Research & Practice for Persons with Severe Disabilities
2006, Vol. 31, No. 3, 203–214

Teaching Augmentative and Alternative Communication to Students With Severe Disabilities: A Review of Intervention Research 1997–2003

Martha E. Snell
University of Virginia
Lih-Yuan Chen
National Chiayi University
Kathryn Hoover
Radford University

This paper provides results of a descriptive analysis of peer-reviewed, single subject design, intervention research on augmentative and alternative communication (AAC) for individuals with severe disabilities, from birth to 21 years, published in English between 1997 and 2003. A database of 40 studies was found that met seven specified criteria. The descriptive analysis showed that a variety of antecedent, both adult and child directed, and consequent intervention components, typically used in combination, were effective in improving communication. Most research contexts were rated as less natural. Parents, teachers, and siblings or peers were infrequently involved in intervention. When problem behavior and communication were targeted, functional communication training (FCT) was the method of choice. Treatment integrity was infrequently measured. When measured, generalization and maintenance of treatment effects were good but were reported less than half of the time. Implications for interventionists and researchers are discussed.

DESCRIPTORS: AAC, communication, naturalistic interventions

Most scholars today agree that "with appropriate instruction and support individuals with severe disabilities can learn to communicate effectively regardless of the nature and/or cause of their underlying impairments" by using either idiosyncratic or symbolic forms (National Joint Committee for the Communication Needs of Persons with Severe Disabilities, 2002a, p. 148, 2002b). Still, for many in this group of learners, research consistently documents extensive limitations in their receptive and expressive language, difficulty initiating and responding to the initiations of others, lack of sustained social interaction, and a tendency to respond more to adults than to peers (Jackson et al., 2003; Yoder & Warren, 2004). Their communication serves a few basic functions (e.g., request, reject, social interaction) and involves an organized, but unconventional, repertoire of gestures, vocalizations, visual gaze, and facial expressions (Seigel & Cress, 2002; Snell, 2002). Prelinguistic repertoires including problem behavior are viewed as alternative ways to communicate (Rowland & Schweigert, 2000). When aggressive and disruptive behaviors become the forms used to communicate, these behaviors can be replaced with appropriate communication forms (Durand, 1999).

Recent reviews of intervention research with persons with autism or multiple and cognitive disabilities on communication and social interaction support the position that these learners can benefit from interventions directed toward these skills (Goldstein, 2002; Hwang & Hughes, 2000a; Lancioni, O'Reilly, & Basili, 2001; McConnell, 2002; Mirenda, 2001; Reichle, 1997; Romski & Sevcik, 1997). Individuals with severe disabilities can learn to establish joint attention and to request, reject, inform, greet, and socially interact through traditional word forms, augmentative and alternative communication (AAC; such as conventional pointing, signing, showing pictures, or operating a speaking communication device), or both (Reichle, Halle, & Drasgow, 1998; Wilcox & Shannon, 1998). Finally, some individuals with extensive communication limitations will acquire alternative forms such as picture communication books to augment their difficult-to-understand speech (Hughes et al., 2000).

Martha E. Snell is with the Curry School of Education, University of Virginia; Lih-Yuan Chen is with the Department of Special Education, National Chiayi University, Taiwan; Kathryn Hoover is with the School of Teacher Education and Leadership, Radford University.

Address all correspondence and reprint requests to Martha E. Snell, Curry School of Education, University of Virginia, P.O. Box 400273, Charlottesville, VA 22904-4273. Email: Snell@virginia.edu

These reviews also support other conclusions: (a) inexpensive technology (e.g., microswitches connected to speech output) can serve as a means for communicating; (b) identification of the learner's preferred activities and functional motivations contributes to intervention effects; (c) family preference for AAC systems and symbols may be important to outcomes; (d) "inclusion is a necessary, but not sufficient, condition for social interaction interventions for young children with autism" (McConnell, 2002, p. 367) and appears to contribute to the effects of communication interventions; and (e) long-term maintenance of communication and social interaction skills and their generalization from school to home and community continue to be outcomes less frequently documented by research.

Despite the richness of the early communication research base with individuals with disabilities, there are more options for intervention strategies suited to learners exhibiting symbolic communication than there are for those in the prelinguistic stage of communication (Romski, Sevcik, Hyatt, & Cheslock, 2002). Typically, individuals with severe disabilities with little or no symbolic communication are omitted from group design research addressing communication intervention because of their small numbers and heterogeneity. Yet, individuals with severe disabilities are the most likely to benefit from effective AAC interventions for several reasons: they frequently exhibit problem behavior and communication breakdown due to ineffective expressive skills and they rely on nonsymbolic forms with limited or ineffective symbolic and spoken vocabulary. It is important that practitioners and care providers have an up-to-date understanding of effective intervention methods for teaching these learners to communicate functionally in their everyday lives.

This review examined 7 years of research starting in 1997 and ending in 2003 on AAC communication interventions that were applied to persons with severe disabilities from birth to 21 years. We adopted a broad definition of AAC: "An area of clinical practice that attempts to compensate (either temporarily or permanently) for the impairment and disability patterns of individuals with severe expressive communication disorders…" (American Speech-Language-Hearing Association, 1989, p. 107). Our focus was on identifying evidence-based interventions that enable individuals with severe disabilities from birth to 21 years to communicate with others using AAC alone or with words. Because of our interest in beginning communicators, we excluded from this review research addressing only a spoken mode of communication and included research addressing nonsymbolic (e.g., nonconventional gestures, physical movement) and iconic AAC modes (e.g., objects, line drawings). We defined severe disabilities to include (a) severe to profound mental retardation alone or in combination with additional disabilities such as cerebral palsy or visual or hearing limitations, (b) autism (but not Asperger syndrome), and (c) young children who demonstrate extensive developmental delays but lack a specific diagnostic or disability label. Our intent was to reliably analyze the characteristics of this database to gain an understanding of effective interventions and needed research directions.

Method

Selection of the Research

We started the review by identifying the criteria for selecting research to include in the database. These criteria were consistent with those used by Dunlap, Clarke, and Steiner (1999) and Snell, Voorhees, and Chen (2005) but were modified to include intervention addressing prelinguistic or AAC communication with others. Research was included if

1. It was published in peer-refereed journal in English between 1997 and 2003;
2. Its participant(s) was aged 21 years or younger;
3. Its participant(s) had a severe disability, defined as having one or more of the following: (a) diagnosis of moderate to profound mental retardation, (b) diagnosis of autism or PDD, but not Asperger syndrome, or (c) if under the age of 9 years, a label of developmental disabilities described as being significant and/or accompanied by cognitive limitations with or without additional disabilities;
4. Target communication forms were either prelinguistic or symbolic AAC expressive responses (if the target responses were limited to words or to receptive skills, the study was excluded);
5. A single subject experimental research design was used with one or more participant (case studies and AB designs were excluded, as were group designs); individual student data were graphically displayed and reliability estimates for the dependent variables were reported and acceptable;
6. The independent variable was educational, involving a teaching intervention; and
7. The dependent variable(s) included interactive communication responses that were nonspoken (prelinguistic or symbolic AAC); other responses (e.g., eye contact, receptive skills, reduction of problem behavior, speaking) also may have been measured.

The following search procedure was used to locate research articles for this review. First, an electronic search was conducted of all pertinent journals using ERIC and PsycINFO covering the years 1990 to 2003. Combinations of keywords ("communication skills" and "communication training" with "autism," "mental retardation," "severe disabilities," "augmentative and alternative communication," and "case study") were used in this electronic search. Applying the search parameters of journal articles in the English language between 1990 and 2003, a total of 936 hits resulted from

these keyword combinations, not counting repetitions. This search revealed several comprehensive reviews of AAC, communication skills, and communication intervention for this population covering the period prior up to 1997 and described previously; for this reason, we decided to limit our search period to the most recent 7 years. Using the same search procedure described but limiting it to the years 1997 to 2003 resulted in 290 hits. Second, we read each article abstract from 1997 to 2003 to determine if there was any information that would exclude it from our criteria; if not, the article was read in full to determine if it met the seven criteria. Third, we conducted an ancestral search (Cooper, 1989) of reference lists from a series of literature reviews on communication, AAC, and positive behavior support (e.g., Goldstein, 2002; Lancioni et al., 2001; Mirenda, 2001; Snell et al., 2005) and identified potential research articles. Next, we hand searched the 18 journals that had yielded potential research articles. Studies identified in these searches that met our criteria were added to our database. Each level of search involved scanning any potentially appropriate article to determine if it met the seven criteria for inclusion in the database.

Selection Reliability

To check our interrater agreement on the seven criteria, we compared our independent ratings on 20 articles resulting from our initial search on a point-by-point basis and calculated interrater agreement using the following formula: agreements / agreements + disagreements × 100. These comparisons yielded 99% agreement. Further, we agreed that 10 articles were to be included in the database and 10 excluded. The remainder of our search for research to include in the database was done without comparison. A total of 40 studies in 11 journals were found that met these criteria (Table 1). (Research studies in the database are included in the Reference List and marked by asterisks).

AAC Research Evaluation Instrument

The AAC research evaluation instrument used to code studies in the data base was organized into four categories with a total of 166 codes: (a) general (49 codes), (b) functional assessment for studies that addressed problem behavior and communication (47 codes), (c) reinforcer assessment (5 codes), and (d) intervention (65 codes).[1,2] This research evaluation instrument was based in part on the work of Dunlap et al. (1999) and Snell et al. (2005). Because our focus was on research addressing prelinguistic and symbolic AAC communication interventions with students having severe disabilities, we added the category on reinforcer assessment and included additional items in two categories (general and intervention) to reflect dependent and independent variables relevant to these communication modes. The general category was the most broad in that codes were included that addressed age, gender, number of participants, diagnosis, research design, dependent measures, and interrater reliability.

Table 1
Source of Reviewed Studies

Journal title	*n*	%
Augmentative and Alternative Communication	5	12.5
Focus on Autism and Other Developmental Disabilities	4	10.0
Journal of Applied Behavior Analysis	14	35.0
Journal of Autism and Developmental Disabilities	4	10.0
Research and Practice for Persons with Severe Disabilities	4	10.0
Journal of Behavioral Education	1	2.5
Journal of Developmental and Physical Disabilities	1	2.5
Journal of Early Intervention	2	5.0
Journal of Positive Behavior Intervention	3	7.5
Journal of Speech, Language, and Hearing Research	1	2.5
Research and Intervention in Developmental Disabilities	1	2.5
Total	40	100.0

Coding Reliability and Analysis

Half of the database of 40 studies (20 studies) addressed problem behavior and intervened with communication. Five from this group were randomly selected to assess interrater agreement on coding. Of the remaining 20 studies in the database that did not focus on problem behavior, 12 studies were randomly selected from this group for interrater agreement. Thus, interrater agreement on coding was based on a total of 17 studies (42% of the total) randomly selected from the database of 40 studies. Researchers independently coded the articles and compared each one on a point-by-point basis; interrater agreement was calculated using the formula agreements / agreements + disagreements × 100. Agreements of 92% were obtained for both groups (those with and without a focus on problem behavior) with ranges of 88–95% and 83–98%, respectively. All cases of disagreement were compared to the original study and discussed until resolved, and the correct codes identified. Codes for each study were entered into a Microsoft Office Access form designed by the researchers; descriptive statistics across coding categories were obtained with SPSS 12.0 for Windows.

Results

With one exception, all results are reported as percentages calculated on the total database of 40 studies. The exceptions are those percentages reported on studies addressing problem behavior, which were calculated on a total database of 20 studies.

[1] The list of research studies included in the database can be obtained from the senior author.

[2] A copy of the *Coding Guide for the AAC Research Evaluation Instrument* and the *Coding Sheet for the AAC Research Evaluation Instrument* can be obtained from the senior author.

Participants

In the database of 40 studies, 93 individuals met the age and disability criteria. The participants were primarily preschool/elementary school aged and male, with a majority having autism or severe disabilities. The percentage of studies with one or more individuals between ages 0 and 5 was 50%, ages 6–11 (52.5%), 12–17 (25%), and 18–21 (5%), whereas 92.5% of the research had one or more male participants and 42.5% had one or more female participants. The percentage of studies with one or more participants identified as having autism was 65%, severe disabilities (severe-profound mental retardation with or without other disabilities) 50%, moderate mental retardation 17.5%, developmental delay 17.5%, sensory impairments 15%, attention disorders 5%, emotional disorders 2.5%, and traumatic brain injury 2.5%.

Dependent Measures

By selection, all studies measured participants' AAC communication. Specifically, simple aided/iconic forms (e.g., objects, pictures, photographs, communication books) were measured in 47.7% of the database, unaided symbolic gestural communication (e.g., conventional gestures, manual signs) were measured in 45%, prelinguistic forms (e.g., looking at or reaching for an object, stiffening of the muscles, vocalizations, leading another) were measured in 36.5%, and device-aided/iconic symbolic forms on speaking devices were measured in 35%. Unaided spoken communication (speech/words) was also measured in 40% of the studies; however, studies that were selected for this review had an instructional focus on AAC or AAC plus words, but not words alone. The requesting function was addressed in 87.5% of the database, the function of engaging another in social interaction (e.g., requesting social routine, greeting, calling) was addressed in 37.5%, and the function of establishing joint attention (e.g., directing another's attention to an object, event, or topic; commenting) was addressed in 30% of the database. Although the majority of research assessed interactions with adult partners (90%), peer/sibling interaction was measured in 17.5% of the database. Dependent measures addressed spontaneous, self-initiated communication in 82.5% of the studies, whereas communication elicited in response to a partner was measured in 50% of the research, and imitative communication (in response to a partner model) was measured in 5% of the research. Additional student-dependent variables addressed by this database included disruptive behavior (35%), destructive behavior (32.5%), skills (social, academic, etc.; 22.5%), eye contact (7.5%), and engagement (5%). Adult behavior (e.g., supporting the student's target behavior by interacting, reinforcing replacement behavior) was measured in 20% of the research, whereas peer/sibling behavior (e.g., interacting with student) was measured in 10% of the research. Finally, for all research in the database, interrater agreement means on these dependent measures were within acceptable ranges.

Functional Assessment and Analysis

Twenty of the 40 studies addressed communication intervention as a means for reducing problem behavior. (Percentages reported in this section are calculated on this total of 20 studies.) When *just* these studies were examined, functional analyses were conducted in 60% of the studies, primarily by manipulating the consequences (65%) in a multi-element design (70%). In 20% of the studies, functional behavioral assessments were conducted with interviews, rating scales, or other means to gather data and hypothesize function. Ten percent of these studies used a combination of functional analysis and assessment, whereas 30% (6) of the research did not use any behavioral assessment.

Behavior assessments took place in inpatient/hospital settings (30%), special education classrooms (15%), empty classrooms (15%), homes (5%), outpatient clinics (10%), and general education classrooms (5%). Assessments were conducted by the experimenter alone (80%) or in combination with family members (20%), special education teachers (10%), or paraprofessionals (5%). Of these 20 studies, assessments were conducted in typical settings (not designed for special populations) 10% of the time, in a typical social context (among nondisabled peers) 10% of the time, and using routinely scheduled activities 10% of the time. Functions identified for the problem behaviors were attention (55%), tangible (40%), escape (30%), and sensory (15%).

Reinforcer Assessment

In 45% of the total database (n = 40), reinforcer assessments were conducted for participants before intervention. When specified, assessment procedures involved interview or simple observation (20%) and/or a systematic assessment method (e.g., forced choice, free operant) (35%). In 10% of the database, reinforcer assessments were repeated to update the participant's preferences.

Planning and Implementation of Intervention Agents and Settings

Intervention was planned and implemented by experimenters or research assistants/therapists in all 40 studies, with assistance given by special education teachers (37.5%), paraprofessionals (20%), parents (15%), peers (15%), related service providers (10%, e.g., speech and language pathologist), and general education teachers (7.5%). Intervention was conducted in one or several settings with the special education classroom used in 47.5% of the research, in-patient settings and the general education classroom each used 22.5%, the home used 20%, instructional school settings beyond the classroom (e.g., cafeteria, library, recess) used 12.5%, empty classrooms used 12.5%, the community

Table 2
Percentage of Database Using Antecedent Communication Strategies

Method name	Description	Number	Percent
Prompts correct response	Partner uses verbal, gestural, model, physical prompts to promote responding	38	95
Proximity partner, materials, AAC	Partner arranges self, relevant materials, or communication aids within reach of student	36	90
Uses multiple stimuli	Partner teaches across a range of cues, materials, settings, people	27	67.5
Enhances motivation	Partner follows student's lead, shares control with student, uses turn-taking in play routine	23	57.5
Uses embedding	Partner embeds instruction in ongoing, natural, routine activities	20	50
Enriches environment	Partner uses preferred items and activity choices or gives attention on a noncontingent basis	19	47.5
Creating opportunities or temptations to respond	Partner presents part of task, some but not all needed materials, small portion, or items out of reach, or delays assistance or blocks access; then pauses while watching student	18	45
Instructor request	Partner gives a request to the student that is not a prompt	15	37.5
Peer/sibling mediated	Partner involves peers/siblings as natural or trained partners to interact with or prompt student	7	17.5
Obtains attention	Partner gets student's attention before task presentation	2	5
Intersperses maintenance with acquisition	Partner intermixes requests for learned responses with requests for new responses	1	2.5

Note: Total $n = 40$.

used 7.5%, and outpatient clinics used 5%. In more than half of the database (55%), intervention was conducted using routinely scheduled activities, but intervention was less frequently conducted in typical settings (not designed for special populations; 37.5%) and in typical social contexts (among nondisabled peers; 30%).

Antecedent Strategies

Frequently used antecedent strategies (Table 2) included prompting responses (95%), using proximity of partner or materials (90%), teaching across multiple stimuli (67.5%), enhancing student motivation (57.5%), embedding instruction in ongoing, natural, routine activities (50%), enriching the environment (47.5%), creating opportunities or temptations to respond (45%), and using instructor requests (37.5%). Less frequently used strategies included mediation by peer/sibling (17.5%), obtaining attention by a peer, and interspersing maintenance with acquisition requests. When prompts were used, 37.5% of the research identified those as being a system of prompts. A system of least prompts was used alone in eight studies or in combination with other prompt methods in three studies; time delay was applied alone in one study and in combination with other prompt strategies in four studies; and graduated guidance or other physical prompts were used in two studies.

Consequence Strategies

As shown in Table 3, of the eight consequence intervention strategies coded three were applied frequently in these 40 studies: the use of specific reinforcers (natural consequence reinforcers) (97.5%), contingent reinforcement (95%), and nonpunitive error correction (52.5%). Of the remaining five strategies, the presentation of a choice of preferred items/activities was applied 15% of the time, whereas four strategies were applied less often (reinforces approximations, and uses contingent imitation, artificial reinforcers, and punishment for errors).

Table 3
Percentage of Database Using Consequent Teaching Strategies

Method name	Description	Number	Percent
Specific reinforcers	Partner provides reinforcers with a specific relationship to the desired behavior (e.g., responds to communicative intent, fulfills request, plays with when approached)	39	97.5
Contingent reinforcement	Partner gives reinforcement contingent on target behavior	38	95
Nonpunitive error correction	Partner provides a prompt such as a model or repeats trial with assistance	21	52.5
Choice of preferred items/activities	Partner presents a choice of preferred items/activities as reinforcement	6	15
Reinforcement of all approximations	Partner reinforces any goal-directed attempt to respond to the request, instruction, or opportunity	3	7.5
Contingent imitation	Partner contingently imitates student's communication or turn taking in play routine	2	5
Artificial reinforcement	Partner uses artificial reinforcer, not a natural consequence (tangible, activity not related to communication)	2	5
Punishment for errors	Partner presents punishment for errors (time out, reprimand, repeating the request with mandates)	0	0

Note: Total $n = 40$.

Problem Behavior Strategies

Half of the database ($n = 20$) addressed the instruction of communication skills as a means to replace the problem behavior. Of these communication methods, 92% cited functional communication training (FCT; Carr & Durand, 1985) and one used Picture Exchange Communication System (Bondy & Frost, 1994). Only one study used punitive consequences in the form of reprimands contingent on the problem behavior (Piazza et al., 1999).

Use of Multiple Intervention Strategies

When all studies were considered ($n = 40$), we found repeated combinations of antecedent and consequent strategies. Of the 12 antecedent strategies that were coded, the mean number of strategies used in a given study was 5.53 with a range of 1 to 9. In five studies, the antecedent strategies of proximity, enhancing motivation by following child's lead, and prompts were combined; other combinations were novel across the 12 antecedent strategies that were coded. Of the eight consequence strategies that were coded, the mean number of strategies applied in a given study was 3 with a range of 1 to 4. In 26 studies, the consequence strategies of contingent reinforcement and specific reinforcers were combined, whereas 13 of these studies added a third strategy of using nonpunitive error correction. When we examined the five studies with the most frequent combination of antecedents (proximity, enhance motivation, prompts), we also found that they all used specific reinforcers.

When problem behavior and communication were the focus ($n = 20$), a combination of three of the eight strategies coded was used in 55% (11) of the studies: functional assessment, replacement skill training, and the provision of positive consequences for the target behavior. FCT generally is thought of as consisting of these three components and most researchers identified FCT as the method they applied.

Treatment Integrity

Treatment integrity is the reliability of the independent variable that involves measurement to determine whether the intervention procedures were implemented as intended (Schlosser, 2002). Treatment integrity was assessed in only 12 of the 40 studies (30%); 11 of these 12 studies reported treatment integrity to be 80% or better.

Outcomes

In all 40 studies, outcomes were supported by student data on the targeted communication skill. In 85%, or 17 of the 20 studies where problem behavior was measured, outcomes were also supported by data indicating a reduction in problem behavior. Forty percent (16) of the total database provided data to indicate that generalization of the communication behavior occurred, and 15% (3) of the problem behavior research showed generalization of the treatment effects on problem behavior. Only 5% (2) of the total database showed maintenance of effects on targeted communication for 6 months or longer, whereas 10% (2) of the problem behavior research reported maintenance of effects on problem behavior. Finally 20% (8) of the total database reported data indicating improvements in adult/peer skills that supported effects in the target communication behavior, whereas only one problem behavior study (Durand, 1999) reported improvements in adult/peer skills to support effects in the reduction of problem behavior.

Almost half of the research that produced both communication skill increases and reductions in problem behavior reported the following combination of interventions: functional assessment or analysis, skill replacement training, and contingent reinforcement using specific reinforcers, coupled with proximity, enhancement of student motivation (e.g., following lead, shared control), and prompting. The 16 studies that documented generalization of skills reported the following combination of strategies: contingent reinforcement using specific prompts and the application of multiple antecedent strategies, with proximity, multiple stimuli, and prompting being the most frequent combination.

Social validation of some type (e.g., goals, procedures, outcomes) was conducted in only one quarter or 25% (10 studies) of the total database. In all 10 studies the research outcomes were judged to be socially valid, while in four studies the practicality of the procedures were determined to be valid, and in two studies the goals were judged to be important.

Discussion

This descriptive analysis of communication research indicates that a variety of antecedent and consequence intervention components, typically used in combination, have been reported to improve AAC communication in learners with severe disabilities from birth to 21 years whose communication ranges from nonsymbolic to symbolic AAC. These findings agree with the results of other reviews of children with autism and other severe disabilities learning to communicate with or without AAC (Goldstein, 2002; Hepting & Goldstein, 1996; Hwang & Hughes, 2000a; Mirenda, 2001; Reichle, 1997; Romski & Sevcik, 1997); furthermore, these findings extend our understanding of effective communication methods to a more recent 7-year period and with the population of individuals who do not use spoken words as their primary communication mode.

Naturalistic Language Intervention

This analysis showed frequent use of a number of intervention strategies referred to by some as "naturalistic" (Koegel, Camarata, Koegel, Ben-Tall, & Smith, 1998; Schepis, Reid, Behrmann, & Sutton, 1998) or "normalized" (Delprato, 2001). Natural communication

intervention is described as being similar to the ways parents teach children language during routine interaction contexts (Hepting & Goldstein, 1996; Reichle, 1997). Such approaches have been viewed as being more child directed (e.g., partner follows the child's lead, teaches within typical routines or preferred activities, gives reinforcers that are related to the child's communicative intent) than adult directed (e.g., adult gives a request, prompts child, chooses the teaching materials, setting, and activity, and selects the reinforcer). These "shared control" approaches have been argued as being critical for advancing the pivotal behavior of motivation for learning (Keogel, O'Dell, & Koegel, 1987). Specific examples of these motivational techniques include (a) following the child's lead (Camarata & Nelson, 1992; Koegel, Dyer, & Bell, 1987); (b) using preferred objects and activities during instruction (Dunlap, Kern-Dunlap, Clark, & Robbins, 1991; Dyer, 1987; Yoder, Kaiser, Alpert, & Fischer, 1993); and (c) using natural reinforcers (Charlop, Shreibman, & Thibodeau, 1985).

The term "naturalistic intervention" lacks consistent usage by researchers (Goldstein, 2002). In an effort to clarify naturalistic approaches, Hepting and Goldstein (1996) conducted an analysis of early spoken language intervention research identified as being "naturalistic" and involving young children with developmental delays. They examined seven components (intervention contexts, trainers, targets, etc.), one of which was the specific intervention. In this category, 11 procedures were identified, some of which overlap with the categories of antecedent (adult request, prompting, waiting for a response, temptation) and consequent intervention strategies (praise, delivering desired consequences) coded in this review. Prompting imitation and praising were deemed more adult-directed than modeling and delivering desired consequences, respectively, whereas waiting for a response and arranging the environment were regarded as having a lesser "degree of obligation." Intervention contexts were judged on a continuum of naturalness with training conducted by parents in the home or by teachers at school regarded as more natural and favorable to generalization than experimenters teaching in isolated settings. Hepting and Goldstein's (1996) analysis of research along these lines revealed inconsistency in what researchers regarded as "naturalistic" language intervention.

Although methods found successful with prelinguistic learners appear to be somewhat different than those found effective with learners who are using words (Cress, 2002), Hepting and Goldstein's (1996) analysis is still of interest. When children have more severe disabilities, teacher-directed approaches are often used to "make the response happen." In the database examined in this paper, prompting (the most frequently cited antecedent strategy) falls into the teacher-directed category. However, we also found that a combination of child-directed approaches were used in most studies: proximity of partner and materials, teaching across a range of stimuli, following the child's lead, embedding instruction in activities, enriching the environment, creating opportunities, and specific reinforcement. Additionally, because multiple intervention components were applied in most studies and treatment integrity was infrequently measured, it is difficult to know whether the intervention components were implemented as described. There would be value in knowing more about the individual and comparative effects of these intervention components.

Somewhat similar to Hepting and Goldstein (1996), our means for evaluating intervention context coded (a) whether a study's intervention activities were routine (55% were judged to be) rather than created for the research, (b) whether the physical context for intervention was typical (37.5%) and not limited to special populations, and (c) whether nondisabled peers were present during intervention (30%). Only one third to one half the time did the researchers in this database use natural contexts for intervention. Parents, teachers, and siblings or peers were less likely to be involved in the intervention. Unnatural settings (special, isolated, or empty classrooms) were used far more often than homes, general education classrooms, or community settings. Goldstein's (2002) cautions are relevant to this discussion: (a) treatment components need better specification and (b) users of the research should not assume that treatment components are equal when called by the same name.

Effective Interventions for Advancing Beginning Communication

Antecedents

Several antecedent procedures that have been promoted as building the learner's interest and motivation to attend and participate (Koegel et al., 1987) were applied repeatedly in this database. The first approach reported in 90% of the research was that practitioners arrange the environment in ways that encourage learners by having needed AAC materials present (picture cards, voice output communication device) and being physically close to the learner. Although it is somewhat obvious that aided communication forms that depend on photos, objects, or devices cannot occur without the presence of those aids and should be available to learners at all times (Rowland & Schweigert, 2000), natural school environments may be weak in this regard. AAC materials may be put away after communication instruction or kept at school rather than accompanying the learner home. Organized team-generated plans seem to be required to make AAC aided systems readily accessible (Lancioni et al., 2001; Sevcik & Romski, 1999). Additionally, partner proximity allows partners to be responsive to the learner's responses and attention. Close observation of opportunities for communication enables partners to verbally label and reinforce

the learner's communication attempts, to focus on learner attention so target responses can be modeled when learners are attending, and to be alert to learner attention and preferences so choice and request prompts are more accurate. These partner responses in turn foster the learner's ability to comprehend and use symbolic forms (Harwood, Warren, & Yoder, 2002).

Other strategies that appear to motivate learners to initiate communication were also found in the database (e.g., following the learner's lead, offering enriched environments, embedding instruction, and using environmental temptations), along with the infrequent use of adult requesting. The former methods appear to promote child initiation, reducing the need for adult requesting. One study in the database (Hwang & Hughes, 2000b) used all four strategies with prelinguistic preschoolers during toy play. First, they increased the child's control by following children to materials they selected and then playing with them; by following the children's line of vision to look in same direction as they did at objects of their interest; and by imitating the children's actions. Second, they enriched the environment first by having preferred toys present and replacing items participants lost interest in with other preferred items, and second by providing ongoing noncontingent attention. Finally, they embedded instruction within toy play and set up the environment to increase the opportunities for communication, such as presenting a choice of options for playing together. These strategies were coupled with prompting if the child did not respond with a social communicative response (i.e., eye contact, joint attention, motor imitation) during a period of expectant looking by the partner. Partners used the consequence strategy of specific reinforcement, wherein the partner reinforces the child by fulfilling the learner's request.

Consequences

Contingent reinforcement and reinforcement with consequences specifically related to the desired behavior were two prevalent strategies in this database. For example, Hwang and Hughes (2000b) reinforced child choices by playing with the chosen object rather than praising or giving food tangibles. Also Hughes et al. (2000) recruited high-school-aged nondisabled peers to teach students with severe disabilities and minimal speech and interaction skills to use self-prompting communication books of pictures that reflected students' interests (cars, fishing, sports). Students learned to engage peers in conversations by pointing to pictures in their books, commenting, and waiting for a response. Peers reinforced contingently and specifically by adding more comment on the same preferred topic.

Other recommended consequence practices (Koegel et al., 1987) were infrequently reported in this database: reinforcement of any goal-directed attempt, contingent imitation, and presentation of a choice of preferred items in consequence to a target response. Instead, choices were available or provided as antecedents (follow student's lead, enriched environments) and prompts were used to evoke target responding. Rarely used was the more traditional practice of presenting artificial reinforcers (such as food) unrelated to the teaching activity but contingent on target behavior.

Strategies for Problem Behavior

FTC was the method of choice when both problem behavior and communication were targeted. There was great variability in procedural description across the 13 studies reporting use of FCT. Whereas all but one author used the term FCT, some were less explicit about what procedures constituted FCT. In some studies, problem behavior was blocked, whereas in others it was ignored. Some researchers set up training situations where problem behavior was likely, whereas others initially taught the alternate response in isolation. One study cited the use of FCT but was not credited for this procedure because no training was given; instead before each session the researcher simply stated the rule for getting reinforcement with an alternate behavior ("You can either sign "please" or hand the card to your mom to get your toys"; Richman, Wacker, & Winborn, 2001, p. 74). Additionally, only two studies applying FCT (18%) reported treatment integrity, making consistency of FCT as a prescribed treatment somewhat questionable. Future researchers should delineate the procedures used when FCT is cited as the independent variable and report reliability on their fidelity in implementing the treatment.

The Challenge of Promoting Generalization and Retention

Teaching across multiple stimuli and in naturally occurring interaction contexts constitutes accepted ways to promote generalization and maintenance of communication skills. Whereas the first strategy (teaching across multiple stimuli) was prevalent in this database, the second (teaching in naturally occurring interaction contexts) was not: A little more than half the time intervention was conducted in routine activities but only infrequently in integrated settings involving nondisabled peers. McConnell (2002) identified inclusive settings–typical classrooms and social settings where students with and without disabilities of the same age are present–as being necessary but not sufficient for teaching social interaction to children with autism. Consistent with his conclusion is Rafferty, Piscitelli, and Boettcher's (2003) study of the impact of inclusion on language development and social competence of preschoolers with disabilities. They found that children with severe disabilities in inclusive settings made greater language and social skill gains than did similar peers in segregated settings, although included children also exhibited more problem behavior. Although skill generalization was

reported in 40% of the research reviewed, the practice of using primarily segregated intervention settings may have led to less skill generalization than might have been obtained in integrated settings with nondisabled peers present.

It is commonly known that learners with autism and other severe cognitive disabilities are poor at generalizing their skills across settings, people, and materials. In this review, student data indicating that communication responses generalized in some way were reported less than half the time, whereas reductions in problem behavior were reported to generalize even less. Even if generalization was to have been measured more often in this research, the outcomes are likely to have been depressed given the facts that (a) teachers and care providers were typically not involved in intervention and (b) that intervention less often took place in integrated settings including the home and community.

Long-term maintenance of outcomes was reported less often in this database than was generalization. Long term was defined as maintenance of a communication skill or the treatment effects on a problem behavior for 6 months or longer following intervention. In AAC interventions one characteristic reported to influence widespread and ongoing usage by a student is whether care providers are involved in the decision making about the choice of AAC or the vocabulary, as well as whether they know how to use the AAC system as communication partners (Lancioni et al., 2001; Sevcik & Romski, 1999). Several researchers mentioned close involvement of parents in the selection of the AAC device (Durand, 1999) or the involvement of family and educational team in the design of support strategies for students' use of AAC in the general education classroom (Hunt, Soto, Maier, Muller, & Goetz, 2002). But many studies in the database did not mention how such decisions were made, leading one to wonder if the omission meant that little collaboration took place and thus contributed to poor generalization and maintenance of the target responses.

Although the number of studies showing skill transfer and retention was relatively small, we found that certain combinations of intervention components were associated with the generalization/maintenance of communication skills and with the dual outcome of skill generalization/maintenance and reductions in problem behavior. Because the ultimate value of intervention comes when learners retain and transfer skill to everyday life, future researchers should not only test transfer and retention (as not all studies did so) but also evaluate the contribution made by specific intervention components.

Shortcomings and Future Research Directions

There were several shortcomings to this literature review. First, the expressive range of the population was wide and extended from speaking individuals (Hughes et al., 2000) to those with no meaningful vocalizations, making our conclusions about intervention effects less precise. Second, we set somewhat arbitrary limits for defining the database, (a) omitting important research on early communication with words alone, (b) confining the search to a 7-year period (1997–2003), and (c) including only single subject methodology. The review would be more complete if it included the two most recent years. Furthermore, we did not assess whether researchers matched AAC systems and vocabulary to individual learners. Finally, there was no meta-analysis of the research outcomes, rather it was a descriptive view of research characteristics.

Based on this review, several recommendations can be made for future research. First, the communication partner needs closer study. Almost all of the research assessed interactions with adult partners rather than peers or siblings. Additionally, the role of the partner (whether adult or child) was infrequently examined in this research, despite the importance of partner responsivity in developing exchanges in beginning communicators (Harwood et al., 2002; Yoder & Warren, 2004). Dependent measures of partner or peer/sibling supportive or interactive behaviors were rare. Only one third of the time was partners' fidelity in implementing the intervention assessed.

Second, the experimental rigor was inconsistent in this pool of research. Although all 40 studies were published in peer-reviewed journals and reported acceptable reliability on student-dependent measures, many studies did not involve more than three subjects, failed to report treatment integrity, or did not measure generalization or maintenance of outcomes. Goldstein (2002) also warns of the possibility of placebo effects that may occur with single subject research from added attention and the effects of repeated testing; these internal validity threats are reduced with the use of multiple methodologies, treatment comparisons, and reliable measures, as well as the attainment of performance stability within each baseline and experimental conditions. One challenge when studying those with severe disabilities is whether adequate numbers of similar participants are available for random selection and group design.

Third, researchers should aim to assess the contribution of different components of treatment in an effort to better understand the power of different procedures (e.g., adult and child-directed, natural and unnatural contexts) and the definition of and importance of "naturalistic" interventions. Although most interventionists will use multiple components to teach communication and did so in this review, Goldstein (2002) alerted interventionists looking to the research for proven methods to be wary of studies evaluating multiple-component treatments because of the difficulty of knowing which components (single or combined) are responsible for learning. Individual treatment components often lack documentation of their actual use (treatment integrity)

and their individual effects. Only 11 of 40 studies reported acceptable treatment integrity and most used multiple component treatments. In addition to multielement design and comparative group design, improvements that would help clarify the contribution of treatment components include specificity and consistency in the names and elements of common treatment components and measurement of treatment elements during intervention to document treatment integrity. Also it might be better to evaluate frequently used treatment component combinations (e.g., FCT) rather than individual components.

Consistent with this latter point, a fourth area important in future research will be consistent measurement of treatment fidelity. For example, when FCT is applied, researchers should delineate the procedures used and report reliability on their fidelity in implementing the treatment.

Finally, this review did not examine the effects of treatment intensity nor did any of the research included in the review. Methods of measuring treatment intensity traditionally have included number of trials or amount of daily training time and length (days, months) of intervention. Likewise students' entry skill level or their generalization of skills were not evaluated separately or in combination with treatment intensity. For example, how well do students starting with skills in early acquisition (below 20% accuracy) fare in comparison to those in later acquisition (entry skills above 50% accuracy) when treatment varies in intensity (number of trials daily and length of training)? How do these groups (differing entry level and treatment intensity) compare on skill generalization? Currently in the United States, there is a widespread but comparatively untested emphasis on one-to-one teacher-directed, massed discrete-trial interventions for students with autism. It is important that research advance our understanding of the separate and combined effects of student entry level, intensity of training, generalization, and teacher versus child directedness with various groups of children with severe disabilities (Goldstein, 2002; Lonigan, Elbert, & Johnson, 1998). Such analyses are needed to weigh the efficiency of various treatments.

Conclusion

This review lends support to a number of teaching strategies that appear effective when building AAC skills in beginning communicators with severe disabilities. Because researchers typically have combined intervention strategies, the effectiveness of isolated procedures is less clear. Although it is common to classify early communication methods by their "naturalistic" features, these classifications lack universal acceptance and do not clearly predict effectiveness. However, this review found support for antecedent and consequent procedures that were child directed, whereas some traditional teacher-directed approaches were less frequently used. This review also identified several general weaknesses in this database: little reporting of generalization and maintenance of outcomes, infrequent involvement of teachers and parents, infrequent measurement of partner behavior, poor reporting of treatment integrity, and contexts that less often included general education and nondisabled peers.

References

American Speech-Language-Hearing Association (ASHA). (1989). Competencies for speech-language-hearing pathologists providing services in augmentative communication, *ASHA, 31,* 107–110.

Bondy, A. S., & Frost, L. A. (1994). The picture exchange communication system. *Focus on Autistic Behavior, 9,* 1–19.

*Brady, N. C. (2000). Improved comprehension of object names following voice output communication aid use: Two case studies. *Alternative and Augmentative Communication, 16,* 197–204.

*Buffington, D. M., Krantz, P. J., McClannahan, L. E., & Poulson, C. L. (1998). Procedures for teaching appropriate gestural communication skills to children with autism. *Journal of Autism and Developmental Disorders, 28,* 535–545.

Camarata, S. M., & Nelson, K. E. (1992). Treatment efficiency as a function of target selection in the remediation of child language disorders. *Clinical Linguistics and Phonetics, 6,* 176–178.

Carr, E. G., & Durand, V. M. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis, 18,* 111–126.

Charlop, M. H., Schreibman, L., & Thibodeau, M. G. (1985). Increasing spontaneous verbal responding in autistic children using a time delay procedure. *Journal of Applied Behavior Analysis, 18,* 155–166.

*Charlop-Christy, M. H., Carpenter, M., Le, L., LeBlanc, L. A., & Kellet, K. (2002). Using the picture exchange communication system (PECS) with children with autism: Assessment of PECS acquisition, speech, social-communicative behavior, and problem behavior. *Journal of Applied Behavior Analysis, 35,* 213–231.

Cooper, H. M. (1989). *Integrating research: A guide for literature review* (2nd ed.). Newbury Park, CA: Sage.

Cress, C. J. (2002). Expanding children's early augmented behaviors to support symbolic development. In J. Reichle, D. R. Beukelman, & J. C. Light (Eds.), *Exemplary practices for beginning communicators: Implications for AAC* (pp. 219–272). Baltimore: Paul H. Brookes.

*Davis, C. A., Reichle, J., Southard, K., & Johnston, S. (1998). Teaching children with severe disabilities to utilize nonobligatory conversational opportunities: An application of high-probability requests. *Journal of the Association for Persons with Severe Handicaps, 23,* 57–68.

Delprato, D. J. (2001). Comparisons of discrete-trial and normalized behavioral language intervention for young children with autism. *Journal of Autism and Developmental Disorders, 31,* 315–325.

*Derby, K. M., Wacker, D. P., Berg, W., DeRaad, A., Ulrich, S., Asmus, J., et al. (1997). The long-term effects of functional communication training in home settings. *Journal of Applied Behavior Analysis, 30,* 507–531.

*References in the database

*DiCarlo, C. F., & Banahee, M. (2000). Using voice output devices to increase initiations of young children with disabilities. *Journal of Early Intervention, 23,* 191–199.

*Drasgow, E., Halle, J. W., & Phillips, B. (2001). Effects of different social partners on the discriminated requesting of a young child with autism and severe language delays. *Research in Developmental Disabilities, 22,* 125–139.

Dunlap, G., Clarke, S., & Steiner, M. (1999). Intervention research in behavioral and developmental disabilities: 1980–1997. *Journal of Positive Behavior Interventions, 1,* 170–180.

Dunlap, G., Kern-Dunlap, L., Clark, S., & Robbins, F. R. (1991). Functional assessment, curricular revisions, and severe problem behavior. *Journal of Applied Behavior Analysis, 24,* 387–397.

*Durand, V. M. (1999). Functional communication training using assistive devices: Recruiting natural communities of reinforcement. *Journal of Applied Behavior Analysis, 32,* 247–267.

*Dyches, T. T. (1998). Effects of switch training on the communication of children with autism and severe disabilities. *Focus on Autism and Other Developmental Disabilities, 13,* 151–162.

Dyer, K. (1987). The competition of autistic stereotyped behavior with usual and specially assessed reinforcers. *Research in Developmental Disabilities, 8,* 607–626.

*Fisher, W. W., Kuhn, D. E., & Thompson, R. H. (1998). Establishing discriminative control of responding using functional and alternative reinforcers during functional communication training. *Journal of Applied Behavior Analysis, 31,* 543–560.

*Frea, W. D., Arnold, C. L., & Vittimberga, G. L. (2001). A demonstration of the effects of augmentative communication on the extreme aggressive behavior of a child with autism within an integrated preschool setting. *Journal of Positive Behavior Interventions, 3,* 194–198.

*Garrison-Harrell, L., Kamps, D., & Kravits, T. (1997). The effects of peer networks on social-communicative behaviors for students with autism. *Focus on Autism and Other Developmental Disabilities, 12,* 241–254.

Goldstein, H. (2002). Communication intervention for children with autism: A review of treatment efficiacy. *Journal of Autism and Developmental Disorders, 32,* 373–396.

*Grisham-Brown, J., Schuster, J. W., Hemmeter, M. L., & Collins, B. C. (2000). Using an embedded strategy to teach preschoolers with significant disabilities. *Journal of Behavioral Education, 10,* 139–162.

Harwood, K., Warren, S. F., & Yoder, P. (2002). The importance of responsivity in developing contingent exchanges in beginning communicators. In J. Reichle, D. R. Beukelman, & J. C. Light (Eds.), *Exemplary practices for beginning communicators: Implications for AAC* (pp. 59–95). Baltimore: Paul H. Brookes.

Hepting, N. H., & Goldstein, H. (1996). What's natural about naturalistic language intervention? *Journal of Early Intervention, 20,* 249–265.

*Hughes, C., Rung, L. L., Wehmeyer, M. L., Agran, M., Copeland, S. R., & Hwang, B. (2000). Self-prompted communication book use to increase social interaction among high school students. *Journal of the Association for People with Severe Handicaps, 25,* 153–166.

*Hunt, P., Soto, G., Maier, J., Muler, E., & Goetz, L. (2002). Collaborative teaming to support students with augmentative and alternative communication needs in general education classrooms. *Augmentative and Alternative Communication, 18,* 20–35.

Hwang, B., & Hughes, C. (2000a). The effects of social interactive training on early social communicative skills of children with autism. *Journal of Autism and Developmental Disabilities, 30,* 331–343.

*Hwang, B., & Hughes, C. (2000b). Increasing early social-communicative skills of preverbal preschool children with autism through social interactive training. *Journal of the Association for Persons with Severe Handicaps, 25,* 18–28.

Jackson, C. T., Fein, D., Wolf, J., Jones, G., Hauck, M., Waterhouse, L., et al. (2003). Responses and sustained interactions in children with mental retardation and autism. *Journal of Autism and Developmental Disabilities, 33,* 115–121.

*Johnston, S. S., McDonnell, A. P., Nelson, C., & Magnavito, A. (2003). Teaching functional communication skills using augmentative and alternative communication in inclusive settings. *Journal of Early Intervention, 25,* 263–280.

*Johnston, S., Nelson, C., Evans, J., & Palazolo, K. (2003). The use of visual supports in teaching young children with autism spectrum disorder to initiate interactions. *Augmentative and Alternative Communication, 19,* 86–103.

*Kahng, S. W., Hendrickson, D. J., & Vu, C. P. (2000). Comparison of single and multiple functional communication training responses for the treatment of problem behavior. *Journal of Applied Behavior Analysis, 33,* 321–324.

*Keen, D., Sigafoos, J., & Woodyatt, G. (2001). Replacing prelinguistic behaviors with functional communication. *Journal of Autism and Developmental Disabilities, 31,* 385–398.

*Kelley, M. E., Lerman, D. C., & Van Camp, C. M. (2002). The effects of competing reinforcement schedules on the acquisition of functional communication. *Journal of Applied Behavior Analysis, 35,* 59–63.

*Kennedy, C. H., Meyer, K. A., Knowles, T., & Shukla, S. (2000). Analyzing the multiple functions of stereotypical behavior for students with autism: Implications for assessment and treatment. *Journal of Applied Behavior Analysis, 33,* 559–571.

Koegel, R. L., Camarata, S., Koegel, L. K., Ben-Tall, A., & Smith, A. E. (1998). Increasing speech intelligibility in children with autism. *Journal of Autism and Developmental Disorders, 28,* 241–251.

Koegel, R. L., Dyer, L., & Bell, L. K. (1987). The influence of child-preferred activities on autistic children's social behavior. *Journal of Applied Behavior Analysis, 20,* 243–252.

Koegel, R. L., O'Dell, M. C., & Koegel, L. K. (1987). A natural language paradigm for teaching nonverbal autistic children. *Journal of Autism and Developmental Disorders, 17,* 187–199.

*Kravits, T. R., Kamps, D. M., Kemmerer, K., & Potucek, J. (2002). Brief report: Increasing communication skills for an elementary-aged student with autism using the picture exchange system. *Journal of Autism and Developmental Disorders, 32,* 225–230.

Lancioni, G. E., O'Reilly, R. F., & Basili, G. (2001). Use of microswitches and speech output systems with people with severe/profound intellectual or multiple disabilities: A literature review. *Research in Developmental Disabilities, 22,* 21–40.

*Lerman, D. C., Kelley, M. E., Van Camp, C. M., & Roane, H. S. (1999). Effects of reinforcement magnitude on spontaneous recovery. *Journal of Applied Behavior Analysis, 32,* 197–200.

*Light, J. C., Binger, C., Agate, T. L., & Ramey, K. N. (1999). Teaching partner-focused questions to individuals who use augmentative and alternative communication to enhance their communication competence. *Journal of Speech, Language, and Hearing Research, 42,* 241–255.

Lonigan, C., Elber, J., & Johnson, S. (1998). Empirically supported interventions for children: An overview. *Journal of Clinical Child Psychology, 27,* 138–145.

*McCathren, R. B. (2000). Teacher-implemented prelinguistic communication intervention. *Focus on Autism and Other Developmental Disabilities, 15,* 21–29.

McConnell, S. R. (2002). Interventions to facilitate social interaction for young children with autism: Review of available research and recommendations for educational intervention and future research. *Journal of Autism and Developmental Disorders, 32,* 351–372.

Mirenda, P. (2001). Autism, augmentative communication, and assistive technology: What do we really know? *Focus on Autism and Other Developmental Disabilities, 16,* 141–151.

National Joint Committee for the Communication Needs of Persons with Severe Disabilities (2002a). Position statement on access to communication services and supports: Concerns regarding the application of restrictive "eligibility" policies. *Communication Disorders Quarterly, 23,* 143–144.

National Joint Committee for the Communication Needs of Persons with Severe Disabilities (2002b). Supporting documentation for the position statement on access to communication services and supports: Concerns regarding the application of restrictive "eligibility" policies. *Communication Disorders Quarterly, 23,* 145–153.

*O'Neill, R. E., & Sweetland-Baker, M. (2001). Brief report: An assessment of stimulus generalization and contingency effects in functional communication training with two students with autism. *Journal of Autism and Developmental Disorders, 31,* 235–240.

*Piazza, C. C., Bowman, L. G., Contrucci, S. A., Deila, M. D., Adelinis, J. D., & Goh, H. L. (1999). An evaluation of the properties of attention as reinforcement for destructive and appropriate behavior. *Journal of Applied Behavior Analysis, 32,* 437–449.

Rafferty, Y., Piscitelli, V., & Boettcher, C. (2003). The impact of inclusion on language development and social competence among preschoolers with autism. *Exceptional Children, 69,* 467–479.

*Reeve, C. E., & Carr, E. G. (2000). Prevention of severe behavioral problems in children with developmental disorders. *Journal of Positive Behavior Interventions, 2,* 144–160.

Reichle, J. (1997). Communication intervention with person who have severe disabilities. *Journal of Special Education, 31,* 110–134.

Reichle, J., Halle, J., & Drasgow, E. (1998). Implementing augmentative communication systems. In A. M. Wetherby, S. F. Warren, & J. Reichle (Eds.), *Transitions in prelinguistic communication* (pp. 417–436). Baltimore: Paul H. Brookes.

*Richman, D. M., Wacker, D. P., & Winborn, L. (2001). Response efficiency during functional communication training: Effects of effort on response allocation. *Journal of Applied Behavior Analysis, 34,* 73–76.

*Rodi, M. S., & Hughes, C. (2000). Teaching communication book use to a high school student using a milieu approach. *Journal of the Association for People with Severe Handicaps, 25,* 175–179.

Romski, M. A., & Sevcik, R. (1997). Augmentative and alternative communication for children with developmental disabilities. *Mental Retardation and Developmental Disabilities Research Reviews, 3,* 363–368.

Romski, M. A., Sevcik, R. A., Hyatt, A. M., & Cheslock, M. (2002). A continuum of AAC language intervention strategies for beginning communicators. In J. Reichle, D. R. Beukelman, & J. C. Light (Eds.), *Exemplary practices for beginning communicators: Implications for AAC* (pp. 1–23). Baltimore: Paul H. Brookes.

Rowland, C., & Schweigert, P. (2000). Tangible symbols, tangible outcomes. *Augmentative and Alternative Communication, 16,* 61–78.

*Schepis, M. M., Reid, D. H., Behrmann, M. M., & Sutton, K. A. (1998). Increasing communicative interactions of young children with autism using a voice output communication aid and naturalistic teaching. *Journal of Applied Behavior Analysis, 31,* 561–578.

Schlosser, R. W. (2002). On the importance of being earnest about treatment integrity. *Augmentative and Alternative Communication, 18,* 36–44.

Seigel, E. B., & Cress, C. J. (2002). Overview of the emergence of early AAC behaviors: Progression from communication to symbolic skills. In J. Reichle, D. R. Beukelman, & J. C. Light (Eds.), *Exemplary practices for beginning communicators: Implications for AAC* (pp. 25–57). Baltimore: Paul H. Brookes.

Sevcik, R. A., & Romski, M. A. (1999). Issues in augmentative and alternative communication in child psychiatry. *Child and Adolescent Psychiatric Clinics of North America, 8,* 77–87.

*Sigafoos, J. (1998). Assessing conditional use of graphic mode requesting in a young boy with autism. *Journal of Developmental and Physical Disabilities, 10,* 133–151.

*Sigafoos, J., Didden, R., & O'Reilly, M. (2003). Effects of speech output on maintenance of requesting and frequency of vocalization in three children with developmental disabilities. *Augmentative and Alternative Communication, 19,* 37–47.

*Sigafoos, J., & Drasgow, E. (2001). Conditional use of aided and unaided AAC: A review and clinical case demonstration. *Focus on Autism and Other Developmental Disabilities, 16,* 152–161.

*Sigafoos, J., & Roberts-Pannell, D. (1999). Wrong-item format: A promising intervention for teaching socially appropriate forms of rejecting to children with developmental disabilities? *Alternative and Augmentative Communication, 15,* 135–140.

Snell, M. E. (2002). Using dynamic assessment with learners who communicate nonsymbolically. *Alternative and Augmentative Communication, 18,* 163–176.

Snell, M. E., Voorhees, M. D., & Chen, L. H. (2005). Team involvement in assessment-based interventions with problem behavior: 1997–2002. *Journal of Positive Behavior Intervention, 7,* 140–152.

*Stiebel, D. (1999). Promoting augmentative communication during daily routines. *Journal of Positive Behavior Interventions, 1,* 159–169.

*Thompson, R. H., Fisher, W. W., Piazza, C. C., & Kuhn, D. E. (1998). The evaluation and treatment of aggression maintained by attention and automatic reinforcement. *Journal of Applied Behavior Analysis, 31,* 103–116.

*Vollmer, T. R., Borrero, J. C., Lalli, J. S., & Daniel, D. (1999). Evaluating self-control and impulsivity in children with severe behavior disorders. *Journal of Applied Behavior Analysis, 32,* 451–466.

Wilcox, M. J., & Shannon, M. (1998). Facilitating the transition from prelinguistic to linguistic communication. In A. M. Wetherby, S. F. Warren, & J. Reichle (Eds.), *Transitions in prelinguistic communication* (pp. 385–416). Baltimore: Paul H. Brookes.

*Winborn, L., Wacker, D. P., Richman, D. M., Asmus, J., & Geier, D. (2002). Assessment of mand selection for functional communication training packages. *Journal of Applied Behavior Analysis, 35,* 295–298.

Yoder, P., Kaiser, A. P., Alpert, C. L., & Fischer, R. (1993). Following the child's lead when teaching nouns to preschoolers with mental retardation. *Journal of Speech and Hearing Research, 36,* 158–167.

Yoder, P., & Warren, S. F. (2004). Early predictors of language in children with and without Down syndrome. *American Journal of Mental Retardation, 109,* 285–300.

Received: October 20, 2005
Final Acceptance: April 7, 2006
Editor in Charge: Lynn Kern Koegel