

Part Eight:

**Functional Developmental
Approach to Intervention
Research**

Evaluating Effective Interventions for Children with Autism and Related Disorders: Widening the View and Changing the Perspective

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INTRODUCTION

Intervention research reviews for autistic spectrum disorders typically consider only research on children with this syndrome. An alternative approach is to broaden the focus and consider intervention research on the many functional developmental deficits found in autistic spectrum disorders. This would include intervention research on speech and language, executive functions and motor planning, sensory processing (including sensory modulation and visual-spatial thinking), relationships (including symbolic play, caregiver-child interactions, and peer interactions), and surface behaviors. When such a broader review is carried out, the results suggest that there is considerable research support (i.e., clinical trial studies) for interventions with speech and language, executive functioning and motor planning, symbolic play, and child-caregiver and peer relationships.

Intervention for surface behaviors (i.e., behavioral approaches) involves a large number of studies, but many of them involve multiple-baseline designs with small numbers and with no control groups. None of them,

including Lovaas's longitudinal study (1987), sufficiently assesses the outcomes most relevant to autism (i.e., abstract thinking, the capacity for empathy and theory of mind, and the ability for affective reciprocity and relating with trust and intimacy). In addition, the major behavioral studies, including the Lovaas study, did not use a clinical trial methodology (i.e., random assignment), leaving the support for this area relatively weak.

In addition, there is less support for interventions on sensory modulation and visual-spatial thinking. But there is a great deal of support for the importance of these areas of functioning in autism and other developmental problems, supporting the view that the best available approaches need to be employed and more research implemented in these areas.

Reviewing the intervention research suggests that there is considerable support for working with many of the functional developmental deficits that characterize autism and other disorders involving problems in relating, thinking, and communicating. In fact, there is far more support for a comprehensive functional developmental approach to interventions for autism and other developmental problems than for circumscribed

approaches that work only with selective cognitive skills, symptoms or surface behaviors (without attention to underlying processing or developmental deficits).

BACKGROUND

Autism intervention research reviews typically focus only on intervention research on children with autistic spectrum disorders. The research reviews are limited to this specific syndrome based on the assumption that the syndrome constitutes a unitary disorder with a sufficiently unique pattern of functional deficits to warrant a circumscribed research review. As discussed in Chapters 1 through 3, however, there is not sufficient evidence at present to consider autism as a unitary disorder, either neurobiologically or psychologically (Volkmar & Cohen, 1997). Interestingly, specific theories are often suggested to account for autistic patterns, such as Baron-Cohen's work on theory of mind (1994), Minshew's hypothesis about the autism deficit involving specific types of higher-level abstract thinking (making inferences) (1997, 1999), Zimmerman and Gordon's work on selected neurophysiological patterns (Chapter 27, this volume), and Bauman's work on neuroanatomical and chemical pathways (Chapter 29, this volume). Inevitably, these perspectives illuminate a particular facet of this complex problem. While developing a unifying framework is an ultimate goal, we need to consider these current findings.

Current evidence seems to favor multiple deficits involving multiple neurobiological and psychological mechanisms. The complex interweaving of these deficits and mechanisms in varying forms for each individual helps explain the unusually large heterogeneity of autism, and the wide spectrum of presentations of the disorder. What may be most

unique about the patterns described under the autistic spectrum umbrella is the large number of functional developmental deficits involved (e.g., higher-level abstract thinking, empathy, affective reciprocity, functional language, sensory modulation, motor planning, emotional arousal and regulation, and the organization and attention involved in the executive processing of information) and the critical role of each in the development of the social competence that is generally deficient in autism (Casey, Bronson, Tivnan, Riley, & Spenciner, 1991; Guralnick, 1998; Klinger & Dawson, 1992).

Because the individual symptoms of autism vary so widely, breaking these characteristics down into specific common areas of deficits at a neuropsychological and functional developmental level can provide a stronger foundation to evaluate the effectiveness of the various interventions currently utilized to treat autistic spectrum disorders. A framework of common areas would enable more specific examination of what each intervention program addresses in terms of each deficit area as well as the soundness of educational and therapeutic strategies for remediating these common deficit areas (Rogers, 1998). There is general agreement in medicine, education, psychology, speech-language, and occupational therapy that children with autism show varying degrees of deficits in the following areas:

- *Speech-language, communication and auditory processing skills* (verbal and nonverbal communication, acquisition of language, processing, pragmatics and comprehension)
- *Executive cognitive functions and motor planning* (attending to, planning, prioritizing, sequencing, and integrating information from input to output in an organized manner)
- *Visual processing and visual-spatial skills*

- *Sensory reactivity and sensory modulation*
- *Affect and social/emotional skills*
 - Play skills
 - Parent and caregiver relationships
 - Peer relationships and social skills
- *Surface behaviors*
 - Deficit areas (behaviors needing to be increased, e.g., eye-gaze, attention, compliance)
 - Excess areas (behaviors needing to be decreased, e.g., self-stimulation, aggression, noncompliance, perseveration)

In looking at the intervention literature for autistic spectrum disorders, it is necessary to broaden the research base to include research in all of these neuropsychological and fundamental functional developmental areas that characterize autism.

In this broad research perspective, we are also looking at a focus on surface behavior as another type of functional deficit for research review. The justification is that, just as sensory modulation (i.e., the ability to regulate and modulate sensation) constitutes an underlying neurophysiologic parameter that can be worked with through appropriate interventions, surface behaviors such as perseverative behavior, self-stimulatory behavior, and other similar symptoms can be similarly worked with directly as a behavior rather than in relationship to underlying processing differences. In fact, this is the assumption and theoretical orientation of applied behavioral approaches (ABA), including ABA discrete trial interventions. Therefore, the research for working on the behavioral system directly through behavioral intervention can be examined in the same manner as research for working with different underlying processing capacities.

The multiple functional developmental deficits that characterize autistic spectrum problems can be approached in two ways. Interventions for these functional deficits

(e.g., speech-language therapy for auditory processing problems) can be reviewed only for children with autism, as is often done. Alternatively, a broader alternative can be considered. In this broader alternative, rather than limit the research reviewed to studies conducted on children with autism, the scope would be expanded to include studies conducted on children who demonstrate one or more of these neuropsychological or functional developmental deficits who are not on the autistic spectrum. For example, research on children with functional language deficits; problems with motor planning, executive functions, and their higher-level cognitive capacities; visual-spatial thinking; sensory modulation; and affective reciprocity would be relevant even when these deficits are part of cerebral palsy, Down syndrome, or specific learning disabilities because it is the functional deficits that the interventions work on rather than the “syndrome.”

There is a strong tradition in medical research for this type of an approach. For example, a complex disorder such as diabetes involves problems in the cardiovascular, renal, and neurological systems. Research findings on nondiabetic individuals, but who also have similar cardiovascular, renal, or neurological challenges, are highly relevant to understanding the multiple functional problems seen in diabetes. Interventions for these different systems are often generic across different syndromes.

Within autism, the use of this approach has even more cogent rationales based on a number of “stumbling blocks” that have faced researchers in the field of autism. The most important of these is the unusual heterogeneity of the population, not only in intelligence levels but also in variety and degree of symptomatology present. While nonverbal IQs are frequently used as comparative measures, two children of the same age,

sex, and nonverbal IQ could be dramatically different in their presentations of the disorder (i.e., one might engage in extensive hand-flapping, repeatedly stack blocks in play, and have no language, whereas another might echo lines from her favorite television shows and constantly try to climb high objects). Describing these children as equivalent would obviously be inaccurate. Newer paradigms stressing matching groups based on skills in information processing (Zelazo, 1997) and scores on play observation scales (Rogers & Lewis, 1989) show promise in remedying this deficit but have not yet gained widespread use, perhaps because they are so labor- and time-intensive. Alternatively, researchers have been studying smaller groups, unfortunately decreasing the validity of the study. Single-case studies, descriptive studies, and chart reviews, while allowing for specificity, have important limitations in comparison to experimental research standards due to their inability to compare equivalent groups as well as to have matched controls.

Research with populations of children with more defined syndromes and disabilities is not burdened with these challenges to the same degree as research with populations of autistic spectrum children. As a result, research from other, more well-defined etiological groups can provide valuable intervention-relevant insights. For example, the results of biobehavioral research in the attention-arousal systems for children with attention deficit disorder have been used to help increase the understanding of the derailed developmental patterns in many other disabilities that involve problems in attention (Spiker, 1990).

Using research from other etiological populations, combined with a focus on functional developmental areas, avoids another pitfall that research has fallen into in the field

of autism—namely, the emphasis on program comparison. In general, outcome studies in autism have striven to measure the effects of intervention *programs* versus pinpointing specific strategies per se. The goal has been to conduct studies that measure the effects of intervention programs against control groups that did not receive the intervention or received a less intensive version of the same or different intervention. This is problematic.

We know that early childhood interventions have a cross-modal effect developmentally to make intervention as a whole better than no intervention (when IQ scores are used as the index of improvement) (Guralnick, 1998). However, this does not mean that social awareness, communicative intentions, conceptual development, and language improve simultaneously, nor that improvement in one area means improvement in another (Goldstein & Hockenberger, 1991). When research reviews in the field of autism emphasize program effectiveness and program comparison, focus on the individual child with autism with his unique pattern of deficits tends to be overlooked. Freeman, in his 1998 article “Guidelines for Evaluating Outcomes for Children with Autism,” asserted that the field would not be able to develop appropriate interventions unless a focus was maintained on the individual child’s needs and deficit areas. Only by moving beyond which approach is best for a heterogeneous disorder will we be able to answer the more important question of how to develop individualized interventions for a child who exhibits his own unique pattern of development and symptoms, regardless of IQ level (Freeman & Piazza, 1998).

Another limitation of program comparisons involves traditional pre- and post-design models as well as traditional strategies (e.g., t-test, ANOVA) that are frequently used in such clinical trial methodology. These research protocols are usually unable to

model and measure changes in developmental growth during the course of intervention as they often only evaluate the level of an outcome behavior at a particular point (following the intervention.) (Rogosa & Willet, 1985). Thus, these designs cannot look at change throughout the course of the intervention (Muthen & Curran, 1996). In the field of autism, and particularly for preschool children with autism, this information is important so that we can ascertain how much growth was attributed to the specific intervention and how much might be attributed to the ongoing course of developmental maturation. This could be done by accounting for typical developmental growth rates with the rate of change during the intervention. Although multiple-baseline designs can do this somewhat better, they can only focus on a few subjects. Thus, the generalization of these results to the population as a whole is limited.

Other issues also plague program comparison models. The findings in the developmental literature regarding speech and language strongly suggest that among typical as well as challenged children, "There may be considerable differences both in the way individuals learn language and in the extent to which specific aspects of language are susceptible to certain types of training" (Law, 1997). As language and communication are critical components of all early childhood programs, let alone those for children with autism, it is reasonable to suggest that the array of individual learning differences may even make program comparison research ultimately inaccurate, and particularly so in the extremely heterogeneous autism population. What may work for one child does not necessarily work for another, even if the children were identical in age and received equivalent interventions in terms of intensity and duration. The issue may have nothing to do with one intervention being better or

worse than another. Rather, the issue may be one of appropriateness: how *much* of *what intervention* for *which deficit area*, works to *what degree*, for *what type of child*, and *when is the optimal time* for such services. This degree of specificity is what Guralnick (1998) refers to as the "second generation of research" that has yet to occur in the field of early intervention as a whole, let alone for children with autism and disorders of relating and communicating.

Translating and integrating the increasing bulk of developmental and biobehavioral information into highly individualized intervention strategies and curriculum is necessary before we can evaluate their success potential for an autistic child's individual needs. Organizing the enormous wealth of information to structure and execute interventions from a sound data base must occur as the first step in this regard. In an effort to provide a foundation for this "second generation of research" this chapter will examine the intervention research for the critical functional developmental deficits seen in children with autistic spectrum disorders from this wider perspective, using studies from both the field of autism as well as those focusing on children with other developmental deficits.

METHODOLOGICAL CHALLENGES

Funding sources not infrequently limit a family's ability to tailor a program to a child's unique profile, using the justification that they only consider intervention programs that have been evaluated with a clinical trial methodology (e.g., random assignment, equivalent groups, double-blind evaluations). As indicated, however, program evaluations are fraught with significant limitations. In addition, as will be discussed, the vast majority do not employ rigorous clinical trial methodologies, and, as this review will show,

the result is often a funding source (i.e., school system/insurance company) going beyond the limitations of current data to justify a particular policy.

Before the second generation of research occurs to generate a wider range of interventions, it is imperative that families, clinicians, and educators have a literature base to aid them in making critical treatment decisions.

What kind of research base is necessary to initiate programs and strategies, yet still will not overstep the current data? Michael Rutter has eloquently stated that the essence of research, in any field, is “in the process of problem solving, and not in the mere provision of a set of factual answers” (Rutter, 1999). If the problem to solve is what interventions work best for what child with autism and his own unique symptoms, than the framework and perspective for evaluating research must be expanded beyond the factual answers presumed to be provided by the clinical trial methodology.

An important construct within such an expanded framework relates to the distinction between clinically *significant* and clinically *meaningful*. While results should be clinically significant (i.e., those that indicate a substantial change in the variables being measured, unrelated to any other variables), this alone is inadequate. For example, increases in receptive language scores on tests that were administered before and after an intervention under the identical conditions might yield score increases that are significantly higher than those of a similar group of children who did not receive any intervention. Such results would be seen as clinically significant and as an indication that the intervention was effective. However, if those children could not use their increased vocabulary in a reciprocal conversation, their functional use of language did not improve in a clinically meaningful way. In other words, increases

in rote use of language as an outcome measure may be clinically significant but not clinically meaningful. We need to begin to require that our studies discuss not only clinically significant results, but clinically meaningful results as well.

A focus on what is clinically meaningful in research will point out the limitations in many clinically significant studies that do not focus on clinically meaningful changes. It will also highlight the need to present a wider range of studies for consideration because, not infrequently, studies employing experimental designs may include significant degrees of clinically meaningful outcome measures. Anecdotal records, single-case studies, parent reports, and chart reviews become important elements of the knowledge base if they represent the current status of studies on clinically meaningful phenomena and changes. As Rutter stated in the 1998 Emanuel Miller Memorial Lecture, *Autism: Two-Way Interplay between Research and Clinical Work*, “Many key advances (in autism research) have been prompted by astute clinical observations, while some more extravagant research claims were given a more balanced perspective through the light of clinical experience.”

In addition to the terms *clinically significant* and *clinically meaningful*, other terms to be utilized in this review are defined as follows:

- *Equivocal results*: Results that did not demonstrate evidence for use of an intervention nor evidence against the use of it.
- *Evidence for use*: Study demonstrates increase in desired behavior, trait, or construct measured as a direct result of the intervention utilized.
- *Evidence against use*: Study demonstrates negative effects on desired behavior, trait, or construct measured as a direct result of the intervention utilized or as side effects.

- *Experimental study (clinical trials)*: Outcome-based study looking at the cause-and-effect relationship between an intervention (independent variable) and a change in skill level or subject characteristic (dependent variable). A clinical trial must include random assignment to treatment groups for intervention as well as use of a control group. Variables must be held constant and controlled to prevent confounding influence of other factors to cause-and-effect relationship desired.
 - *Long-term gain*: Increase in skill level/desired characteristic from a baseline level that is maintained at designated point in time after administration of an independent variable (e.g., skills in spontaneous request-making are still present 6 months after intervention was terminated at a higher rate than before intervention took place).
 - *Short-term gain*: Increase in skill level/desired characteristic from a baseline level immediately after administration of independent variable (e.g., use of intervention, service delivery model).
 - *Meta-analysis*: A cumulative review of several studies that attempts to show the validity of an intervention through determining a statistical effect size or other measure of justification for the effectiveness/comparison of several studies in a related area.
 - *Record/chart review*: A systematic review of subject history through treatment, school, medical records, questionnaires, and other data sources. Usually, subject characteristics of common interest are predetermined and defined prior to the review to enable comparison of subjects.
 - *Research review*: A narrative review of a variety of research articles and studies on a given topic in an attempt to summarize the information and possibly to provide an informed judgement or opinion on it.
 - *Quasi-experimental study (non-clinical trials)*: Outcome case study looking at cause-and-effect relationship between intervention and change in skill level or subject characteristics (dependent variable). It does not involve use of control group, and may not include random assignment to treatment groups.
- Based on the considerations described previously, it was decided to conduct this research review based on interventions for different functional areas regardless of the syndrome (e.g., autism, cerebral palsy, Down syndrome). Because such a review has not been conducted before in this format for these functional areas with challenged populations of children, studies during the past 15 years in each area were reviewed in detail using abstract or full-text format according to the criteria stated earlier. As research on autism has been reviewed in-depth previously in other sources, studies on populations in the autistic spectrum were sampled and summarized in a briefer and more narrative format within each functional area.
- Searches for studies to be included in this review were conducted using ERIC, MEDLINE, PubMed, and a variety of other literature and data bases. Obtaining parent reports and anecdotal records and case studies was more difficult and required more literature-based research efforts as well as consultation with various agencies and advocacy groups involved in their respective areas. Although some published studies and reviews may have been inadvertently missed, the reader is assured that no such study or review was intentionally excluded from this review. Citations for references cited in this chapter are located in the “References” section. Specific research studies reviewed for each of the functional areas can be found in specific subject area sections of a bibliography included as a chapter appendix.

SPEECH-LANGUAGE AND COMMUNICATION

This area is important because language and communication deficits are core characteristics of autism, and the lack thereof are frequently the first reasons for referral of young children for diagnosis. The theoretical and descriptive research base in this area is enormous and well reviewed in other sources. For example, the research of Prizant (1983, 1992), Schuler and Prizant (1985), and Wetherby & Prutting analyzed and described from a developmental perspective the uneven emergence and patterns indicative of the particular communication and language patterns common to the wide spectrum of autism in relation to typical language development. This was done with detailed precision that laid the foundation for the design of many appropriate interventions ranging from prelinguistic communication skills to more complex conversation maintenance. It is a credit to the field of speech-language therapy that their research has maintained a focus on this continuum of skill level, from the most to the least severe deficits within the spectrum, and thus is applicable for a broad range of children with autism. Further theoretical work in linguistic dysfunction and its continuum has been summarized by others in the field (e.g., Beitchman & Inglis, 1991; Rapin & Dunn, 1997; Rapin & Allen, 1983; Tager-Flusberg, 1994).

To clarify the scope of the analysis to follow, it should be pointed out that theories espoused in the literature are generally incorporated by multiple disciplines and service providers as well as by specific programs, and not just by speech-language clinicians. For example, the TEACH program incorporates the Prizant and Wetherby theory of using visual-processing skills to teach language and communication. Bondy and

Peterson's (1990) work with the Picture Exchange Communication system (PEC) is now a mainstay of most special education programs for children with autism nationwide, although its initial successful outcomes were first documented at the Delaware Autism Program in 1990. The Walden School program in Massachusetts incorporates the Natural Language Paradigm (Williams, Koegel, & Egel, 1981) as well as discrete trial formats. Each of these program reviews indicates clinically significant pre- and post-test data outcomes in the areas of language and communication, and some give clinically meaningful data as well. Many other programs, including the University of Colorado Health Sciences Center, the Miller Language and Cognitive Development Center in Boston, and the Princeton Child Development Center, clearly give pre- and post-language/communication outcome data, but they have broader forms of instruction and intervention that are more programmatic in nature rather than being oriented to speech-language in particular. The majority of program review studies (including those listed previously) look at program effectiveness as a whole, with speech-language outcomes as only one of many variables. Because isolating the variables in such comprehensive programs that improved speech-language skills is difficult, if not impossible, they will not be further reviewed in this section.

Many research studies have also been conducted on the teaching of specific speech-language and communication skills to children with autism using behavioral methodology; for example, Charlop and Haymes (1994) and Donnellan and Kilman (1986). To avoid overlap with the "Surface Behavior" section of this chapter, this review of speech-language interventions in autism specifically targeted interventions and studies designed, supervised, and/or implemented by speech-language

Table 1. Speech-Language Communication Intervention Studies in Autism

Type of Study	Evidence for Intervention	Evidence Against Intervention	Short-Term Gains	Long-Term Gains	Clinically Significant	Clinically Meaningful
Case study	3	0	3	1	3	2
Single-subject designs (N < 1, but > 7)	6	0	6	0	6	4
Quasi-experimental design (non-clinical trials)	5	0	5	2	5	2
Experimental design (clinical trials)	1	0	1	1	1	1

clinicians, based on theories from the field of speech-language pathology and not solely on the behavioral literature. However, studies that used behavioral methods in combination with, or in the context of, other speech-language communication interventions were also included in this autism review.

The speech-language intervention literature in autism will be surveyed briefly, as this information is available in detail in other sources. In particular, the reader is referred to Schuler, Gonsier-Gerdin, and Wolfbergs' *The Efficacy of Speech and Language Intervention: Autism* (1990) for a more detailed review of this research. A summary of the 15 samples of this research can be seen in Table 1.

The subject number in these studies ranged from 1 to 60, with 10 of these studies having a size of less than 6 subjects. Topics covered in these studies include using sign language, pictures, promoting communicative eye-gaze and prelinguistic communication skills, peer mediation, imitation skills, integrated play settings, and maintaining attention during structured tasks. Studies also contrasted analog versus natural language teaching as well as developmental versus behavioral models. All of these studies focused on short-term gains, as well as the clinically significant results. A little more

than half of these had clinically meaningful results as well.

One of these studies warrants particular recognition in covering the variables utilized for evaluation in this chapter. This study used clinical trial methodology and included careful matching of 60 students diagnosed with autism and random assignment to one of 4 treatment groups (Yoder & Layton, 1988). The study included both long- and short-term gains, as well as clinically meaningful outcome of the retention of signs and words taught 3 months after treatment. Results were differential, but clinically significant in that high-verbal imitators did equally well in four treatment conditions—speech-alone, sign-alone, alternating sign-and-speech, and simultaneous sign-and-speech. Low-verbal imitators did poorest in speech-alone conditions and high-verbal imitators performed better than the low-verbal imitators in all conditions. Regardless of the condition or imitative ability, the words or signs learned were retained and utilized in real-life situations after 3 months of treatment. The results of this study have a direct impact on the instruction of individual children with autism and can be applied differentially, based on individual language and communication needs.

Our next review of the literature in speech-language and communication research was much broader. This was done in an effort to focus on those studies that targeted speech-language deficit areas that were similar to those for children on the autistic spectrum as described in DSM-IV and noted by leading researchers in the field, but presented in children who were not identified specifically with this disability at the time of the study. Diagnoses of the various subjects in these studies included specific language impairment, oral-motor dyspraxia, developmental dyspraxia, receptive and expressive language delays, mental retardation, and communication disorders. The studies did not focus on treatment of the disorders, but rather emphasized specific skill remediation, regardless of the diagnosed disability. The skill areas surveyed included:

- Expressive language delays
- Limited single-word vocabulary
- Weak comprehension of verbal language
- Limited/incorrect use of grammatical and linguistic structure
- Limited/incorrect use of language pragmatics
- Limited use of communicative actions and signals (verbal and nonverbal)
- Limited or absent social conversation with peers and/or adults

Studies focusing on these skill areas investigated the effects of a wide variety of strategies, service delivery models, and individual-child characteristics on the acquisition of these skills using standardized instruments and observational techniques to different degrees to determine short- and long-term gains.

Given the size of this review, studies looking at phonology and articulation were not included. Also omitted was the wealth of descriptive studies that compared and contrasted the characteristics of children with a

variety of speech-language deficits with those of children with typical language levels and acquisition patterns. Although many of these were conducted using clinical methods and eventually led to the development of specific teaching strategies in the field, in the interest of scope and time, this review focused on studies that were experimental in nature. That is, studies were included that tried to determine a cause-and-effect relationship between the treatment, delivery model, child characteristic, and the change or lack of change in a specific skill area.

Between 1985 and 1999, 60 studies were reviewed, and fell into the descriptive categories displayed in Table 2. Many of the studies conducted covered more than one topic and thus are accounted for in several of the categories.

Table 2. Skills Categories in Speech-Language Outcome-Based Research

Topic	No. of Studies
Increasing single-word vocabulary (receptive and expressive)	11
Increasing communicative acts and range of intent (nonverbal and verbal)	14
General expressive language gains	14
Improvement in semantic, grammatical, linguistic, and pragmatic structures (expressive and receptive)	16
Improved social interactions	none
Effectiveness of various treatment strategies ^a	19
Effectiveness of various service delivery models ^b	12
Influence of individual child characteristics	15

^aStrategies included milieu teaching, environmental arrangement, Mand, Mand model, incidental teaching, mediated instruction, direct instruction, specific curriculum sequelae response to child initiation, imitative modeling, Hanen, and combinations of all of these.

^bDirect service in clinic, direct service in home, parent training and parent teaching, center-based services, inclusion-based services, small-group services, and combinations of all of these.

These studies were then categorized for evaluation purposes in Table 3.

Of the 33 quasi-experimental studies, none met the criteria for clinical trial research due to either the lack of a control group or the lack of random assignment to groups. Given the difficulties inherent in meeting these requirements, it is quite impressive that 21 articles did indeed surmount these methodological obstacles to be categorized as a true experimental design.

The majority of the reviewed studies dealt with strategies for improving expressive language or expressive means of communication. While outcomes measuring receptive language were usually included in most of the studies, the means to get these outcomes usually had an expressive output requirement.

An unexpected emphasis on the variety and type of different service delivery models was noted, regardless of what strategies were implemented. Service delivery models included home teaching by parents, training of parents combined with parent/staff teaching, clinic- or school-based instruction, and combinations of all of these. Five of the research studies specifically dealt with parent training, parent implementation, and delivery of strategies in the child's home.

Arguments regarding directive teaching styles versus more incidental ones that fol-

lowed the child's lead and initiative were also studied frequently, as well as more behavioral versus interactive approaches. These are quite similar to the current issues in the field of autism for such diverse approaches.

Seventy percent of the surveyed studies demonstrated clinically significant results (statistically, $p < .05$ or better), usually for short-term gains. The results of these studies involved standardized test measures of quantification of defined behaviors taken before, after, and sometimes during the intervention.

Results were classified as *clinically meaningful* if they included observational measures of the child's increase in the designated skill area in unstructured settings outside of the teaching situation. These included, for example, observations and recording of language discourse in the home, in recreational settings, and with peers at playtime. Clinically meaningful results generally demonstrated the child's use of the designated skill (for example, three-word utterances) in noninstructional demand situations and contexts. For example, let us say that 3-word utterances were observed to increase in 3 separate 15-minute samples during a child's interactions with peers and adults in her playgroup, home, and day care. These results would be considered clinically meaningful differences that were seen in the amount of

Table 3. Speech-Language and Communication Research Summary

Type of Study	Evidence for Intervention	Evidence Against Intervention	Short-Term Gains	Long-Term Gains	Clinically Significant	Clinically Meaningful
Case study	1	0	1	1	0	0
Record/chart review	0	0	0		0	0
Quasi-experimental design (non-clinical trials)	33	2	32	3	24	23
Experimental design (clinical trials)	21	3	20	6	18	13

three-word utterances produced in such settings before and after intervention. Sixty percent of the speech language research reviewed included such criteria, providing support for many of the strategies generalizing to multiple and novel settings.

Lacking in this area of research were studies that looked at long-term gains and skill maintenance over time. This appeared difficult to determine because of the possibility of intervening variables, which may have served to maintain the skill over time as opposed to the intervention in isolation. Such information, however, is important, particularly given the cumulative nature of language development and the need to master and maintain a skill before learning more complex ones.

Two other intervention areas are rapidly emerging in the field of autism, as well as in other learning-and-relating challenges that merit attention. The first of these is auditory processing. Deficits in this skill area ultimately affect language comprehension and the ability to attend to listening tasks (including interpersonal conversations) for any extended time period. The basis for the importance of this area was in part established in a variety of neuroimaging studies that demonstrated central nervous system patterns associated with auditory processing and comprehension in relation to language and reading (see Bruneau, Dourneau, Garreau, Pourelot, & LeLord, 1992; Lyon, Reid, & Rumsey, 1996).

Because it is an emerging area, there are a number of different approaches that focus on auditory processing per se that are quite distinct, each one with its own research base. The strongest evidence (based on physiological measurements and neuroimaging studies) is seen in phonemic awareness instruction for improving not only language, but also reading and developmental spelling. Six quasi-experimental studies were located in this

area, all of which had both clinically significant and clinically meaningful results. (For a review of the state of the art as well as literature on phonemic awareness, see Lindamood & Lindamood, Chapter 23, this volume). There is also emerging support for acoustically modified environments and acoustic modification of speech as well (Tallal, Miller, & Bedi, 1996). Finally, augmentative communication is another emerging area to be noted. By changing the emphasis from language output to communication, augmentative systems enable children with autism to use their visual and other strengths to communicate with or without verbal language in real-life settings (see Lindamood, Chapter 24, this volume).

Discussion

Because speech-language and communication skills (and lack thereof) are among the defining features and earliest diagnostic indicators of children on the autistic spectrum, this is one of the most important functional developmental areas in this syndrome. The research base for this area shows an exceptionally strong empirical and qualitative foundation.

Of the studies, 21 met the criteria for true experimental designs using clinical trial methodology and 33 were quasi-experimental for etiological populations other than autism, with one case study. All of these studies researched constructs that were pertinent to children with autism and disorders of relating and communicating. The clinical significance of this work is supported by statistically significant results for 44 of these studies, and clinically meaningful results for 37. Future research in this area can be improved by examining long-term gains and skill maintenance over time.

As many of the interventions were successful for a wide variety of children, it is

reasonable to expect that we can refer to them when dealing with a child with autism or pervasive developmental disorder whose language deficit area can be specifically identified.

EXECUTIVE COGNITIVE FUNCTIONS AND MOTOR PLANNING

In cognitive psychology, intelligence is no longer accepted as an isolated construct separate from the processes that enable children to learn. Specifically, higher-order processes are involved that integrate, organize, and sequence learning and social behaviors across tasks. Children with autistic spectrum disorders have particular difficulty attending to salient aspects of information and planning and organizing this information to respond to it appropriately. Problem solving, particularly social problem solving, is a hallmark deficit of autism, as well as unusual patterns of learning strengths and weaknesses that make “thinking” with full integration of all sensory and cognitive modalities atypical (Bauman & Kemper, 1997; Dawson, Meltzoff, Osterling, & Rinaldi, 1998; Denckla, 1986; Huebner, 1992; and Rogers, 1996). This functional area is, therefore, very important to address.

A brief description of the history and constructs of executive function and motor planning is presented to help clarify the constructs reviewed. In the past decade alone, the field has undergone tremendous changes due to an influx of neuropsychological and corresponding neurological and physiological data. Indeed, the United States Congress declared the 1990s as the “Decade of the Brain.” Based on Luria’s work (1966 through 1980), the PASS theory of intelligence was developed and describes a theory based on Planning, Attention, Simultaneous, and Successive (PASS) information processing to

conceptualize cognitive processes (Das & Nagliere, 1984, 1989). These theories have been expanded to include additional constructs of self-regulation, regulation of affect, working memory, motor planning and sequencing, rhythmicity, and timing that all affect the broader constructs of planning and attention (Barkley, 1997; Denckla, Rudel, Chapman, & Krieger, 1985; Gillberg, 1988; Piek et al, 1999a, 1999b). During the past 20 years, confirmation of these constructs includes neurological data on brain differences between children with reading disabilities, conduct disorders, attention deficit disorders, and hyperactivity (Hynd, Hern, Voeller, & Marshall, 1991; Hynd et al., 1993; Hynd & Semrud-Clikeman, 1989; Morrigan, Hynd, Riccio, & Hall, 1996).

The impact of this information upon education and therapy for children changed much of the basic framework on which previous interventions have been based. Even for preschool children, executive processing skills are now emerging as a factor that is separate from the field’s, and the public’s, traditional view of intelligence and assessments of intelligence (Casey, Bronson, Tivnan, Riley, & Spenciner, 1991). Executive functions are now viewed as clearly relevant to both nonsocial and social problem-solving tasks, and must be considered as part of any assessment and intervention system for children (Guralnick, 1993, 1998).

Motor planning and sequencing is a construct developed by the field of occupational therapy. It is a specific type of problem solving that describes a similar process involving sequential actions or motor acts. Praxis (i.e., motor planning) and motor control correlate with better mathematical skills, social behavior, and more frequent peer interactions, and these relationships strengthen with age (Parham, 1998).

One of the studies that documented the difficulties for typical, mentally retarded, and autistic children in motor planning analyzed the performance of each group on a simple task of reaching, grasping, and placing an object in a location (Hughes, 1996). The descriptive data indicated that the autistic subjects had more problems than the other groups in executing goal-directed motor acts, even in very simple situations, suggesting an independent and marked impairment in motor planning and control (and corresponding neurologic executive functions) as well as other action-outcome competencies (Losche, 1987). Others showed deficits in ball-catching and throwing skills, as well as lack of lateralization and consistency of handedness (Cornish & McManus, 1996).

Studies looking at specific intervention strategies under the heading “motor planning” are not as widespread as studies listed under the umbrella of executive functioning, with only 16 found (including case-study reports and compilations). Some of the motor-planning research was conducted under the umbrella of sensory integration therapies, and these studies are included in the “Sensory Reactivities” section of this chapter. Because both executive functioning and motor planning deal with a child’s basic ability to plan and sequence actions and thoughts in order to problem solve, they will be looked at together.

Within the areas of executive functioning and motor planning and sequencing, studies were classified as clinically meaningful if they included measures of children’s motor functioning and sequencing in real-life skill and play situations, as opposed to just test scores and observations in the therapy room or during the therapy session. Stacy Barnes (1996) documented individual progress of students in Linda Biadabe’s MOVE curriculum, first on the movement skill itself, and

then on the use of such skills in real-life situations in what is more of a multiple-study case format. Her case studies in California of severe and profoundly disabled children showed that her movement activities caused dramatic increases in attention, affect, and responsivity in her clients (Barnes, 1996). Freeman and Dennison described their use of movement, balance, laterality repatterning, and vision training (based on the theories of Paul Dennison’s educational kinesiology theories) to work with a wide range of multiply challenged children. The authors documented case studies of several years of work with children with cerebral palsy, mental retardation, deafness, and blindness, as well as autism, showing their progress at home and school.

Shaeffer et al. (2000, in press) used a computer-based interactive metronome (IM) to improve motor planning and, as a consequence, sustained attention, focus, academic, and social skills with children with attention deficit disorder using an experimental pre- and post-test design. Unlike other interventions in the field, the IM was assessed for internal reliability and concurrent validity as a measure of motor performance on a sample population of 585 children ranging in age from 4 to 11 years old before it was utilized in treatment (Kuhlman & Schweinhart, 1999). The intervention groups in the Shaeffer et al. study showed statistically significant improvements over control groups in areas of attention, motor control, language processing, reading, and the ability to regulate aggression. This clinically significant evidence was translated into clinically meaningful evidence by Burpee, Dejean, Frick, Kavar, and Murphy (2000, in press) using clinical applications of the IM in an individual case study format to show longer-term changes as a result of the intervention. Stemmer (1997) improved the motor integration and writing skills of special education students using the IM.

Autism research for executive processing has not looked at interventions specifically. One exception is Zelazo's 1998 study that looked at remediating deficits in information processing for toddlers diagnosed with autism. Most of the other studies were descriptive in nature and compared aspects of executive functioning with control groups using traditional neuropsychological test instruments to look at frontal lobe processing, working memory, temporal memory, temporal-order functions, and short- and long-term recall (Benetto et al., 1996; Prior & Hoffman, 1990; and Russell & Jarrold, 1996).

Surveying the literature base outside of autism on interventions based on executive function theory of cognition and motor planning involved varying definitions of terms and use of constructs. A focus was kept on locating studies that attempted interventions to achieve outcomes versus descriptive reports of varying executive function characteristics in designated populations. Studies on adolescents and adults were excluded unless they involved long-term gain measurement for these groups from the time the children were younger.

The research revealed intervention research with a major emphasis on learning disabilities and attention difficulties.

Outcomes with students with mental retardation were also located. Interventions reviewed included the following:

- Self-assessment for students
- Schema-based instruction
- Self-monitoring strategies
- Attention cueing
- Interspersion of known and unknown tasks
- Use of progressive and consistent time delays
- Transfer strategies
- Metalinguistic problem-solving strategies
- Transactional strategies
- Reciprocal teaching
- Emotional regulation
- Cognitive instruction
- Planning/process strategies
- Mediated learning
- Comprehension strategies
- Process-oriented problem solving
- Sequential movement rehearsal
- Laterality repatterning/balance training

A review of the literature studied is given in Table 4.

Of the 61 studies reviewed, all but 6 demonstrated support for the use of the intervention. The results of 72% of the studies reached a clinically significant level. In particular, evidence supports motor-learning and

Table 4. Executive Cognitive Functions and Motor Planning Research Summary

Type of Study	No.	Evidence for Intervention	Evidence Against Intervention	Equivocal Results	Short-Term Gains	Long-Term Gains	Clinically Significant	Clinically Meaningful
Case study	9	9	0	0	9	8	2	9
Parent report	3	3	0	1	3	0	1	0
Research reviews/meta-analysis	6	5	0	1	6	1	4	1
Quasi-experimental design (non-clinical trials)	36	33	0	3	33	4	30	8
Experimental design (clinical trials)	7	6	0	1	5	2	6	3

perceptual-motor skill training to improve clumsiness, lack of coordination, perceptual-motor skills, and graphomotor skills in many children, and increased speed of motor gains in populations with Down syndrome (Shanz & Menendez, 1992).

Clinically meaningful results were ascertained if the children demonstrated the executive functioning and motor-planning skills mastered in solving problems in real life at play, home, school, and in social situations and not just on standardized test scores or observations of progress in the therapy room during a session. Close to 30% of the studies met this criterion. Long-term gains based on follow-up results 3 months to several years later (for case studies) were generally positive, even if few were noted.

Discussion

The review of literature in this area reveals 7 designs out of 61 that met criteria for true experimental designs. Six of these showed clinically significant results. Of the quasi-experimental cases, 36 of the 61 were clinically significant whereas 9 were clinically meaningful. Three studies showing equivocal results indicated that gains in motor treatment groups did not differ from other or no interventions.

It is possible that the inability to locate more parent reports or case studies resulted in a lack of clinically meaningful information. Perhaps such reports are included within books that describe motor and perceptual-motor learning techniques and thus could not be specifically accessed through the traditional means of literature searches used for this review.

The research base in the descriptive and theoretical literature regarding the constructs of executive functioning and motor planning is large, while the research base of the effec-

tiveness of interventions in this area is embryonic, but showing some positive trends in the areas of parent reports and case studies. Future research efforts are needed to focus on direct measurement of constructs such as improved attention span, alertness states, and use of body in space and in novel situations. Studies are needed on the ability of such interventions to improve the ease, efficiency, and precision of sequencing, processing, planning, and organizing of cognitive and motoric information.

The executive functioning and motor planning and sequencing research intervention base is promising, considering the relative novelty of this construct. The research emphasizes learning beyond a rote level, with an end goal of generalization and organization of the material that has been taught. Deficits in this capacity are a common problem for children with autism and other disorders of relating and communicating. These children frequently learn rote skills easily but can not apply them in a sequential, problem-solving manner in their play and social interactions without prompting. The importance of this functional developmental area in autism dovetails with the increasing knowledge base regarding executive function and motor-planning capacities.

Recent research regarding infants between the ages of 9 and 12 months who were later diagnosed with autism confirms deficits and differences in sensory-reactivity and motor skills for these children compared with other developmental delays and typical children (Baranek, 1999; Osterling & Dawson, 1994). Although deficits in motor planning and learning have not been commonly listed as one of the core characteristics of autism, the descriptive research in this review indicates clear differences between even the most basic goal-directed motor actions for children with autism versus other

populations that may begin to be evident in infancy. This knowledge suggests that motor-planning skills may be one of the earliest “open windows” available for intervention, lending further support to the relevance of this functional area.

SENSORY REACTIVITY

The importance of this area is probably best found in the poignant and often painful narrative accounts of Barron (1992), Christopher (1989), Grandin (1991, 1995), McDonnell (1993), McKean (1994), and Williams (1996, 1998)—all individuals with autism who describe in great detail their over- or underreactivity to sensory information. Differences within the autistic spectrum population itself in the areas of sensory processing and sensory reactivity were documented in a “Chart Review of 200 cases of Children with Autistic Spectrum Disorder” (Greenspan & Wieder, 1998). The importance of this area is reflected in the relationship between stereotyped behaviors (repetitive motor patterns, object manipulations, and behavioral rigidities) and tactile defensiveness found in research by Baranek, Foster, and Berkson (1994, 1996). They found the relationships in children with autism and/or mental retardation, using empirically precise methods and instruments. These findings lent empirical support to the theory that stereotypic behaviors were not just behaviorally based, and paved the way for increasing the use of occupational therapy techniques, which work with sensory processing, to work with developmental disabilities, especially autism. Furthermore, research with 9- to 12-month-old infants who were later diagnosed with autism found deficits and differences in sensory reactivity and motor skills for these children compared with other developmental delays and typical

children (Baranek, 1999; Osterling & Dawson, 1994).

Research reviewed in this area focused on studies looking at the therapies of sensory integration and vestibular movement therapy as administered by occupational therapists or treatment teams including occupational therapists. The bulk of literature in this area is descriptive in nature and is based on Ayres’s work from 1965 to 1987, which factor-analyzed perceptual-motor and sensory deficits in children with disabilities compared to peers without disabilities. Since that time, this original analysis has met with much criticism (Arendt, Maclean, & Baumeister, 1988; Cummins, 1994; Hoehn & Baumeister, 1994). Simultaneously, information from the neuropsychological sciences and descriptive studies of children with autism and related disorders, as well as hyperactivity, learning disabilities, obsessive compulsive behaviors, and self-stimulatory behaviors, have lent theoretical support to Ayres’s original ideas of sensory differences in children with disabilities, with some revisions to her theory (Baranek & Creedon, 1991; Case-Smith, 1991; Ghez, Gordon, & Ghilardi, 1995; Lincoln, Courchesne, & Hans, 1995).

Since 1983, descriptive studies have attempted to quantify more precise sensory processing and integration deficits in children with attention deficit disorder, obsessive-compulsive behaviors, learning disabilities, and other developmental delays. Thirteen studies have specifically looked at the differences in sensory processing for children with autism compared to other populations, and clearly document differences. All these studies were descriptive versus strategy-oriented in nature and are cited in the reference section.

This analysis reviewed 34 studies that examined the effects of sensory integration and movement-based treatment on the con-

structs listed in Table 5 for populations of students with and without autism. Effects on the following outcome areas were noted.

Table 5. Skill Categories in Sensory Reactivity Research

Skill Category	No. of Studies
Play skills	2
Eye movements	2
Motor skills	11
Academic skills	8
Calming/self-organization	5
Self-stimulation	4
Perceptual processing	2

Of interest was the lack of outcome studies looking at the constructs of attention, arousal, and interaction, and under- and over-reactivity more specifically. Although gains in skills in these areas would be difficult to measure using standardized instruments, such measurement would be more in keeping with the short-term goals of occupational therapies. Rather, cause-and-effect studies tended to focus on the byproduct of improvement in these skill areas; that is, increased attention and less reactivity should result in better academic skill scores.

The intervention studies on the effectiveness of sensory integration therapies (including movement) and occupational therapy that

were reviewed yield a puzzling picture (see Table 6). Twelve of the studies yielded results that were equivocal in nature; that is, gains in specific skill areas could not be attributed to the intervention itself because control groups and comparison groups receiving alternative treatments made the same gains. In these studies, there was not specific evidence against the use of the intervention but rather no data to definitively point to the intervention as the only cause of the change. The fact that three meta-analyses of several studies did show significant effect sizes for the outcomes measuring improvements in motor skills is encouraging, although no long-term gains were assessed in these same studies. Only two of the studies looked at long-term gains for their interventions.

The experimental studies reviewed showed gains in the areas of academic performance, perceptual processing, and perceptual-motor skills based on standardized test results. Only one of these studies, however, attempted to look at transfer of these skills in a different classroom setting and to different subject matter. The quasi-experimental studies did look at the ability to self-calm and organize as well as at academic, motor, and perceptual skills, providing evidence to support use of sensory integration strategies for deficits in this regard as well as in motor and perceptual processing. But five of these studies showed the same

Table 6. Sensory Reactivity Research Summary

Type of Study	No.	Evidence for Intervention	Evidence Against Intervention	Equivocal Results	Short-Term Gains	Long-Term Gains	Clinically Significant	Clinically Meaningful
Case study	7	7	1	0	5	0	0	8
Meta-analysis	3	1	0	3	2	0	3	0
Record/chart review	1	1	0	1	0	0	0	0
Quasi-experimental (non-clinical trials)	15	11	0	5	5	2	5	3
Experimental design (clinical trials)	8	4	0	3	4	0	4	1

skills were also acquired using alternative treatments and even by a no-treatment control group!

Case studies documented increases in language and play and decreases in self-stimulation behaviors (such as head-banging). The results of those reviewed in this analysis were all clinically meaningful in that the descriptive accounts described improvement in quality of life for the individuals treated as a result of the decreases/increases in areas treated. It is likely that a larger bank of anecdotal evidence from teachers and parents is available in sections of books, letters, and narrative accounts that are not directly accessible through a more traditional literature review format.

Case studies include the previously noted autobiographical accounts of Barron (1992), Christopher (1989), Grandin (1991, 1995), McDonnell (1993), McKean (1994), and Williams (1996, 1998). These include narrative accounts of what sensory experience felt like to these individuals, and what techniques seemed to help them feel better and keep them more available for learning and interaction. These techniques included joint compression, massage, brushing, and several other sensory integration activities. Temple Grandin, now an accomplished animal behavior researcher, presented a paper before the National Institutes of Health requesting funding for more research for this area as well as for overall support for the field. Her paper kept reiterating that, despite the lack of clinically significant evidence, the issues of sensory over- and underreactivity interfered with her life, her work, and her overall health, as well as that of other autistic individuals she had met in her lifetime. She gave an impassioned account of the interventions she herself had developed and began experimenting with, as well as those from the occupational therapy literature.

A more recent attempt to measure the benchmark characteristics of autism (nonengaged behavior, inability to master goal-directed play, and low-interaction frequency) showed that these change as a result of sensory integration therapy (Case-Smith & Bryan, 1999). Checklists and videotaped observations were used to quantify the results using a single-subject format.

Even without clinically significant documentation of effectiveness, other leading methods of treatment have incorporated accommodations for sensory, attention, and arousal deficits. For example, the TEACCH curricula include an emphasis in their instructional formats, physical layouts, visual strategies, and schedules that reduces uncertainty and over-arousal. Roger's Denver Model program uses sensory input to optimize arousal levels for learning, to increase experiences of positive affect, and to stimulate child initiations. Rogers openly acknowledges her belief in these constructs and use of them, and describes them as being critical elements of her program (Rogers, 1998). At the same time, she acknowledges the lack, and ambiguity, of research results in this area, but justifies her use of the strategies as being grounded in neuropsychological theory and neurological research.

Newer approaches that involve "top down" processing, such as that used in cognitive rehabilitation techniques (Toglia, 1997), as well as technology to improve timing and rhythmicity related to motor planning and sequencing (Shaffer et al., in press), are also being implemented in conjunction with more traditional sensory integration therapies.

Discussion

Because variations in sensory reactivities are difficult to empirically document, it is easy to underestimate their importance.

However, the voluminous number of case studies, narrative accounts, and personal reports provide evidence on the significant impact of such reactivities.

Because sensory reactivity ultimately affects an individual's availability for relationship development as well as spontaneous and specific learning tasks, it is part of the foundation for acquiring many of the other functional developmental capacities. This makes it a very important and critical functional area to address.

Furthermore, neuropsychological constructs offer a strong theoretical support for occupational therapy constructs involving sensory modulation, attention, and body organization, including hyper- or hypo-arousal and sensory reactivity. Using brain scans, Courchesne, Townsend, Akshoornoff, and Saitoh (1994) have described the neurological deficits that result in impairment in shifting attention, arousal, and spatial orientation in individuals with autism.

While the research base for sensory integration interventions in children with other disabilities is limited and mixed, there are some studies (8 experimental and 15 quasi-experimental) supporting their use in improving motor skills, perceptual-motor skills, self-calming and organization, and play skills. The 12 studies in which clinically meaningful information did exist were largely narrative accounts describing increased attentiveness, calmness, and the ability to tolerate a larger variety of instructional and recreational environments after interventions.

A challenge for future research is to focus on outcomes that are specifically related to sensory reactivity as opposed to those that are the byproducts of normal sensory regulation. This would involve looking at attention levels, amounts of sustained attention under varying social and play circumstances, under- and over-arousal levels in children,

and problem-solving capacity. The newer, computer-based instruments looking at sustained attention, distractibility, perseverance, and other attention related traits may be useful for pre- and post-testing in these areas.

Even though the outcome research is limited, this is an area of enormous clinical importance, which requires more research. Many program models for children with autism (Walden, TEACH, LEAP, Princeton Child Development Institute) emphasize attending to the individual differences in the sensory reactivity areas as a critical intervention component. Therefore, the best available approaches should be considered while additional research is being carried out.

VISUAL AND VISUAL-SPATIAL PROCESSING

Closely related to executive functioning and motor-planning are sensory-processing capacities dealing with visual-spatial processing. There are a number of levels to visual-spatial processing:

- Recognizing visual patterns (e.g., identifying pictures or shapes).
- Remembering what is seen (reproducing a sequence of shapes such as a circle, square, rectangle, and diamond).
- Solving a basic visual-spatial problem, such as finding an object hidden in a room and/or playing treasure hunt with mom, dad, or peers.
- Perceptual-motor exercises that involve locating something in space (e.g., tracking a ball, finding words on a page).
- Visual-spatial problem-solving involving reproducing and transforming spatial configurations (e.g., copying basic shapes with blocks or drawings, transforming shapes [flipping a block design over in different planes]).
- Visual-spatial problem-solving involving conservation tasks, relativistic thinking,

and complex sequencing challenges (e.g., tall glass and short glass holding same amount of water, sequencing objects by size, color, weight, volume).

- Problem-solving involving figuring out sequencing patterns (e.g., number or shape sequences that require analyzing patterns).
- Part and whole problem solving (e.g., how the parts make up the whole and vice versa).

(See Wachs, Chapter 20, this volume, for a complete description of different types of visual-spatial challenges).

Many of these visual-spatial challenges involve sequencing and are mastered by performing motor acts with objects. Therefore, there is considerable overlap between the areas of visual-spatial processing and executive functions and motor planning. The research supports for the importance of, and working with, executive functioning and motor planning discussed earlier, therefore, also support the importance and usefulness of working with visual-spatial thinking.

Visual-spatial thinking, however, also needs to be discussed in its own right. It involves its own independent elements as well as overlapping elements with executive functioning and motor planning. There are individuals, for example, who can solve complex visual-spatial tasks as just described if someone else helps with the motor component (e.g., a child describing where to search for a toy or solving a complex conservation problem without motor actions). Visual-spatial thinking can be clearly assessed through neuropsychological test batteries and a variety of related procedures (see Black & Stefanatos, Chapter 18; Wachs, Chapter 20; Feuerstein, Chapter 22, this volume). It has been studied in a variety of ways in neuropsychological and neurobiological studies

(See Minshew & Goldstein, Chapter 28, this volume). In addition, visual-spatial processing problems are an important component of many learning problems and developmental disorders, including autistic spectrum disorders (e.g., Asperger's syndrome and many other autistic patterns (Greenspan & Wieder, 1997; Klin et al., 1999; Klin, Volkmar, Sparrow, Cicchetti, & Rourke, 1995; Schultz et al., 2000; also see Minshew & Goldstein, Chapter 28, this volume). It also appears to be an essential part of scientific, mathematical, and general analytical thinking in a variety of contexts (Furth & Wachs, 1974).

The literature on perceptual-motor activities involving visual tracking is sometimes confused with the larger category of visual-spatial processing. Perceptual-motor activities involved in tracking, however, are one part of perceptual-motor capacities which, in turn, are only a small part of a larger set of capacities involved in visual-spatial processing.

Visual-spatial processing is a relatively new area of intervention research, even though a number of clinicians have been working in it for many years (See Wachs, Chapter 20; Youssefi & Youssefi, Chapter 21; Feuerstein, Chapter 22, this volume). Therefore, reports about visual-spatial processing interventions are often clinical case descriptions, informal clinician networks, or are embedded in the category of executive functioning and motor planning discussed earlier.

Visual-spatial processing is a critical area of functioning, often impaired in many developmental and learning disorders, including autism. The innovative clinical techniques now available and being developed require more attention and systematic research efforts. In the meantime, visual-spatial processing needs to be worked with as part of a comprehensive program. It needs to be worked with either as part of a broad approach to motor planning and executive

functioning or in its own right. At present, therefore, expert clinical opinion, together with available research, especially from the work on executive functioning and motor planning, will need to guide efforts in this area.

AFFECT AND SOCIAL-EMOTIONAL CAPACITIES

Play and Symbolic Play Skills

Deficits in symbolic play are listed in the DSM-IV (1995) as one of the core and diagnostic features of the autistic spectrum disorders. The importance of this functional deficit area is also indicated in a number of studies. When compared to subjects matched for mental age, autistic children displayed considerable deficiencies in these areas in studies by Ungerer and Sigman (1981) and Wing and her colleagues (1977). Greenspan and Weider (1997) described deficiencies in play in their chart review of 200 cases of children with autistic spectrum disorder. These deficiencies ranged from the total absence of any play and odd use of toys to the inability to be symbolic and generate more than one step of a sequential reenactment of a symbolic play sequence.

Yet while the importance of play in early childhood development has long been emphasized in education, psychology, and medicine, the outcomes-based research on this topic during the past 15 years is not as profuse as one might expect. Only 12 studies surveyed attempted to show the effects on various strategies of improving or increasing play skills in a specific manner, not only for children with disabilities but also for typical children. The majority of research on this topic was descriptive in nature, and not outcome-based. These studies hypothesized constructs that were demonstrated by showing a relationship between one construct and

another (e.g., the parallel between language ability and symbolic play skills). Those studies that did look at intervention outcomes affecting play fell into these categories:

- Behavioral interventions
- Pivotal response training
- Play therapy sessions (described for children with mental retardation)
- Effect of amount of maternal involvement available for play
- Increasing vocabulary levels to increase play levels
 - Child-chosen options for play versus adult-imposed options
- Effects of mixed-age grouping
- Effects of occupational therapy
- Social-skills training (As the overall objective of these studies was to improve peer relationships, a review of these studies is included in the “Peer Relationships” section of this chapter.)
 - Inclusive and mainstream settings for children with disabilities

Table 7 displays a summary of research related to play and symbolic play skills.

The majority of outcome based studies demonstrated evidence of use of various interventions, with close to 30% of these reaching clinically significant levels. Results demonstrate improved (e.g., higher levels of play, more complex play, use of more themes) in a setting other than the experimental one. Of the outcome studies reviewed, 68% could be classified as both clinically meaningful and clinically significant. Most of the studies, however, did not provide evidence for long-term gains or maintenance of play skills over time. Many programmatic interventions (e.g., Princeton Child Development Institute, TEACH, UCLA Intensive Behavioral Program, and Walden) include play as part of their programs, but do not measure play variables specifically enough outside of a general

Table 7. Play and Symbolic Play Skills Research Summary

Type of Study	No.	Evidence for Intervention	Evidence Against Intervention	Equivocal Results	Short-Term Gains	Long-Term Gains	Clinically Significant	Clinically Meaningful
Case study	5	5	0	0	1	3	0	1
Descriptive or correlation studies	15	7	0	1	4	3	9	7
Research reviews	2	2	0	1	1	1	1	1
Quasi-experimental (non-clinical trials)	12	10	0	2	9	2	7	8
Experimental design (clinical trials)	1	1	0	0	1	0	1	1

measure of program effectiveness to be included in this review.

Finally, as noted in other functional developmental deficit areas, there is a strong likelihood of case study and parent report evidence in narrative forms that may indicate at least qualitative improvement of play skills after various interventions. Such information is, unfortunately, not accessible at large through the search methods used for this review and thus was unintentionally left out. Samples of such accounts were utilized whenever located.

The descriptive studies reviewed largely examined the relationship of levels of play skills to language and prelinguistic language skills and, for the most part, confirmed theories regarding this relationship. Hierarchical levels of play corresponding to language levels were then usually formulated. Three studies looked at the play characteristics of children with Down syndrome, and one reviewed the characteristics of children with specific language impairment. If the strong relationship between speech-language competencies and play skills is as valid as the descriptive and theoretical research suggests, it is of interest that more research on play and language is not occurring for challenged children who do not have autism. The majority of other disabilities clearly fall into the category

of having language difficulties, delays, and deficits, which would ultimately impact their play skills.

In surveying this category of literature, it was noted that the outcome-based studies that looked at play skills for children with autism were as numerous as the outcome studies for both typical children and children with other disabilities (10 outcome-based studies and 11 descriptive studies).

Discussion

The importance of play as a functional deficit area in the autistic spectrum disorders is indicated by the fact that a deficit in symbolic play is one of the definitive diagnostic indicators in the classification of the disorder. Numerous descriptive literature reviews and studies also note not only the deficiencies in this area but also the qualitative characteristics that make the play of children with autism so different from other challenged as well as typical populations of children. In general, however, the field has expended more effort on describing this play as opposed to determining how to intervene with it.

Out of the 13 experimental and quasi-experimental designs located, only one met the criteria for a true clinical trial. Eight of these 13 studies were clinically significant and 9 were clinically meaningful.

Most programs for autism include play to varying degrees as part of an intervention package with general outcomes of program effectiveness. Much more outcome-based research, however, is needed on existing and new interventions working with symbolic play skills.

Parent/Caregiver Relationships

Qualitative impairment in social interaction is a core characteristic of autism. For infants, toddlers, and preschoolers (with and without disabilities), early development is embedded within a social context. During these early years, this context is largely defined by the interactions with the child's parents and caregivers (these terms will be used synonymously throughout this section), thus establishing the importance of this area as a functional deficit. To foster an environment that facilitates optimal developmental outcomes, child-caregiver interactions are a critical window through which to influence developmental outcomes of concern and to influence outcomes across several domains of functioning (McCollum & Hemmeter, 1998).

Both the autism literature and the child development literature have emphasized a number of constructs that highlight specific facets of interaction and relationships. These include reciprocity (Dawson & Galpert, 1990; Lewy & Dawson, 1992; Tanguay, 1999), shared attention (Mundy, Sigman, & Kasari, 1990), empathy and theory of mind (Baron-Cohen, 1994), and functional interactive use of language (Prizant & Wetherby, 1993). These constructs are incorporated into relationship-based interventions and more subtle outcome measures.

An overview of this area historically is given first to clarify the constructs in this area. The importance of attachment and bonding with the caregiver has been well-documented

in the attachment literature by Bowlby (1978, 1982, 1984), Spitz (1972, 1997), Ainsworth (1962), and others, beginning in 1945 and continuing to the present. The first true statistical verification that infant's interact with others was seen in an extensive literature review and experiments by Carew (1980). Her work showed that interactions with others were important for a range of developmental capacities. This led theorists to hypothesize that the power of human interaction could impact abnormal development and its course positively and perhaps significantly. A more integrated approach to support human development began to gain favor, such as the model developed by the Peckham project in London in 1935. This project established health centers to serve as social, recreational, medical, and psychological resources for high-risk families. This was later replicated in the work of the South End Community Health Center in Boston.

Several significant studies were completed prior to 1985 that produced clinically significant results to set the stage for the increase in funding for education and social early intervention for the next decade. Two of these studies followed children into adulthood and reviewed the effects of early educational and family support interventions in high-risk families. The Perry Preschool project and the Carolina Abecedarian programs both showed enduring social and intellectual gains in children who received such early services. Analysis of these programs showed statistically significant positive gains in long-term follow-up, leading the National Education Consortium in 1992 to present such papers as "At Risk Does Not Mean Doomed" (Ramey & Ramey, 1992).

Other seminal work in this area include studies by Honig and Lally (1983) and Provence and Naylor (1983), which both showed clinically meaningful results inferring

that providing support to families and opportunities for socialization and cognitive enrichment helped children do better in school and have fewer difficulties when they grew up.

The same effects of early and relationship-based interventions were seen not only in typical and high-risk children, but also with young children with disabilities as well. Important results with a Down syndrome population were described in studies led by Feuerstein (1980, 1981). He described an increase in cognitive abilities that remained 2 years after the intervention was completed. Most interesting in this research was the finding that the instruction involving more actual teaching time (300 hours of more instruction!) of specific content areas did not produce the same gains in cognitive ability scores as did the intervention of *individualized adult interaction* together with teaching of problem-solving skills strategies. Results lent support to the idea that teaching thinking skills within an emotionally based individual relationship was especially important. Without the relationship emphasis, the teaching was not as effective for a population with developmental challenges. For many years, the Son-Rise program has emphasized the importance of relationships and family support in working with children with autistic spectrum disorders (Kaufman, 1976). There are a number of detailed case narratives about this program. A parallel emphasis on different types of processing capacities and different types of outcome studies, including ones with clinical trial designs, however, are needed.

Sally Provence summarized the literature from 1980 to 1985 on long- and short-term results of early intervention programs, and noted the positive trend towards more comprehensive services to children versus approaches that focused primarily on cognitive areas. She recommended the use of broad measures of adaptation and social

competence for measuring program effectiveness rather than cross-sectional IQ outcomes as the direction future research should head at that time.

Recent neuroscience research (Greenough & Black, 1992; Weiler, Hawrylak, & Greenough, 1995) further supports appropriate interactional experiences during the early years to foster central nervous system growth.

To complement the knowledge base in this area of parent-child interaction interventions for children with disabilities, the reader may wish to refer to the comprehensive work completed in this area by McCollum and Hemmeter in *The Effectiveness of Early Intervention* (Guralnick, 1998). The focus of this chapter is to take a comprehensive look at research strengths and weaknesses in this area.

In reviewing the research base in this area during the last 15 years, most of the studies surveyed covered the following topics and interventions:

- Following the child's lead
- Behavior modification techniques
- Contingent response training
- Floor time
- Types of adult utterances
- Combining structured with unstructured activities
- Naturalistic language
- Turn-taking
- Interactive matching of affect
- Therapeutic support/counseling to families

Outcomes reviewed in these studies included affect levels, amount of child initiations, amount of reciprocal parent-child interactions, types of child verbal/communicative acts, and increases in levels of symbolic play. The research summary of this area is given in Table 8.

Of the 27 articles reviewed, all but two demonstrated beneficial uses of the interventions surveyed. The issues of matching family

Table 8. Parent/Caregiver Research Summary

Type of Study	No.	Evidence for Intervention	Evidence Against Intervention	Equivocal Results	Short-Term Gains	Long-Term Gains	Clinically Significant	Clinically Meaningful
Case study reports	6	6	0	0	6	3	0	6
Descriptive studies/single-subject designs	7	6	0	1	7	0	4	5
Research review	2	2	0	1	2	2	2	0\
Quasi-experimental (non-clinical trials)	9	8	0	1	8	3	8	4
Experimental design (clinical trials)	3	3	0	0	2	0	1	0

and child characteristics and ethical considerations in using control groups obviously limited the number of true experimental clinical trial designs in this research area. However, the majority of this research was clinically significant when short-term gains were measured ($p < .05$). Long-term gains (in regard to changes in the children) were usually not adequately defined to draw conclusions that were as clinically significant as those seen in studies prior to 1985. Two exceptions to this were the studies by Greenspan, Wieder, and Nover (1985) and Klein, Wieder, and Greenspan (1989). These studies looked at change over 4- and 2-year time periods, respectively, in multiple developmental and cognitive areas. Clinically meaningful results were determined if the outcomes measured were demonstrated in the home and measured under more than one circumstance when interventions were no longer taking place. Also included in this category were studies that measured outcomes in settings other than the home.

The study conducted by Klein, Wieder, and Greenspan with the Clinical Infant-Child Program of the National Institutes of Mental Health (1985) was particularly comprehensive. This 4-year longitudinal study noted previously provided counseling, teaching, and assistance in obtaining services for

multi-risk families and included more than 200 children. Parents were trained in strategies of affect, social interaction, sensory-motor development, and cognition, and also given an ongoing emotional relationship in an attempt to reverse maladaptive developmental patterns. The approach was transactional and holistic as opposed to remedial, skill, or developmental-domain specific. Infants in the intensive intervention group showed a capacity to recover from early perinatal stress or developmental deviations, both from qualitative observations and statistical measures using relationship scales. Infants whose development had decompensated during the first 3 months of life (as demonstrated by chronic gaze aversion, lack of human attachment, and extreme affect lability) were able to achieve adaptive homeostatic and attachment capacities. This was done by helping parents make subtle changes in handling and approaches unique to the infant's sensory and processing style in their daily interactions and to eventually take over the treatment of their child.

Interestingly, the parent intervention research does not simply indicate that quantity of parent intervention sessions, or number of service providers correlates with positive outcomes. Intervention models that were associated with increased stress in mothers

actually caused less improvement in development in a population of infants with developmental disabilities in low socioeconomic status (SES) families in a study by Brinker, Seifer, and Sameroff (1994).

Rather, the combination of quality and intensity of the intervention intersecting with the unique and changing characteristics of the child, the parent, and the resulting relationship characteristics tended to show the more robust research findings and clinically meaningful results.

In general, the research reviewed indicates that interaction strategies taught as content-bound skills were not as effective as context-bound skills taught as flexible processes based on the unique characteristics of the child's and the caregiver's ability to read and to adapt to these characteristics. This suggests that the intervention processes assume equal importance with the content, and are systematically selected to support specific content (Barrera, 1991; Rauh, Achenbach, Nurcombe, Howell & Teti, 1988). This involves defining characteristics and representative behaviors from within the context of the interactions between parent and child. Dyad research in this regard conducted by Landry and colleagues (1989, 1994) was particularly exemplary.

Discussion

The importance of parent/caregiver relationships as a functional deficit area is established not only by the core characteristic of impairment in social relatedness for autistic spectrum disorders but also by the literature across psychological, developmental, and psychiatric disciplines that have emphasized parent/caregiver relationships with the child as a foundation for social relationships and many emotional and problem-solving capacities.

Three experimental and 9 quasi-experimental designs yielded 9 clinically significant

results, and 4 clinically meaningful ones. Of the 27 articles reviewed, the most evidence for clinically meaningful results was seen in case-study reports, whereas the most clinically significant results were seen in the quasi-experimental studies.

Across all developmental challenges, research emphasized the avoidance of a one-size-fits-all approach to the child-parent dyad interaction, the need for integrated support to families, and the sensitivity to individual-child characteristics as the critical components in this intervention area. Many of the program evaluation studies that were not accessed specifically indicated that inclusion of the parent/caregiver relationships into an intervention seemed to be correlated with the most stable and enduring results of other treatment areas as well.

Although the construct of parent/caregiver relationships seems to be known across disciplines, much more research is needed in this area regarding interventions to improve these relationships. There has been insufficient research on interventions that work on relationships for children with autism and other developmental disorders. The role of parent/caregiver-child relationships for intervention with autistic spectrum disorders and other developmental problems, therefore, requires special emphasis.

The research support for interventions on parent/caregiver-child relationships and symbolic play, when coupled with the autism research on shared attention (Mundy & Crowson, 1997; Mundy et al., 1990), affective reciprocity (Lewy & Dawson, 1992; Tanguay, 1999), theory of mind (Baron-Cohen, 1994), functional language (Prizant & Wetherby, 1993), and abstract thinking (e.g., making inferences)(Minshew, 1997, 1999, 2000), presents a substantial case for working with relationships at multiple functional developmental levels. These levels

include shared attention, relating to others, reciprocal social interaction and social problem-solving, the creative and functional use of ideas (symbolic play), and logical and abstract thinking (see Chapters 3 and 4, this volume).

Peer Relationships

The inability to socially relate to other peers, and not just to adults, is one of the diagnostic indicators and core characteristics of children with autistic spectrum disorders. The importance of this functional deficit area is established not only by the DSM-IV definition of autism, but also because children's social competence in general, and peer-related social competence in particular, has emerged as a central issue in the treatment and education of children with disabilities (Guralnick, 1988). Much attention is being given to the difficulty with peer interactions that challenged children have because problems in this area extend well beyond what is expected, based on the child's overall developmental level (Guralnick & Groom, 1985, 1987, 1988; Lieber, Beckman, & Strong, 1993).

The research literature base over the past 15 years reflects this emphasis in the field, and mirrors the current educational reform movements towards more inclusive education models for children with disabilities. This review surveyed studies for all disabilities, including autism, that attempted to show the effects of interventions on the peer relationships of challenged children with more typical peers. While the preponderance of studies reviewed involved preschoolers, studies of elementary-age children were also utilized. The types of interventions utilized fell into the following categories, with several studies incorporating more than one intervention in their research (see Table 9).

Table 9. Interventions Surveyed by Peer Relationship Studies

Category	No. of Studies
Use of mainstream/inclusive settings	21
Social-skills training for challenged students	8
Training of typical peers in strategies/responses	6
Typical peer collaboration/mediation	6

A wide range of outcomes were evaluated, using both standardized and observational measures. These included the following:

- The amount/type of challenged child interactions typical peers
- The amount/type of typical peer interactions with challenged peers
- The type of play demonstrated by challenged peers
- Developmental progress in language, gross motor skills, comprehension, and cognition
- Social-competence measures
- Measures of teacher acceptance
- Amount of typical peer integration of challenged peers
- Generalization of all of the above skills to alternate settings

The research is summarized in Table 10. Of the studies reviewed, 78% had results that were clinically significant, even when measures taken were behavioral indices of incidents of observed interactions. Studies were determined to be clinically meaningful if measures of skill generalizations in settings other than the experimental ones were utilized and demonstrations of targeted skills were observed spontaneously, with no interventions. Fifty-seven percent of the studies included such information.

Long-term gains were not studied frequently but, when they were, they ranged

Table 10. Peer Relationship Intervention Research Summary

Type of Study	No.	Evidence for Intervention	Evidence Against Intervention	Equivocal Results	Short-Term Gains	Long-Term Gains	Clinically Significant	Clinically Meaningful
Single-subject design	5	4	1	2	5	2	3	5
Multiple-study review	1	1	0	1	1	0	1	1
Quasi-experimental (non-clinical trials)	29	24	2	7	28	6	22	14
Experimental design (clinical trials)	6	6	3	2	5	2	6	3

from 3 months to 1 year after the intervention was completed. While evidence against the use of the intervention was rare, the negative effects were interesting. One study noted better social interactions for children with higher-cognitive ability, but weaker social interactions for children with more limited ability in an integrated setting compared to a control group in a specialized setting. A decrease in measured gross motor skill development was noted in one integrated setting compared to a specialized one, possibly because of the lack of consistent physical and occupational therapy in the integrated setting. More challenged peer interaction with adults than with typical peers was noted in two of the studies in integrated settings.

Equivocal results centered on the limited differences in academic and developmental skill gains between challenged children in mainstreamed and specialized settings, despite gains in social competence measures and quantity of social interaction. Cognitive levels of play also did not tend to change in several of the studies as a result of the setting, although this was hypothesized.

The studies widely support the use of integrated settings for challenged children as well as the effectiveness of social-skills training for both typical and challenged peers. The literature demonstrates, however, that placement in such a setting is not sufficient in and

of itself to improve peer relationships. The qualities of the setting (e.g., staff, program elements, and types of interactions facilitated are obviously of great importance). Placement in integrated settings had the largest effect sizes when adult mediation and teaching of specific skills occurred as a part of the program for both the challenged and typical peers. Finally, the selection of setting and program intervention should be based on the individual profile of the child involved, and not just on a category of a disability. Because one intervention worked for one child with autism, there is no information that specifies which type of child with autism (in terms of his language, arousal levels, eye contact) would benefit the most from this intervention.

Discussion

The importance of peer relationships as a functional developmental area for intervention is seen not only in the diagnostic characteristic criteria for the autistic spectrum disorders but also in the general trend in educational programs that emphasizes social competence through inclusion with typical peers.

More than 60% of intervention studies were done using experimental and quasi-experimental designs, while most of the remaining surveyed research used single-subject designs. For many of the functional deficit areas surveyed in this chapter, a preponderance of traditional

research designs over more narrative formats usually did not correlate with a large amount of clinically meaningful results. This was not true in the peer relationships area. Even with a lack of parent report and narrative case studies, 50% of these studies still yielded clinically meaningful results. Six of the studies were experimental in nature, with all 6 yielding clinically significant results and 3 showing clinically meaningful data. Twenty-nine of the 41 reviewed were classified as quasi-experimental—22 of these were clinically significant with 14 having clinically meaningful outcomes.

In general, the studies widely supported the use of integrated settings for challenged children, but emphasized that placement in such a setting was not sufficient to improve peer relationships without inclusion of adult mediation and specific skill instruction for both the challenged and typical peers. The studies also stressed the need for a “fit” between a program and a child, based on the child’s individual profile, not just age or grade level.

Constructs that lay the foundation for social competence, such as shared understanding, emotional regulation, and information processing, were not generally researched with peer relationships, despite their strong theoretical base as foundations for such social skills and relatedness. It is likely that the understanding of processes rather than an attempt to “train” processes per se will be central in determining if peer relationship interventions will have long-term efficacy (Guralnick, 1998). Strategies for these interventions would benefit from research on the processes associated with being able to relate to others. The relationship of these constructs to executive functioning deficits (previously surveyed in this chapter) is postulated by many of the leading theorists (Barkely, 1993; Gilberg, 1998; Hynd et al., 1994). An interesting direction in research for

the future could involve looking at the interaction of interventions in both the peer relationship and executive functions areas to see if one improves the other.

Interventions for improving peer relationships for children with characteristics in the autistic spectrum have experimental research validity. There is a need for interventions to be systematic and imbedded in a developmentally based framework and to look at long-term gains in skill maintenance. More case study formats, as well as parent and staff report narratives, are needed to give more qualitative and clinically meaningful information.

SURFACE BEHAVIORS: INTERVENTIONS FOCUSING ON CHANGING BEHAVIOR WITHOUT A FOCUS ON THE UNDERLYING PROCESSING DEFICITS

Surface behaviors can be viewed as an area of functioning, the same as language or motor planning. In general medicine, it is similar to considering the skin and dermatological functioning as a physical system, similar to kidney or cardiac functioning. To understand surface behavioral characteristics as a functional area, however, it is necessary to step back and look at the history of behaviorism in regards to the autistic spectrum, and its early importance.

Overview of Surface Behavior Intervention History

Prior to 1962, autism was viewed within the traditional medical model of disease. Literature regarding autism focused on identifying and/or curing the disease. Various studies showed that available psychological therapies were not effective in remediating autism (Havelkova, 1968; Kanner & Eisenberg, 1958; Rutter 1966). Many children were

labeled “incurable” and were institutionalized for the duration of their lives. This poor prognosis, combined with the advent of behaviorism, set the stage for some to view autism as a learning disorder instead of a disease. According to proponents of the behavioral approach, if the disease model had been able to provide an effective treatment paradigm, it is likely that the behavioral model would never have surfaced (Lovaas, 1979).

The shift from treating the disease, to identifying and treating the behaviors of autism (and their many manifestations), provided many families and professionals with a new sense of optimism and the focus in the field became the more tangible set of skills and behaviors. The public could not see a cure, but they could see when an autistic child learned to feed himself or say a word. The small successes provided by the studies at that time motivated treatment professionals, educators, and parents with specific behavioral goals.

Ferster (1961) was the first to present a theoretical construct regarding autism within a behavioral framework. He proposed that the behavioral problems of autistic children were based on a general deficiency in acquired reinforcers, and then conducted studies to show that such children could be taught simple tasks if reinforcers were significant or functional for them. When their behavior was explained by basic learning theory, it was a logical conclusion within the behavioral model that autistic children could be taught to comply with certain aspects of reality by rearranging the environmental consequences (Ferster & DeMyer, 1962). Several small case studies were reported that successfully used mild punishment and extinction to decrease self-injurious behaviors and teach basic imitation and beginning language skills (Hewitt, 1965; Metz 1965; Wolf, Risley, & Mees, 1964). Although the studies presented no

data on whether treatment effects endured beyond the therapy, they had significance in the kinds of questions they began to ask about autistic children, as well as in the methodology and study designs employed.

Very few of the early studies in the immense body of behavioral literature ever mentioned a “recovery ” from autism. Only the Lovaas studies from 1973 to 1987 made more ambitious claims. In the 79 studies reviewed for this chapter (excluding 6 research reviews), only 6 studies (including the Lovaas study) focused on the following broad outcomes at the end of the treatment interventions:

- Enrollment in regular education classes
- IQ score increases
- Language quotient gains
- Normal vs. abnormal developmental rates of learning
- Diagnosis of autism or pervasive developmental disorder

Rather, the mastery of specific skills and the decrease of designated aberrant behaviors were the major focuses of the behavioral research and literature. The number of studies according to treatment objective is shown in Table 11. A summary of all of the above studies in terms of variables reviewed in this article is given in Table 12.

Only 16% of the studies reviewed were experimental or quasi-experimental in nature and, of these, only 2 were experimental (i.e., involved clinical-trial methodology of random assignment and double-blind outcome assessment). While all of these studies showed clinically significant results in the broad outcome areas noted above, only five showed results that could be described as clinically meaningful. (As noted previously, the clinically meaningful outcomes are indicated when a skill targeted by the intervention is used and applied as it was intended to

Table 11. Treatment Objectives of Surface Behavior Interventions

Treatment Objective	No. of Studies
Initiating behaviors (verbal, language, and social)	6
Decreasing behaviors (echolalia, aggression, self-stimulation/stereotypy, eating problems)	20
Increasing behaviors (verbal compliance, eye-gaze, verbal imitation, pointing)	4
Specific language skills (question-asking, increased vocabulary; object identification; linguistic formats)	6
Language use in general	7
Academic skills (number and letter identification, basic reading, vocabulary, basic math facts)	6
Sign language acquisition	3
Peer interaction behaviors (peer initiations to autistic children; increase in pivotal social response behaviors)	5
Functional life skills (toileting, dressing, shoe-tying)	2
Play skills (increase in appropriate toy play; increase in symbolic play)	4

Table 12. Summary of Surface Behavior Studies

Type of Study	No.	Evidence for Intervention	Evidence Against Intervention	Equivocal Results	Short-Term Gains	Long-Term Gains	Clinically Significant	Clinically Meaningful
Parent reports/narratives	7	7	0	0	7	7	0	7
Case study reports/single subjects	16	16	0	0	16	1	13	3
Research reviews	6	4	2	0	5	1	5	0
Multiple-baseline comparison/non-control group	38	35	1	2	36	7	35	11
Quasi-experimental (non-clinical trials)	10	6	0	1	6	6	10	4
Experimental design (clinical trials)	2	2	0	0	2	0	2	1

be in real life, outside of the intervention setting and the therapist's presence.) The clinically meaningful outcomes in these studies included the following: the ability to tie shoes independently, increased verbal and nonverbal communication in novel settings, and increased amount of spontaneous language at home and at school.

The majority of clinically meaningful information was seen in the more narrative parent reports.

Within this format, clinically meaningful information was cited when the narratives did not note just a skill acquisition or mastery but rather gave an example of a generalized use of the skill spontaneously in a nontreatment setting. Some examples in the parent accounts included a child with autism telling a peer in a preschool that he liked the dinosaur he made, and another telling about his day to a grandmother on the phone.

Forty-eight percent of the total studies reviewed were multiple-baseline studies. This study format is unique to the behavioral literature. As opposed to comparing group performances between treatment and control groups, these studies measure the progress of single subjects at various stages of treatment depending on the design of the study (e.g.,

alternating, pre-post, time-delay). Twenty-seven of these studies had no comparison groups of children (i.e., the child's earlier performance was the basis for comparison). Eleven of the studies used some type of comparison with other children. In these studies, rates of change (or lack of) are compared against other subjects individually (and sometimes averaged with larger numbers of subjects) to determine treatment effectiveness. For example, a decrease in self-abusive behavior prior to a behavioral intervention, during, and after the intervention would be compared against a youngster with self-abusive behaviors who was having a different type of intervention during this time period. These studies often involved only a few subjects at a time. Overall, 29% of the multiple-baseline studies had some clinically meaningful findings. These outcomes included increased initiation of interactions with peers in a classroom setting, increased use of gestures with verbal settings, and a reduction in inappropriate vocalizations. This format permits a look at the effectiveness of an individual strategy in a narrow context, but can not be statistically generalized to a larger sample/population of children with autistic spectrum disorders because of the small size of the subject group.

Throughout the 1970s, 1980s, and much of the 1990s, applied behavior analysis (ABA) techniques were touted as the intervention of choice for working with children to change behaviors. This approach was especially appealing to a family coping with a child with a worrisome behavior, such as head-banging, because the immediate need to stop the behavior obviously takes precedent over all other concerns.

Lovaas's seminal work between 1973 through 1987 studied an intensive application of behavioral approaches to children with autism. His 1987 study asserted that 47% of

his experimental group receiving intensive ABA treatment achieved normal intellectual and educational functioning, measured by normal IQ scores and first-grade performance in public schools (Lovaas, 1987). He referred to this group as "fully recovered." Five years later, McEachin, Smith, and Lovaas (1992) conducted a follow-up study of the experimental and control groups of children. The experimental group earned continued significantly higher scores in adaptive behavior measures, IQ tests, and on a personality inventory.

Later studies (Smith, Eikeseth, Klevstrand, & Lovaas, 1998) reported outcome data on children with intake IQs below 37, noting that none achieved normal functioning (defined by authors as $IQ > 85$), although some children did make gains. Low IQ was seen to be associated with poor prognosis for most children in this study.

Preliminary data on six children participating in one of the Lovaas replication sites (at that time, the Bancroft Young Autism Project) was published in the summer of 1996 and showed limited success. All of these children received 2 years of treatment beginning at an age between 24 and 42 months. Treatment group IQ scores rose from a mean of 49 to 57 (for 3 children), while the IQ scores for the alternative control treatment group dropped from a mean of 57 to 37 (for 3 children). Adaptive behavior scales in the social area raised from a mean of 8 months to 20 months for the treatment group, and 10 to 12 months for the alternative treatment group. After 2 years, the 3 children in the treatment group were placed in regular education classes with aides, while control group children continued in special education classes. However, the treatment group children were still evidencing severe cognitive and language problems, as indicated by the mean IQ score of 57. It is also important to point

out that mainstreaming with an aide may be helpful, but it is not a relevant indication of academic success for a child whose IQ is 57. It is not clear from these results what the individual IQ of each child was, and if one score skewed the average IQ score to be this low.

Other related outcome studies reviewed included the Anderson, Avery, DiPetro, Edwards, and Christian study (1987) at the May Institute in Massachusetts. This study, which did not use a comparison group, involved 114 children with autism receiving 15 to 25 hours per week of intensive behavioral teaching in their homes. Results showed increases: mental age and social age scores increased from range of 2 to 23 months, with language gains ranging from 3 to 18 months. Full language and cognitive and social functioning were generally not achieved. No children in the group were integrated full-time into regular education programs. The Murdoch Program study in Australia, involving 9 treatment and 5 comparison children (Birnbauer & Leach, 1993), also studied an intensive home ABA model at close to 19 hours a week of programming. Gains were seen after 2 years for half of the treatment group, but even children with the best outcome did not achieve the level of functioning the Lovaas study claimed. Similar results were seen in the Sheinkopf and Siegel (1998) home-based intervention study of 10 treatment and 11 comparison children. While the highest IQ score gain was seen for an experimental group, as well as a decrease in symptom severity, all of the experimental group still met the criteria for diagnosis of autistic spectrum disorder after a year of treatment.

School and center-based behavioral interventions were studied at the Princeton Child Development Institute, (Fenske, Zalenski, Hall, Krantz, & McLannahan, 1985). Results indicated 67% of children who enrolled before age 5 achieved some positive gains

compared to just 1 out of 9 children who enrolled after the age of 5. Harris, Handleman, Kristoof, Bass, and Gordon (1990) used ABA methods in both a segregated classroom for children with autism as well as an integrated model with typically developing peers. Children in this group were higher functioning and older than those seen in other studies. On post-testing with the Stanford-Binet, children with autism achieved IQ gains, but the scores of all the children with autism were still well below those of their typical peers on both pre- and post-tests. Other studies also examined ABA methodology within integrated group program settings.

Overall, other behavioral studies have not produced results consistent with the Lovaas claims. They have, however, demonstrated that various forms of behavioral intervention are associated with selective gains. Long-term gains in the major deficit areas of autism—the capacity for empathy, abstract thinking, and relating with intimacy and trust to others—has not been demonstrated in either of these studies or the Lovaas study.

Limitations of the Behavioral Approach

There are two major limitations of the behavioral approaches. One involves working with isolated behavior with relative underemphasis of the whole dynamic system that comprises human functioning. A second is a tendency by many proponents of behavioral approaches to insufficiently deal with numerous methodological limitations pointed out by colleagues over a number of years and, instead, to go beyond the available data in making statements about treatment efficacy.

The last 15 years have seen neurobiological and psychological research that clearly implicates biochemical and genetic influences, as well as neuropsychological processes, in

autistic behavior that are far more complex than the environmental variables tested in the early behavioral research (see Zimmerman & Gordon, Chapter 27; Minshew & Goldstein, Chapter 28; Bauman, Chapter 29, this volume). Recent behavioral scholars have attempted to account for the environmental aspects of isolated behaviors in an attempt to remediate this deficit (e.g., Carr & Durand, 1985; Carr et al., 1999). With increasing evidence of the biological and psychological characteristics of autism, the limitations of the behavioral research have emerged.

In general medicine, it has long been acknowledged that it is essential to consider the whole pattern; that is, the entire body system. For example, the side effects of treatment must be looked at when considering a course of treatment for an illness. A medication that is used to treat pneumonia should not also cause heart disease. Yet the ABA studies largely do not account for the increase or decrease in other constructs that are widely, if not universally, accepted as critical for human functioning. These include the capacity for intimacy, creativity, introspection, mood stability and regulation, attention, and relationships with others. Neuroimaging and other neurological assessments now indicate the corresponding physiological areas of the brain critical for these functions. Stopping head-banging is only treating a symptom of the disorder of autism; it is not addressing the multiple intricacies of neurological and emotional patterns and dysregulations that are part of the problem. By their very nature, in addressing skills in isolation, the behavioral research is too incomplete to care for the child as a whole. As such, their skill remediation needs to be viewed as one possible aspect of a broader approach. Furthermore, when behaviors are dealt with in isolation, the side effects of the treatment on other skills—including the ability for abstract

thought, creativity, trust and intimacy, relating to others with warmth and joy, and mood regulation—are not known or even accounted for, positively or negatively, in the majority of the behavioral literature. Responsible and ethical treatment approaches must acknowledge and measure these side effects, particularly when the client may not be able to provide self-reports of these internal states.

The variables designated as “progress” within the behavioral literature are much easier to measure than the previously discussed constructs, which are more complex. Recent research (Baron-Cohen, Tager-Flusberg, & Cohen, 1993; Minshew, 1997, 1999, in press), however, has substantiated the importance of using more complex, difficult-to-measure outcome variables, not only in the social-emotional realm but also in the cognitive one. Studies by these individuals show that, when matched for IQ scores with normal and retarded individuals, those with autism tend to show selective difficulties in the mental processes associated with higher-level abstract thinking and emotional and social capacities. These include the ability to make inferences, interpret information, generate new ideas or perspectives, and empathize with and understand the feelings and perspectives of others. This information was not known when the behaviorists began to study their outcomes with some of the behaviors of autism. Now that it is known, it is curious that most behavioral studies still do not attempt to measure these constructs—particularly since they are viewed as the benchmark characteristics of the disorder. Similarly, deficits in the ability to relate to others with intimacy and trust and engage in reciprocal, affective interactions (Baranek, 1999; Dawson & Galpert, 1990; Lewy & Dawson, 1992; Osterling & Dawson, 1994; Tanguay, Robertson, & Derrick, 1998; Tanguay, 1999) are benchmark characteristics

of the disorder (e.g., they are listed in DSM-IV), but are generally not sufficiently used in behavioral studies as outcome variables. There are a few notable exceptions in the behavioral research area that have begun to look at more complex social behavior, but still do not deal with some of the most important human capacities such as creative and abstract thought and a sense of self (Koegel, Koegel, Harrower, & Carter, 1999; Koegel, Koegel, Shoshan, & McNerny, 1999; Schreibman, 1996). These studies have creatively combined milieu-teaching procedures with behavioral methodology to focus on increasing motivation to produce generalized and spontaneous child initiations within a wide range of social situations. These researchers emphasize that treatment responsiveness varies greatly among children and that there is a need to study the child, family, and environment more closely to see how they interact with treatments. Schreibman (1996) has challenged the behavioral field to think “out of the box” of single target behaviors and focus on larger behavior aggregates that result in overall improvement in the quality of life for children with autism. She advocates striving for “social validation” of change that an outside observer could notice (i.e., a difference in the child with autism after an intervention time period that is above

and beyond a simple increase in skills or decrease in behavior).

ABA research also has been criticized from additional methodological and statistical vantage points, despite the large quantity of studies. For example, the New York State Guidelines for Evaluating Programs for autism only recommended ABA or behavioral methods based on its review of the available research at that time. Surprisingly, the majority of the studies surveyed in that document do not involve a true clinical trial procedure using random sampling and group assignment, let alone equivalent groups. The conclusions in that report, therefore, went significantly beyond what the data could support. An analysis of the quantitative characteristics of the 54 studies reviewed in this document, as well as 15 additional studies, is shown in Table 13.

Of the 71 studies reviewed, 76% were individual case studies or used groups that had fewer than 5 subjects. Random assignment to treatment groups, or even choosing a random sample, was not a part of these studies. If traditional research standards are used for reviewing these studies, these factors and the use of such small groups ultimately decrease their validity. The other studies cited focused on circumscribed behaviors, were not sufficiently long-term, and did not demonstrate long-term gains in the deficit

Table 13. Quantitative Characteristics of Surface Behavior Studies

Total Number of Subjects	No.	Use of Non-Treatment Control Groups	Use of Comparison Treatment Groups	Use of Equivalent Matched Groups	Random Assignment into Groups/Controls	Clearly Defined Representative Sample of Specific Child With Autism	Representative Sample of Full Autistic Spectrum
Single subject	20	0	0	0	0	0	0
1 to 4	34	4	0	0	0	4	0
5 to 10	8	2	1	0	0	1	0
10 to 20	6	1	3	0	0	1	0
20 +	3	3*	1	1	0	1	0

*In one study, crossover design of future treatment; group used as non-treatment; control group.

areas most relevant to autism; that is, the capacity for relating with intimacy and trust, engaging in reciprocal, affective interactions, being empathetic and understanding the feelings of others, and thinking creatively and abstractly.

However, it is Lovaas's research that is generally cited as the basis for funding ABA interventions for autistic spectrum disorders. His studies, however, evidence a number of methodological problems. The methodological issues around which Lovaas has been criticized center on three areas: bias in selection of subjects, inappropriate outcome measures, and an inadequate control group. These were later expanded in a series of criticisms by Gresham and MacMillan (1997, 1998) to also include concerns regarding treatment integrity as well as threats to internal and external validity. Gresham and MacMillan questioned whether the outcome data were related to the intensity of treatment rather than to any specific feature of the intervention itself.

Schopler and colleagues (1989) felt strongly that Lovaas's subjects were skewed toward relatively high-functioning children, and excluded children functioning not only in the profound, but also the mild to moderate ranges of cognitive deficits. Recent estimates suggest that at least 30% of autistic individuals have IQs within the mild to moderate range of mental retardation, 16% have scores in the severe mental retardation range, and half have scores in the average range, with only 5% having scores in the above-average range (Rosenblatt, 1994). The emphasis in autism/pervasive developmental disorder literature on obtaining given IQ scores as an entry criterion for various treatment studies thus makes generalizability of results to the wider range and truer representation of autistic children limited.

Lovaas's stated exclusion criteria only allowed children into the study who had or were in the processes of learning imitational

communication skills. These children, therefore, had higher cognitive abilities than most typical children with autism. Most typical children with autism are not able to imitate when they first enter an intervention program. Most of the Lovaas intervention group, at the beginning, evidenced developmental capacities in the 14- to 18-month-old level of functional abilities, whereas the typical child presenting with autism often evidences developmental capacities at the 6- to 8-month-old level of functioning. In addition, children who were 40 to 46 months old were only admitted into the study if they demonstrated echolalia. Echolalia is commonly perceived as a characteristic of young children with autism who tend to have a better prognosis. Critics have stated that the study selected a group of children with relatively good prognoses and thus was not truly representative of autistic children as a whole (Schopler et al., 1989).

The issue of inadequate control groups has also been discussed. There was no random assignment to a treatment and control group, and families likely knew which group they were in by the intensity of the treatment program. Attempts at making the intensive treatment and control group comparable were fraught with a number of difficulties. Children who applied to enter the study earliest were assigned to the treatment group because the largest number of student trainers was available at that time. While other children did enter the treatment group later, it was only when the correct number of student trainers was available. Thus, initially, the control group consisted of children who met the criteria, but for whom no therapists could be found. The control group received a much less intense form of the treatment (10 hours per week). As all of the families in the intensive intervention group received and engaged in a 40- hour per week program, selection

could not possibly be random in regards to the many personal and family variables that could restrict a family's abilities to participate in such an intense program. While Lovaas claims SES means were almost identical to the national average, the issues here are probably not the range or mean SES but the lack of information gauging the precise numbers of families in each SES category and descriptions of their life circumstances. The life circumstances issue became cogent because Lovaas had previously stated in his 1978 study that parents with restrictions of divorce, maternal employment, and personal and financial problems were counseled to other treatment and placements. Schopler (1989) suggested that Lovaas's own inconsistencies between the reports on his work in 1978 and 1987 appeared to more post-hoc analysis in nature than a true randomly controlled clinical trial.

Lovaas's claims for "recovery" of 47% of his experimental group were based on the children's placement in a regular education classroom and on the result of IQ measures (pre- and post-treatment) (Lovaas et al., 1987). The use of IQ as a measure of progress, let alone "recovery," from autism is seriously problematic.

The lack of validity of using IQ scores with children with autism has been noted in several research studies (Lincoln, Allen, & Kilman, 1995; Lord & Schopler, 1989; Lord, Schopler, & Reveck, 1982). These studies indicated that, while IQ scores for a speaking autistic child were likely to remain in the same range, the converse for a nonverbal child was not true. In fact, in one study, 50% of the nonverbal autistic 3-year-olds showed increases of more than 30 points when reassessed 5 to 8 years later.

Most important, as pointed out earlier, low IQ is not the distinguishing characteristic of autism and, while gains in IQ are welcome,

they do not indicate improvement in many of the most critical autistic patterns. Individuals with autism can have high IQ scores and have severe deficits in abstract thinking (e.g., making inferences), emotional regulation, social behavior, the capacity for empathy, and understanding feelings (Minschew, 1997; Baron-Cohen, Tager-Flusberg, & Cohen, 1993). When matched for IQ scores with nonautistic individuals, those with autism evidence these specific deficits in abstract thinking, empathy, social interaction, and emotional regulation. Therefore, it is these characteristics that are the hallmark of autism that must be improved in a successful intervention program. Also, IQ scores measure what has been learned as opposed to how easily or the manner in which something was learned. It does not measure the dynamic cognitive processes of how information is processed.

Lincoln et al. (1995) and Schriebman (1981) hold that because children with autism frequently lack the skills necessary to function adaptively in certain contexts, it might actually be more valid to utilize alternative assessment techniques. Such techniques could incorporate the ability to gain from instruction—that is, the before and after abilities/skills that are associated with varying tasks that have been taught, rehearsed, and practiced.

It can also be hypothesized that part of the failure of children with autism to function adaptively across contexts is a failure to measure and design interventions that focus on the key characteristics of autism noted in more recent research, such as empathy, reciprocal interactions, and abstract thinking (Minschew, 1997; Baron-Cohen, Tager, Flusberg, & Cohen, 1993). Recovery from autism for a child with significant cognitive deficits might mean limited degrees of IQ increases, but dramatic improvement in social-interaction skills, communicative functions, play levels, and

range of emotions, as well as a decrease in aberrant behavioral mannerisms. Schriebman (1981) stresses that these types of changes in functioning must also be “socially valid;” that is, an outside observer could look at such children after an intervention and determine changes in the above areas.

Discussion

The “Surface Behavior” literature (without focusing on underlying processing deficits that may or may not contribute to the behavior) is an important area because of the degree and quantity of aberrant and maladaptive behaviors that can be seen in children with autistic spectrum disorders. Indeed, it is the interventions for these behaviors that provided the earliest assistance to families long before autism began to be understood better in terms of its range and underlying processing differences.

Contrary to the conclusion of the New York State Health Department, ABA discrete trial and behavioral methodologies do not have definitive scientific support and, in fact, face the same methodological challenges and weaknesses seen in the other functional deficit areas.

The majority of the behavioral studies reviewed have very small numbers of subjects, even though a lot of these studies (71) look at discrete behaviors in isolation and do not employ a clinical trial methodology. The eight larger-scale outcome studies (still relatively small groups with a size of 10 to 20) reviewed also did not use a true clinical trial procedure that included random assignment and grouping. More important, none of these studies included clinically meaningful data. This is because the larger-scale studies focused on such outcome variables as IQ scores and placement in regular education

and not on critical abstract thinking, emotional, and social skills.

The existing research base supports behavioral interventions for discrete behaviors in the short term without sufficient attention to “side effects,” long-term outcomes, or the most important human capacities that are compromised in autism. These include such constructs as relating with others, reciprocal affective interactions, abstract and creative thinking, empathy and understanding of the feelings of others.

At the same time, however, the base of clinically meaningful information seen in the parent narratives should not be ignored. Interestingly, the information parents provided as meaningful and important in their children did not always dovetail with the goals and outcomes espoused by the behavioral studies. Thus, it is difficult to determine if these parent reports reflect change attributed to the behavioral intervention itself or to other variables, such as the relationship between therapist and child, occurring during the intervention (e.g., Catherine Maurice’s poignant account of the time her daughter first pointed and looked back at her to show her a water fountain in the park). Practitioners should look closely at the constructs parents deemed to be meaningful in their accounts and consider quantifying and documenting this information more systematically to set new targets for behavior interventions.

In addition, it would be helpful at some point to obtain personal accounts from individuals who underwent intensive ABA programs and are now becoming young adults. As this information led to much clinically meaningful information for the sensory reactivity interventions (which were weak in clinically significant information), it would be interesting to see if the same applies to the surface behavior interventions (which are relatively strong in clinically significant information,

but weak in clinically meaningful data). At the present time, the literature supports the consideration of behavioral interventions for selected and isolated behaviors for children who may require them as one part of a comprehensive program.

OVERALL CONCLUSIONS

As discussed earlier, this review characterized the studies along the dimensions of clinically significant and clinically meaningful. It also looked at studies that used a clinical trial methodology involving random assignments to a control group and appropriate objectivity in the evaluation process (e.g., individuals and evaluators not knowing which group they are assigned to), as well as other types of less definitive research designs. The strongest research support and the only that could be considered definitive would be a study that showed both clinically significant and clinically meaningful findings emerging from a clinical trial-like design. Using this standard to review the research analyses in the prior sections suggests that only a few functional developmental deficits have definitive research support for interventions. This includes speech and language interventions, relationship-based interventions, and circumscribed motor planning interventions. Other areas, including behavioral interventions (ABA discrete trials), do not have definitive research support, although there is support from less vigorous designs.

Therefore, if we only recommended interventions that have definitive research support behind them, we would advocate programs focused on speech and language, relationships—including child-caregiver and peer interactions—and selected sequencing and motor capacities. Focusing on these areas, while not comprehensive, is actually not a bad beginning and would constitute a

more comprehensive approach than many children are presently receiving. Many children, for example, receive very little work on child-caregiver interactions and insufficient work on sequencing and motor planning or motor-based interventions.

There is, however, another criterion that needs to be applied to what is recommended for a comprehensive intervention program. It relates to the importance of a particular problem area; that is, the degree to which the problem itself requires the best approach available. In working with complex problems in the real world, clinicians do not have the luxury of ignoring critical problems, even in the absence of definitive research support for interventions for those problems. There are many medical problems, for example, which require the best treatment approaches available even though definitive evidence of efficacy for a treatment is lacking. In fact, only a small percentage of general medical practice is based on definitive, clinical trial supported treatments.

As a general rule, the more significant the problem area, the more compelling the case can be made for using the best interventions available as more research is being conducted. Often, these determinations, as indicated in Chapters 1 through 3 of this volume, are made by expert opinion, combining clinical experience with available research.

Therefore, a number of the functional developmental areas described in the research review that have some degree of research support behind them, including systematic case studies and quasi-experimental designs, require interventions based on this combination of clinical experience and available research. The areas of sensory reactivity and visual-spatial processing in particular are critically important and, therefore, require the best approaches available. As indicated, behavioral approaches are also in this category. Such approaches can be an important part

of an overall program for children with severe motor planning problems who have difficulty executing initial motor sequences required in play and speech, including basic imitative skills. Using a behavioral approach to teach a child how to stack a three-block building, or clap hands, or sit down briefly in a small group can provide a foundation for skill competence that can then be expanded into relationship-based play and verbal and nonverbal communication with the interventions noted in the other functional developmental areas. Interestingly, Lovaas did not specifically mention this type of problem in his original study, and there are indications that children who appear lower functioning on standardized test scores due to these types of deficits were omitted from the study. There is not a great deal of efficacy data in the behavioral literature on this topic. Nonetheless, clinical experience suggests that very structured behavioral approaches, as well as structured developmental approaches (see McGee, Morrier, & Daly, 1999; Prizant & Rubin, 1999; Miller & Eller-Miller, Chapter 19, this volume), may be a helpful component of a program for this particular challenge.

Comprehensive, Functional Developmental Approach Versus More Circumscribed Approaches

When we combine analysis of available intervention research with research on the identification of the areas of functioning that require intervention, we observe the importance of a comprehensive approach to assessment and intervention that works with the core areas where there are functional developmental deficits (e.g., language). The alternative approach is to work only with circumscribed aspects of this larger pattern of problems, such as selected surface behaviors or selected cognitive skills (as is done in

many programs). There is, however, compelling evidence for the usefulness of interventions for multiple functional areas and evidence for the existence of other functional deficits that are part of the pattern of disordered functioning. It is, therefore, untenable to support a more circumscribed approach. This is especially true given the fact that research support for the more circumscribed approaches, such as those that focus on surface behaviors or circumscribed cognitive skills, do not have definitive, clinical trial research support behind them. In other words, it is good practice both from a humane point of view and from an analysis of current research and clinical experience to use a comprehensive developmental approach.

The support for a comprehensive approach includes interventions for the major areas of motor and sensory processing, including auditory processing and language, sensory modulation, and visual-spatial thinking, as well as motor planning and executive functioning. It also includes interventions for relationships, including child-caregiver and peer interactions and the functional developmental capacities that derive from relationships, including shared attention, engagement, affective and social reciprocity, social problem solving, the functional and creative use of ideas and symbolic play, and logical and abstract thought (including theory of mind).

Related to the comprehensive versus circumscribed approach debate is the issue of what school systems are willing to provide and what third-party reimbursers are willing to cover. Interestingly, as this research review has shown, there are many functional areas that have traditionally been supported by both educational systems and medical care for a variety of developmental disorders, even though definitive research evidence for efficacy is not yet available. A good example would be physical therapy for a child attempting to

recover from a cerebral-vascular accident (e.g., post-surgery for an aneurysm). When it comes to autistic spectrum disorders, however, school systems and medical insurers are often reluctant to cover the full range of services required to work with the identified functional deficits. These parties will often cite lack of definitive efficacy studies. This selective use of such a rationale for one disorder and not other disorders or medical conditions constitutes a real bias against certain

types of developmental problems. In light of this bias, and in light of the lack of definitive research support for more circumscribed approaches, it is especially important to employ a model for assessment and intervention that can delineate all the relevant areas of functional developmental deficits. Such a model facilitates both comprehensive, developmentally based assessment and intervention programs. ■

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Appendix

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AFFECT AND SOCIAL/EMOTIONAL CAPACITIES

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CONCLUSION

The foregoing chapters have shown that many children and families with special needs evidence a number of specific functional developmental deficits as well as areas of strength. Even within syndromes such as autism, each child tends to evidence his or her own unique profile. It was also shown that because each child and family evidences their own unique pattern, it is essential to employ a functional developmental approach that can tailor the assessment and intervention to a specific child and family, rather than fit the child into a standard assessment and treatment program. The chapters discussed how to observe, assess, and work with each area of functioning, both at home and at school, providing the infrastructure for a functional developmental approach (i.e., the Developmental, Individual Differences, Relationship-based [DIR] model).

Some functional developmental capacities, such as speech and language functioning and aspects of social and relationship skills, were seen to involve a great deal of research as well as clinical wisdom. Other capacities, such as visual-spatial thinking, were seen to be very important to work with, but were informed predominantly by clinical experience. The discussion showed that meeting the important goal of individualizing the approach to each child's and family's unique profile goes significantly beyond available research and requires a reliance on both research and clinical experience from each of

the disciplines that work with children and families with special needs.

Importantly, both research and clinical experience were shown to point to the importance of working with all the functional developmental capacities, rather than only with surface behaviors or isolated cognitive skills. Such a comprehensive approach was observed to include work with such processing capacities as auditory processing and language, visual-spatial processing, motor planning and sequencing, and sensory modulation. It also included the capacities for shared attention; relating; engaging in basic problem-solving; reciprocal, affective, and gestural interactions; using ideas creatively, meaningfully, and logically; and reaching high levels of abstract, inferential, and empathetic thinking.

Systematizing the vast amount of clinical knowledge required to work with all the functional developmental capacities at the level of each child's and family's unique profile, as the foregoing chapters demonstrate, must, by necessity, be an ongoing, dynamic process. By its nature, such a process needs to involve all those who work with children and their families in sharing their observations and insights to build a growing body of clinical knowledge that can guide what to assess, how to intervene, and where to direct research. ■

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The Interdisciplinary Council on Developmental and Learning Disorders (ICDL) was founded by professionals from a wide range of disciplines who work with children with developmental and learning disorders and their families. Its goal is to integrate knowledge from the different disciplines and improve the prevention, assessment, diagnosis, and treatment of these disorders. The Council works nationally, regionally, and locally to promote dialogue, improve clinical assessments and interventions, identify new directions for research, develop guidelines for clinical practice, and create opportunities for training, supervision, and communication. Among its activities are the annual ICDL 3-day scientific meeting, regional interdisciplinary councils and networks throughout the U.S., training and certification opportunities for clinicians, and the ICDL Parent Group. The Council also maintains an interdisciplinary library of a unique series of training video tapes, and publishes the *ICDL Newsletter*, the *ICDL Journal of Developmental and Learning Disorders*, and the *ICDL Clinical Practice Guidelines*.

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