McConnell, 2002; Rogers, 2000; Stahmer, 1999; Terpstra, Higgins, & Pierce, 2002).

The six EIBI review papers are interesting and useful, and provide somewhat different angles from which to view the problem. We encourage the reader to look at them. Furthermore, interpretations of the data varied considerably from the conclusion that EIBI is “widely acknowledged” as the best empirically validated interventions to the conclusion that long term effects of EIBI are “questionable” (Schreibman, 2000; Shea, 2004). Overarching themes include, the call for more rigorous methodology, and for those who accept the efficacy of EIBI, the need to look at factors such as the age the child starts treatment, their IQ, language levels, type of behavioral treatment, components used, intensity of treatment, where the treatment is provided, how much treatment is given each week, and who provides the intervention (Rogers, 1998; Smith, 1999). These factors can be broken down into two broader categories: client factors effecting outcome and treatment program characteristics.

3. Client factors effecting outcome

EIBI is not a monolith. Investigators pursuing this line of research have varied length of interventions, emphasized different behavior analysis procedures, began treatments at different ages, used parent or professional trainers, or both, and provided training in different settings. Proscriptively, there are a number of child characteristics which are likely to determine how the variables noted above are configured to produce the most effective intervention for a given child.

In order of importance, these are likely to be severity of ASD symptoms, intellectual functioning (IQ), and comorbid psychopathology. As the child ages, the factors may vary. Psychopathology (e.g., depression) is not going to be evident in a two- or three-year-old but certainly could surface in later childhood or the teenage years. We will briefly review these factors. Many others are likely to mitigate treatment response. However, at present, little research has occurred on these other variables.

3.1. *Severity of ASD symptoms*

We are assuming that PDD-NOS and autism are on a continuum with PDD-NOS presenting with fewer and/or milder symptoms than autism. If one accepts this theoretical formulation, then it can be concluded at least tentatively, that more severe symptoms of ASD result in poorer outcome. We say tentative since data is often based on pretest–posttest surveys of ASD characteristics over a number of years with no intervening EIBI or other intensive treatments. For example, Charman et al. (2003) tested a child with PDD-NOS and 9 children with autism at 20 and 42 months. Children with PDD-NOS had a better prognosis. These data are consistent with other studies noting that a milder degree of autism is related to a better outcome (Bartak & Rutter, 1976; DeMeyer et al., 1973; Lotter, 1974). However, prognosis might be effected disproportionately for those with milder or with more severe ASD symptoms.

3.2. *IQ*

As a factor for establishing the effectiveness of EIBI, intelligence has been perhaps the most frequently studied variable (Beglinger & Smith, 2005). Smith, Groen, and Wynn (2000) and Lovaas and Smith (1988), for example, reported that higher IQ was predictive of better response to EIBI directly based on IQ. They found that the lower the IQ, the less likely change in this variable would occur, and that aloofness correlated highly with low IQ scores. Ben-Itzhak and Zachor (2007) made a comparison with 25 children 20–32 months of age who received one year of EIBI. The children were divided into high and low IQ groups. The high IQ group did uniformly better on various behaviors such as language and nonverbal communication. Additionally, an IQ of 50 appears to be a cutoff of sorts, with children above this value having a much more positive long-term outcome (Eaves & Ho, 1996; Gillberg & Steffenburg, 1987; Kobayashi, Murata, & Yoshinaga, 1992).

A marked confound exists with respect to severity of ASD and IQ. Lower IQ is highly correlated to more severe autism (Schopler, Reichler, & Renner, 1986). This finding should not be particularly surprising since problems in social skills, communication, stereotypies and challenging behaviors are hallmarks of both disorders (Cannella, O'Reilly, & Lancioni, 2006; Hill & Furniss, 2006; MacDonald et al., 2007; Matson, Laud, & Matson, 2004; Matson, Laud, & Matson, 2005; Noone, Jones, & Hastings, 2006). Thus, from a diagnostic standpoint, a good deal of similarity in some symptoms may exist, yet different etiologies may produce the behavioral deficit. Since more severe symptoms of ASD and lower IQ affect learning, it seems evident from a pragmatic perspective that these children might respond less favorably to EIBI than other children with ASD. Furthermore, to the same extent, it may be difficult to tease out which of these two factors is responsible for a given deficit. Additionally, it is not inconceivable that an interaction effect between ASD and ID may cause certain deficits.

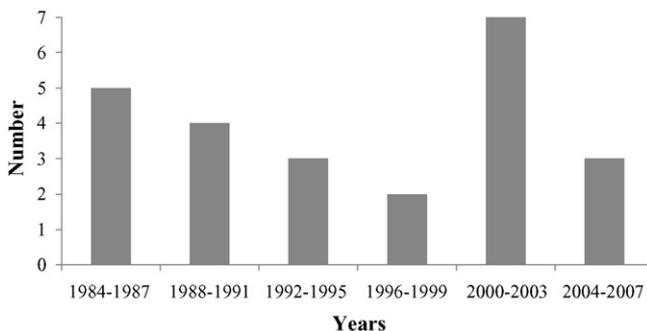
3.3. Comorbid Psychopathology

It stands to reason that additional handicapping conditions are likely to exacerbate problems associated with the application of effective treatment. Comorbid psychopathology is high for individuals with ASD, particularly in later childhood and when the individual becomes an adult (LaMalfa et al., in press; Matson & Nebel-Schwalm, in press). Where children have been studied, they tend to be well into the school age years before these conditions are recognized. Anxiety, mania, depression, and ADHD appear to be among the comorbid disorders that are prevalent (Ghaziuddin, Alessi, & Greden, 1995; Hill & Furniss, 2006; Keen & Ward, 2004; Kim, Szatmaui, Brysm, Streiner, & Wilson, 2000). Unfortunately, children at two to four years of age have not been studied with respect to comorbid psychopathology. Therefore, whether these children evince early signs of particular forms of psychopathology or are likely to develop these conditions later in life is unknown. Better assessment prior to, during, and after EIBI, could be of considerable importance in the long-term prognosis of the condition (Matson, 2007b; Matson, J.L., Matson, M.L., & Rivet, in press; Matson, Wilkins, & González, 2008). Additionally, a better understanding of the comorbid interrelationship of psychopathology, ASD, and challenging behaviors may result in adjustments to the EIBI treatment protocol, which could result in more efficacious treatment (Matson & Minshawi, in press; Matson & Wilkins, 2007). These areas await future investigation.

4. Current status of treatment efficacy

The number of studies using EIBI is very small compared to treatment research in the ASD field as a whole. For example, Matson et al. (1996) report on 251 treatment studies on specific target behaviors and Lord (2000) reports almost 900 papers on communication and autism from 1979 to 1999. She indicates that publication rates remained relatively steady over 20 years, with about 30 papers per year and about half to two-thirds addressing interventions. Starting in 1984 we found an average of about one to two EIBI studies published each year. Rates have been fairly steady; however, methodology in the most recent publications appears to be improving, particularly with respect to the inclusion of control groups and random assignment of participants across experimental conditions. However, researchers need to further enhance the rigor of their methodology in the future (Matson, 2007b) (Table 2).

Table 2
Number of IBI studied in 4-year blocks



It is a testament to the perceived difficulty in doing studies of this type, and at the same time, the importance of this research that studies with major flaws in design continue to be published. However, the field would appear to be at a point where retrospective data or studies with no control groups, or poorly matched groups without random assignment are no longer appropriate.

A second and very disappointing issue has been the selection of outcome variables. Our view is that it is impossible to draw conclusions about cure or recovery without adequate measures of ASD, comorbid psychopathology, or challenging behaviors (Matson, 2007b). To a large degree the continued reliance on outcome variables such as IQ appears to be largely out of convention. Maintaining the same dependent variables does make EIBI studies more comparable. However, much information on the most critical elements of change is being missed as a result.

5. EIBI studies

Different researchers can look at the same data and come to very different conclusions. For example, some conclude that decades of research have produced no method that can produce cure, while others have asserted that the disorder can be remediated at least in some cases (Honda & Shimizu, 2002; Lovaas, 1987). Additionally, there have been a substantial number of concerns about the methodology of most of the EIBI studies. These studies are hard to do and are very labor intensive. Thus, many of these issues need to be considered in light of the difficulty of conducting research of this type. One factor however that should be remediable is the use of adequate control groups and proper matching of participants into groups. We briefly review some of these studies and the current status of EIBI research with respect to groups and group and multiple baseline assignment later.

In addition to using matching and group assignment, Matson (2007a) has enumerated other factors that need to be more adequately addressed. It is pointed out that while EIBI studies routinely include measures of IQ, adaptive behavior, and communication, it is rare to have measures of ASD core symptoms or challenging behaviors. These later two measures are, in our view, essential. Additionally, treatment fidelity is rarely addressed. Symes, Remington, Brown, and Hastings (2006) present a particularly compelling paper regarding issues of therapist fidelity in EIBI. They note that many factors can affect how accurately a treatment can be carried out such as initial training, ongoing supervision, therapist and child characteristics, and intervention techniques used. This paper is an important one that hopefully will spur additional research on this topic as well as enhance the methodological rigor of EIBI studies in general.

Matson (2007a) goes on to note a number of additional dependent variables that require separate study as well as inclusion in EIBI studies. These factors are side effects of interventions, parent satisfaction, and the functions that maintain challenging behaviors of the ASD child in their environment. Given the amount of time and cost associated with research of this type, the addition of these assessments would add little extra time and effort relative to the total project, but could substantially add to what we could learn about the overall efficacy of EIBI.

6. Studies with no control group

Authors have referred to papers they have published where no control group is included as quasi-experimental designs (Stahmer & Ingersoll, 2004). We would argue that the failure to

include controls constitutes no experimental design at all. Quasi-experimental refers to participant selection based on matching individuals across control and experimental groups (Campbell & Stanley, 1963; Spector, 1981). Thus, the experiment is close but not a “true” experiment because children are not randomly assigned to groups. However, given the variability of symptoms and symptom severity in ASD and the small number of children to select from, matching may result in a more parsimonious design than true random assignment for EIBI research. Unfortunately, clinical uncontrolled reports appear to be continuing unabated (see Mahoney & Perales, 2003; Sallows & Graupner, 2005; Solomon, Wecheles, Ferch, & Bruckman, 2004). Equally disconcerting are case studies, which in many instances are little more than testimonials (Schwartz & Sandall, 1998). Typical of this approach was the tracking of children with ASD between two and six years of age in the Oregon school systems (Arick et al., 2003). Sixty-seven students were “tracked” but the lack of a control group and other rudimentary methodological factors make the data uninterpretable. Unfortunately, these lax methods are evident with other treatments that are claimed to be effective with young ASD children (Solomon et al., 2004).

7. Control group studies without random or matched assignment

Salt et al. (2002) have published one of the few EIBI studies with a true control group. Unfortunately, there are problems with their procedures. Most problematic is the fact that 12 children constituted the treatment group but only five children served as controls. Additionally, there were marked differences in IQ across conditions, which we have noted in our review is a major predictor of how responsive children with ASD are to treatment.

Howard, Sparkman, Cohen, Green, and Stanislaw (2005) more recently provide a particularly good model for experimental conditions. They evaluated 62, two- to three-year olds who were in an EIBI group, a group receiving intensive eclectic interventions in public special education classrooms, or in a third condition which was less intensive (15 h per week, versus, 25–40 for EIBI and 30 h for eclectic). Pretest-posttest data was 14 months apart. Educational teams with input from parents determined group assignment. This approach most likely produces a degree of bias in the make up of the groups. However, parents are learning more and more about various interventions, and for ethical and practical reasons, these types of pragmatic assignments are likely to be the norm. However, one of the primary criticisms of the initial EIBI study by Lovaas (1987) was that the treatment group was less impaired, and that parents were more motivated. To the extent that these factors can be controlled to insure roughly similar levels of ASD deficits and parent motivation at pretest would enhance the comparative efficacy of posttest measures for judging effectiveness of treatments.

8. Types of control and matched or random assignment

An optional control group would involve no treatment. However, the field has advanced to a point where even the most conservative researchers would conclude that some early interventions do produce some benefit, at least in the short term. Thus, for ethical reasons, future studies are likely to include placebo control groups. These groups may be based on current clinical practice or some research, but these placebo control groups should diverge considerably from the experimental condition. However, the time and intensity of the intervention and the technical skill of those providing the intervention must be kept as constant as possible across conditions.

Jocelyn, Casiro, Beattie, Bow, and Kneisz (1998) provide an excellent approach. They randomly assigned children between two to six years of age to the EIBI or control conditions. Children assigned to the control groups were offered EIBI once the study concluded. This method is important in that it avoids the ethical issue of controls not receiving treatment. Rather, the point at which treatment is initiated is staggered across groups. This methodology is presented in a different variant by Eikeseth, Smith, Johr, and Eldevik (2002). In this study the controls consisted of children between 4–7 years of age who received “eclectic” therapy. They describe this method as best practice prior to the development of EIBI. Zachor et al. (2007) used a similar group design. As noted, one could conceptualize this approach as a comparison of treatments. However, given the developing view that the child needs intervention “the earlier the better”, it is becoming harder to justify no treatment for a year. Thus, controlled groups comprised of eclectic or other commonly used interventions are likely to be more commonplace.

Finally, Sheinkopf and Siegel (1998) matched children in pairs and assigned one individual from each pair to each condition, controls or experiments versus random assignment. As previously noted this method may produce the most representative comparison samples across groups. Again, and hopefully, this procedure will be used more frequently in future studies.

9. Multiple baseline

Random or matched assignment is obviously very difficult and therefore rare in the EIBI literature. Therefore, researchers may wish to consider the use of multiple baseline designs where large numbers of participants are not available. This approach could only be used when one intervention is tested, but each participant serves as their own control, thus eliminating the need for random assignment. Smith, Buch, and Gamby (2000) give a nice example of how to apply this methodology, using six children receiving EIBI. The first two children received two months of baseline, the second group had four months of baseline, and the third pair had six months of baseline. This model could also be applied if, for example, the researcher staggered the length of baseline across three classrooms. The multiple baseline method has been applied extensively in applied behavior analysis and has applicability to the EIBI literature.

10. Most frequently used methods in practice

The primary thrust of our review has been on what the research looks like, from a development perspective. However, there is often a disconnect between what researchers say works and what is actually done in practice (Green et al., 2006). Nowhere is this disconnect more evident than in the ASD literature, where clinicians and researchers often attempt to follow evidence-based practice only to be overwhelmed by the latest gimmick therapy. This phenomenon led some researchers to write a book chapter recently entitled, “Autism: A late 20th century Fad Magnet” (Metz, Mulick, & Butter, 2005). Parents, who are often desperate for results, appear to be particularly vulnerable to the introduction of new treatments, many of which are not data-based.

Many interventions are available, and sorting out the most effective ones can be very difficult for caregivers. Goin-Kochel, Myers and MacKintosh (2007) note that the typical parent has tried 7–9 therapies while, 4–6 are being used currently based on parent feedback. Children with Asperger’s Syndrome had received significantly more drug treatments than children with autism

or PDD-NOS who were exposed to more behavioral/educational/alternative treatments. Asperger's tends to be diagnosed in later childhood, and these data may to some degree reflect the impact that EIBI is having on treatment practices for autistic and PDD-NOS children in particular. These latter two diagnostic categories make up the cases employed in EIBI. Drug use even with these two groups is greater as the child ages and may be accounted for by parent belief in satisfaction with EIBI while at the same time reporting that their children improved but that cure did not occur (Boyd & Corley, 2001). These data are bolstered by Ruble and McGrew (2007) who surveyed parents of 113 children with ASD. Parents rated in-home behavior therapy as producing the best outcomes. Furthermore, they opined that intervention at younger ages produced better effects.

More research of this type is warranted. The notion of social validation and consumer satisfaction are quite important. No matter how effective an intervention might prove to be, it is likely to be of little value without parental support. We argue that more research of this type, directly aimed at EIBI, since so much money and effort is being put forth on this topic, is urgently needed.

11. Conclusions on effectiveness of EIBI

To date, enough behaviorally oriented EIBI studies have been conducted to suggest that not only is the approach effective, but as a congregate group of learning based methods, it stands alone as the only effective treatment(s) for young children with ASD. Furthermore, parents have expressed satisfaction with these methods. Kasari (2002) reported only five studies with control groups, a number that is increasing, but all too slowly. On the whole, research methodology is getting better, but is still disappointing. Furthermore, while cure was claimed in the initial Lovaas (1987) study, the same magnitude of improvement has not been reported by other scientists. Furthermore, parents whose children have gone through EIBI perceive their offspring as markedly better but not "cured". However, on the whole, these methods are effective and desired by parents.

Another important problem is that the measures of the same construct may vary from pretest, posttest, or across studies. Magiati and Howlin (2001) point out that different measures of IQ may result in considerably different outcomes. Thus, maintaining consistency in measurement methods across groups and time is quite important for controlling treatment artifact. However, we would go a step further and concur with Charman and Howlin (2003) that IQ may not be an appropriate dependent measure of EIBI research. Reliable and valid IQ data for a child two or three years of age is difficult to obtain. And, assuming the data is accurate, it must be emphasized that IQ scores tend to be more stable than most constructs. Thus, marked changes in scores over a year's time or less are more likely to be due to compliance to test taking itself versus real changes in IQ. Finally, we have anecdotally had considerable difficulty in obtaining usable IQ data at initial intake for many children with ASD that we assessed. Children often will not make eye contact, do not show the necessary level of compliance with the task, and in other ways fail to comply with testing. It is doubtful that we are the only researchers who have encountered this problem.

12. Future directions

Much is yet to be learned about the value of EIBI. Is there a period when the child is too young or the intervention is too intense? Client "burn out" may be an issue at least for some children if

intervention is overdone early-on. Anecdotally, we have worked with adolescent persons with ASD who have had intensive direct instruction, and who simply refuse to participate in this treatment approach.

Second, we believe the congregate literature presents a compelling argument for treatment gains for most children. However, what will the individuals with ASD behavior profile look like 5, 10, 15 or 20 years after intervention? Hopefully, receiving EIBI will result in treatment gains for long periods of time. At this time maintenance effects are unknown. Along these same lines, will additional interventions be required to maintain gains, and if so, how intensive will maintenance treatments need to be?

Third, teasing out the effective components of treatment, who has the most favorable response to EIBI, whether at home, at school, or whether a combination of both works best are questions that need to be addressed. Generally speaking, EIBI appears to be the most effective treatment for ASD to date. Thus, research aimed at the refinement of methods and procedures, and addressing long term outcome appear to be the next issues on the horizon. However, increases in the rigor of research methodology are needed to clearly answer these and other relevant questions. Given the findings to date and increased funding, we should see a considerable growth in EIBI research in the next few years. Hopefully, many of the issues noted in this review can thus be addressed and clarified in the near future.

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