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Sight Word Instruction for Students with Autism: An Evaluation of the Evidence Base

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Abstract This paper reviews the evidence on sight word instruction as a method of teaching students with autism and significant cognitive and verbal limitations to read printed words. Nine single-subject studies were rated using Reichow et al.'s (J Autism Dev Disord 38:1311–1319, 2008) evaluative method for identifying evidence-based practice, and studies with at least adequate methodology were analyzed to identify common intervention features. Results yielded evidence in support of a massed trials approach featuring student response to a succession of items, differential positive reinforcement, systematic prompting, and use of visual supports. Across studies, students learned to identify printed words, even those with limited oral language and no prior reading instruction. However, no studies addressed the effects of sight word instruction on broad literacy outcomes.

Keywords Autism · Reading instruction · Literacy · Evidence-based practice · Academics

Introduction

Both the No Child Left Behind Act of 2001 and The Individual with Disabilities Education Act (IDEA) of 2004 made it clear that all students must be given the opportunity to achieve high academic standards and that teachers should implement evidence-based practices (EBP) in instructing all children, including students with disabilities. These mandates have led to the development of systematic methods for identifying EBP and an increase in research syntheses that focus on EBP.

Reading is an area of instruction that has received relatively little attention in previous analyses of EBP for students with autism spectrum disorders (ASD). Because of its centrality to the K-12 curriculum, reading skill defines the success that students are apt to achieve in school (Chard et al. 2009). Indeed, the ability to read is a necessity for social and economic advancement in our society (Snow et al. 1998). Although previous reports have described the exclusion of students with autism from traditional classroom literacy programs (Kliewer and Biklen 2001; Mirenda 2003), more recent conceptualizations of the curriculum for students with ASD include reading as a critical component (Kluth and Chandler-Olcott 2008).

Reading requires the integration of numerous cognitive processes. According to the *simple view of reading* (Gough et al. 1996; Gough et al. 1983), two of those processes are key: word recognition and comprehension. Although word recognition has been identified as a strength for some students with ASD relative to comprehension, difficulties at the word level are an obstacle to literacy for many students with ASD (Huemer and Mann 2010). Nation et al. (2006), for example, assessed reading in 41 students with ASD between the ages of 6 and 15 years. To participate in the study, students had to be identified with sufficient verbal skills to participate in testing. Despite this precondition, nine students were unable to read at all, and the remaining 32 students demonstrated skills that ranged from below floor to ceiling level. Nation et al. concluded that although a significant proportion of students with ASD read at an average or above-average level for their age, impairments in word recognition are more prevalent than in the general population.

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Data from the Special Education Elementary Longitudinal Study (SEELS), a large-scale study of a nationally representative sample of students served under IDEA, also confirmed the frequency of below average word recognition in students with autism (SRI 2002). Collapsed across age and data collection wave, over half of the students in the sample who were classified under the IDEA category of autism and who could be assessed on the Woodcock-Johnson Tests of Achievement-III (Woodcock et al. 2001) fell below the 25th percentile on Letter-Word Recognition. Furthermore, because a significant proportion of students with autism were excluded from SEELS direct assessments due to lack of critical academic skills and/or behaviors, it is likely that these figures underestimate the proportion of students with autism who do not meet grade level expectations in word recognition.

Sight word instruction, a whole-word approach to teaching word recognition, has a long tradition in programs for students with significant cognitive disabilities (Browder and Xin 1998). In sight word instruction, students are taught to identify words as logographs, without explicit analysis of the relationship between the letters and sounds in the word. The approach contrasts with a phonics-based approach featuring phonemic awareness (i.e., identification and manipulation of sounds within spoken words) and instruction in letter-sound correspondences.

Three primary criticisms of sight word instruction have been articulated in the literature. Two address the limitations of a whole-word versus phonics approach to beginning reading. First, if students are taught to recognize words as wholes, without consideration of letter-sound correspondences, they will only be able to identify words that have been explicitly taught. Second, unless students attend to the individual letters within words, they will be prone to confuse words with similar orthographic patterns (Ehri 2005). The third criticism addresses the consequences of focusing on word recognition to the exclusion of other components of reading. Historically, many classroom programs for students with cognitive disabilities have overemphasized sight word recognition, leading to neglect of comprehension—a critical need for all students (Koppenhaver and Erickson 2009).

These criticisms notwithstanding, experts in the practice of reading instruction for students with autism have identified several potential benefits of sight word instruction. First, as an introduction to reading, sight word instruction may be useful in teaching the communicative intent of print and providing a sense of accomplishment and motivation around learning to read (Broun 2004). Second, a sight word approach may be a more accessible instructional starting point than a phonics-based approach for students with autism who have difficulty with abstract, auditory-based concepts (Broun and Oelwein 2007). Third, once mastered, a corpus of known sight words may be used as a foundation on which to build understanding of more abstract alphabetic concepts and principles (Kaderavek and Rabidoux 2004; Mirenda 2003). Fourth, sight word instruction may be embedded as a strand within a comprehensive literacy program that includes instruction in phonemic awareness, phonics, fluency, and comprehension (Browder et al. 2006a). Core reading programs, even those with a strong phonics component, typically include sight word instruction for high utility words that are not decodable at the level at which they are introduced. Finally, mastery of sight words may enable students who are unable to master the alphabetic principle to perform functional tasks such as reading environmental signs, grocery lists, items on a menu, directions on a schedule, or recipes (Browder and Xin 1998).

Although two broad reviews on reading instruction for students with ASD have been published recently (Chiang and Lin 2007; Whalon et al. 2009), neither paper reviewed the quality of the evidence base in support of sight word instruction. However, a previous review of reading instruction for students with cognitive disabilities identified more studies on sight word instruction than on any other approach. Browder et al. (2006b) conducted a meta-analysis of 128 studies of reading instruction for students with significant cognitive disabilities, the majority of which targeted students with moderate mental retardation (78%) or severe mental retardation (11%). In the subset of 56 studies they identified as high quality, 75% addressed sight word instruction. Analyses yielded strong evidence of effectiveness for sight word instruction using massed trials and systematic prompting—an approach in which students respond to a succession of items presented by the teacher and the teacher uses positive reinforcement and prompting to reduce errors and increase correct responses.

More recently, Browder et al. (2009) identified time delay as an EBP for teaching picture and sight word recognition to students with severe developmental disabilities. Time delay is a form of systematic prompting in which the teacher gradually reduces the delay between presentation of the stimulus and the prompt, until the student is able to respond correctly to an item without a prompt. Although a small number of students with ASD participated in studies that were included in these reviews, results were not disaggregated for this subgroup. It is possible that similar sight word practices are effective for students with ASD as are effective for students with cognitive disabilities other than ASD; however, in the absence of direct evidence, generalization to students with ASD should not be assumed. Indeed, experts on the education of students with ASD often note the characteristics of students with this disability that may affect responsiveness to intervention, such as highly advanced splinter skills or esoteric preferences and interests (Simpson and Myles 2008).

The purpose of the present investigation was to evaluate the body of evidence on sight word instruction for students with ASD using an established framework for identifying practices as evidence-based. In doing so, three questions were addressed: (a) what approaches to sight word instruction have been investigated, and in what populations of students with ASD; (b) have there been a sufficient number of high quality studies to identify sight word instruction as an evidence-based practice for teaching students with ASD to read printed words; and (c) what can we learn about effective intervention features from high quality experimental studies?

Method

The investigation comprised three stages: (a) selecting sight word studies, (b) coding study characteristics, and (c) applying established standards for identifying EBP.

Selecting Sight Word Studies

Studies had to meet four criteria to be included in the review. First, they had to include participants with a diagnosis on the autism spectrum. If participants other than those with ASD were included, results had to be disaggregated by category of disability. Second, articles had to be published since 1980 in English. Third, the intervention had to qualify as a sight word approach, and sight word learning had to be directly assessed. For purpose of this research, sight word instruction was defined as an approach in which students are directly taught the association between the printed word and "the thing or idea that the word represents" (Copeland and Calhoon 2007, p. 55), without explicit attention to the relationship between letters and sounds within the word. Studies in alphabetic systems other than English were included if the research report was published in English. Fourth, as has been the case in most other syntheses of intervention research for students with ASD, studies had to have either a group experimental design, quasi-experimental control group design, or a single-subject design capable of demonstrating a functional relationship between the independent and dependent variable (i.e., studies with AB designs were excluded; Kazdin 1982). In practice, no group experimental or quasi-experimental studies met all selection criteria, so the review includes only single-subject research. Furthermore, no studies included participants on the spectrum other than those with a diagnosis of autism. For this reason, the term *autism* is used rather than ASD in describing results.

Studies were located using (a) electronic search of multiple databases, including Academic Search Premier, ERIC, PsyInfo, and Medline, (b) bibliographies of previous research syntheses, and (c) hand search of journals with an autism, literacy or special education focus (e.g., *Journal of Autism and Developmental Disorders, Reading* and *Writing Quarterly*, *Exceptional Children*).

Coding Study Characteristics

Reports that met the criteria identified above were coded on (a) participant, setting and interventionist characteristics (i.e., sample size, age and/or grade, gender, diagnosis, intellectual and language functioning; reading level; educational placement; interventionist); (b) dependent measures; (c) characteristics of the sight word intervention (i.e., group size, instructional materials, and intervention approach); and (d) methodological rigor. Once studies were coded on these dimensions, established standards were applied to make judgments about the adequacy of the research base for purposes of identifying EBP. Studies with at least adequate methodology were then examined further to generate conclusions about effective intervention practices.

Intervention Approach

Both researcher-supplied labels and descriptive features were used to code the intervention approach used in each study. As Browder et al. (2009) found in their synthesis of research on the effectiveness of time delay as a method of teaching picture or word recognition, it is important to look beyond researcher-supplied treatment labels because different researchers may apply the same label to different practices.

Previous reviews of sight word instruction in the broader population of students with significant cognitive disabilities identified the effectiveness of massed trials instruction with systematic prompting (including time delay). Browder et al. (2006b) described massed trials as an approach in which "individuals responded to each word presented in succession (e.g., flash card drill). For these interventions, the teacher presented each word or picture, used a defined prompt, and provided feedback on correct responses or errors. Corrected errors received praise and, sometimes additional reinforcement such as tokens or edibles" (pp. 398–399).

Each study in the present pool was coded to identify the presence or absence of three features: (a) student response to a succession of individual items, (b) use of systematic prompting to reduce/eliminate errors, and (c) differential reinforcement of correct responses. In addition, a modified version of Browder's (2001) framework was used to code prompting methods that were used in each study. The framework comprised two major categories: response prompting and stimulus prompting, with more specific

subcategories within each. The category of response prompting included constant time delay (a method that Browder et al. (2009) recently identified as an evidence-based practice for teaching picture and word recognition students with severe developmental disabilities); progressive time delay; least intrusive prompts; and mixed prompts (for studies that combined types of response prompts). The category of stimulus prompts included stimulus fading and stimulus shaping.

In an earlier synthesis of research on effective practices for young children with ASD in domains other than reading, Odom et al. (2003) rated two practices as well established (adult-directed intervention, differential positive reinforcement); four as emerging and effective (peer-mediated intervention, visual supports, self-monitoring, and involving families), and three as probably efficacious (positive behavior support, videotaped modeling, and modifying task characteristics to align with student interests or preferences). This set of practices provided a framework for coding additional characteristics of sight word interventions.

Coding was completed independently by two individuals with expertise in both single-subject research methodology and reading instruction. Discrepancies were resolved by consensus.

Methodological Rigor and Standards for Identifying EBP

Standards for evaluating the rigor of single-subject research have been proposed by investigators in a variety of fields including medicine, psychology, and education (Horner et al. 2005). Reichow et al. (2008) developed a three-step, evaluative method specifically for the purpose of rating intervention studies and identifying EBP for students with ASD. The first step in the method was to rate each study on six essential and six secondary quality indicators (QIs). Ratings on primary QIs reflected adequacy with respect to (a) description of participant characteristics, (b) definition of the dependent variable, (c) definition of the independent variable, (d) procedures for establishing baseline, (e) use of visual analysis, and (f) design for experimental control. Secondary QIs pertained to documentation of (a) interobserver agreement, (b) kappa, (c) procedural fidelity, (d) use of blind raters, (e) measures of generalization/maintenance, and (f) social validity. The QIs are similar to those proposed by Horner et al. (2005) as part of an initiative sponsored by Council for Exceptional Children to increase the use of evidence-based practice in special education (Odom et al. 2005).

Rubrics within the evaluative method provided explicit criteria for determining whether a study should be rated as high, acceptable or unacceptable on each of the primary QIs. For example, to be rated high on dependent variable (DV), the DV had to be operationalized and described with sufficient precision to enable replication by an outside investigator, and measures had to be clearly linked to the DV. Studies meeting two of the three criteria were rated acceptable and studies meeting one or no criteria were rated unacceptable. Secondary QIs were rated on a dichotomous scale to reflect presence or absence of the criteria. For example, to be credited with meeting the criteria for procedural fidelity, a study had to assess procedural fidelity across participants, conditions, and implementers with reliability greater than .80.

The second step after rating each QI was to generate an overall quality rating for each study. The method provided guidelines for determining the overall strength of the study's methodology once ratings on all primary and secondary QIs were completed. For a study to be rated as strong, it had to receive high ratings on all primary QIs and show evidence of at least three secondary QIs. For a study to be rated adequate, it had to receive high ratings on at least four primary QIs with no unacceptable ratings on any primary QIs.

The final step in the evaluative method was to weigh the evidence provided by the corpus of rated studies: How much research, and what quality of research, is needed to identify a practice as evidence-based? Reichow et al. (2008) recommended a minimum of (a) five single-subject studies of strong report strength that were conducted by at least three different research teams, in at least three different locations, and with a total sample size of at least 15 different participants across studies; or (b) 10 single-subject studies of at least adequate research report strength that were conducted by at least three research teams, in at least three different locations, and included at least 30 participants across studies. In addition, their framework identified as *promising* those practices with a minimum of three single subject studies of at least adequate research report strength if conducted by at least two different research teams, in at least two different locations, and with a total sample size of at least nine participants across studies.

Reichow et al.'s approach was selected for use in the present study because of its reliability and validity for evaluating research on ASD. To ensure the reliability of ratings, two individuals with expertise in single-subject research rated each study independently on all QIs and on overall strength of research, resolving any disagreements by consensus. During an initial trial run to calibrate ratings using three studies, inter-rater agreement was 94%. During the second round of ratings for all remaining studies, inter-rater agreement was 98%, demonstrating a high degree of consistency. Although only studies rated *strong* or *adequate* were considered in drawing conclusions about EBP, descriptive information for the total sample of studies is included in the next section.

Results

Analyses addressed three questions. First, what approaches to sight word instruction have been investigated and in what populations of students with autism? Second, have there been a sufficient number of high quality studies to identify sight word instruction as an evidence-based practice for teaching students with autism to read printed words. Third, what can we learn about effective intervention features from high quality, experimental studies? Results bearing on each of these questions are presented below.

What Approaches to Sight Word Instruction Have Been Investigated and in What Populations of Students with Autism?

Nine single-subject studies met preliminary selection criteria: (a) disaggregated results for participants with autism; (b) taught students to identify words using a whole word approach, (c) published in English between 1980 and 2009 in peer-reviewed journals; and (d) used a single-subject design capable of demonstrating a functional relationship between the independent and dependent variable (i.e., not studies with AB designs; Kazdin 1982). Only four had been included in previous reviews of reading instruction based on the broader population of students with significant cognitive disabilities (i.e., Browder et al. 2006a, b; Browder et al. 2009). Five were published since 2005, and three included one or more participants with disabilities other than autism. Below, *n*s and results are based only on participants with autism.

Participant, Setting, and Interventionist Characteristics

The present set of studies involved a total of 27 participants, all identified with autism rather than PDD-NOS, Asperger Syndrome, Rett Syndrome, or Childhood Disintegrative Disorder. As shown in Table 1, participants ranged in age from 4 to 16 years (*M* and *Mdn* age = 8 years). Males outnumbered females (70% males), a finding that is not surprising given that more males than females are diagnosed with autism. Too few studies reported demographics to permit a description of participants on socioeconomic status, ethnicity, or race.

Although recent discussions of reporting standards for research on autism have urged investigators to make use of standardized autism rating scales to facilitate generalizability of results to other samples (e.g., Lord et al. 2005), only two studies reported scores on an autism rating scale (i.e., Ledford et al. 2008; Mechling et al. 2002: *Childhood Autism Rating Scale*, Schopler et al. 1998). However, five additional studies referenced a diagnostic framework or provided functional descriptions to support the autism diagnosis.

Table 1 includes scores for intellectual functioning where available, or scores on language or adaptive behavior measures where no scores on intellectual functioning were included. Although the present search was not restricted to a particular subgroup of students within the autism spectrum, examination of scores and qualitative descriptions indicated that to date, sight word researchers have targeted students with autism and significant intellectual and verbal limitations. No studies included students with autism who were identified as "high functioning" based on scores or teacher reports.

In addition, all participants were described as having limited to no prior reading experience (see Table 1). Participants in three studies had received some introductory instruction in a functional reading program that emphasizes sight words (i.e., Birkan et al. 2007; Ledford et al. 2008; McGee et al. 1986). Descriptions provided in three additional studies indicated that students had some prior sight word knowledge, but researchers did not identify an instructional approach or program (i.e., Collins and Stinson 1994; Kamps et al. (1990); Mechling et al. 2002). Three remaining studies noted that students had not participated in any prior reading instruction (i.e., Eikeseth and Jahr 2001; Fossett and Mirenda 2006; Hetzroni and Shalem 2005).

All studies but one took place in a room in the child's usual school setting (i.e., Fossett and Mirenda 2006). The primary placement for participants was special education, either a self-contained, special education classroom or a school for students with disabilities. In most studies, the interventionist was described as the teacher. Three studies included peers as part of the instructional intervention, either as tutors (one study) or as members of a small group (two studies). Other than in the aforementioned studies, grouping was 1:1, adult and student. Two studies used computer-assisted instruction as the primary means of delivering the intervention (i.e., Hetzroni and Shalem 2005; Mechling et al. 2002).

Intervention Scope and Duration

Across studies, interventions spanned 4–60 or more instructional sessions, with most interventions occurring over a one to three month period. In eight of nine studies, the total number of words taught and learned was small, ranging from 6 to 15 (*Mdn* = 10). In contrast, Kamps et al. (1990) taught 60 words to two students and 105 words to another student (a student described as having strong rote memory skills). Studies that taught a greater number of words tended to include a greater number of instructional sessions, although it was not possible to quantify the relationship due to inconsistencies across studies in how instructional time was reported.

Table 1 Summary of sight word study characteristics

Study	Participants with autism	Tasks	Experimenter identified intervention	Methodological rigor
Birkan et al. (2007)	$n = 1$; CA = 6 years; Receptive language = 4:2 years (*Peabody Picture Vocabulary Test* [*PPVT*]); Some prior instruction in *Edmark* program	Read aloud words representing exercise equipment (n items = 15)	Stimulus superimposition and fading; 1:1 teacher-student	Adequate
Collins and Stinson (1994)	$n = 1$; CA = 16 years; IQ = 40; Some prior sight word instruction	Read aloud words from warning labels on flashcards; State definitions of words (n items = 12)	Progressive time delay and observational learning; Student dyads with teacher	Weak
Eikeseth and Jahr (2001)	$n = 4$; CA = 4–7 years; IQ = 20–58 (*Bayley Scales of Infant Development-II*); No prior reading instruction	Select pictures to match printed word; select written word to match pictures (n items = 6)	Discrete trials training using picture-text and text-picture matching (UCLA reading and writing program); 1:1 teacher-student	Weak
Fossett and Mirenda (2006)	$n = 1$; CA = 10 years; Receptive vocabulary = 3:3 years; Standard score = 40 (*PPVT*); No prior reading instruction	Match pictures of toys to printed words and match picture-word cards to picture-word cards; use printed word to find toys (n items = 10)	Picture-text matching and paired associate learning; 1:1 teacher-student	Weak
Hetzroni and Shalem (2005)	$n = 6$; CA = 10–13 years; IQ range = moderate mental retardation; Autism using *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-IV*; American Psychiatric Association 1994); No prior reading instruction	Select printed word to match food logo; select logo to match printed word; select printed item to match food wrapper and actual food item (n items = 8)	Stimulus superimposition and fading; 1:1 adult-supervised computer-assisted instruction	Strong
Kamps et al. (1990)	$n = 3$; CA = 8–11 years; IQ = 39–53 (*Stanford-Binet*); Some prior sight word instruction	Match printed Dolch words to pictures, read aloud flashcards, write words on board, match printed words to spoken word (n items = 60–105)	Discrete trials; 1:1 by peers, teacher and aides; small student groups with teachers and aides	Strong
Ledford et al. 2008	$n = 6$; CA = 5–8 years; Grade = K-2; *Childhood Autism Rating Scale* = 35–43; MA = 32–46 months (*Psychoeducational Profile-Revised*); Some students had prior instruction in *Edmark* program	Say letters of word, read aloud printed words representing functional vocabulary on cards; read words on environmental signs (n items = 12)	Direct instruction using constant time delay and observational learning; Student dyads with teacher	Strong
McGee et al. (1986)	$n = 2$; CA = 5–13 years; Adaptive behavior = 2–3 years (*Vineland Adaptive Behavior Scale*). Receptive language = not measurable—2:11 years (*PPVT*); Limited progress in *Edmark* program	Select printed word representing toys to match spoken word; Use printed word to find toys; Read words aloud posted in a book (n items = 9)	Incidental teaching using stimulus fading and prompting; 1:1 teacher-student	Strong
Mechling et al. (2002)	$n = 1$; CA = 9 years. Moderate range of autism (*Childhood Autism Rating Scale*); Some prior sight word instruction	Read grocery words on lists; match to grocery aisle signs, locate groceries on shelves (n items = 12)	System of least prompts; 1:1 adult-supervised, computer-based video instruction	Strong

As shown in Table 1, the types of items that were taught also varied across studies. Kamps et al. (1990) taught Dolch words (i.e., words that appear most often in connected text) whereas Ledford et al. (2008) and Mechling et al. (2002) taught items from functional word lists (i.e., words that appear often in a student's environment). Over half of the investigators selected items to be personally meaningful to individual participants (e.g., preferred toys, food items).

Sight word instruction was implemented as a stand-alone component in all studies. That is, instruction in sight words was not embedded within a lesson that included other reading components such as phonics or story comprehension. All studies, however, included at least one

instructional activity that linked the printed word with its meaning such as picture matching, functional tasks (e.g., locating groceries), or word definitions.

Dependent Measures

All studies used experimenter-developed measures rather than standardized assessments to evaluate treatment effects, and all studies reported high levels of inter-rater agreement for scoring dependent measures. The two most commonly reported dependent measures were number/percent of correct word identifications and number of instructional trials or sessions to mastery. The metric for describing intervention length and intensity varied across studies (e.g., number of trials per item during an instructional session, number of minutes per session), precluding cross-study comparison on a measure such as number of trials to learn a word or number of words learned per hour of instruction.

Studies varied in the tasks that were used to assess performance (see Table 1). About half of the studies used recognition tasks that did not require an oral reading response (e.g., selecting a picture or object to match a printed word, completing an activity in response to the printed word). Two focused on production (i.e., oral reading), asking students to read aloud words printed on cards or other materials (e.g., labels, boxes, environmental signs), and two included both recognition and oral reading tasks.

Differences between studies were also observed in evaluation of maintenance and generalization. Five studies conducted follow-up assessments at least one week after termination of the intervention to provide evidence of maintenance. Eight studies assessed generalization of sight word knowledge (e.g., different fonts, different contexts), including five that assessed transfer of sight word knowledge to a functional task (e.g., using printed words to find toys, locating items on a grocery list). However, the dependent measure was always performance on the set of words that had been explicitly taught, not on broader measures such as text reading, interest in books, or use of print to communicate outside of the instructional session.

Have There Been a Sufficient Number of High Quality Studies to Identify Sight Word Instruction as an Evidence-Based Practice for Teaching Students With Autism to Read Printed Words?

To address questions about the sufficiency of the evidence base for purposes of identifying EBP, each study was first rated on methodological rigor using rubrics within Reichow et al.'s (2008) evaluative method. Criteria for identifying EBP were then applied to studies with strong or adequate ratings on methodological rigor.

Ratings on Methodological Rigor

Overall, five studies were rated as strong, one as adequate, and three as weak. Two studies failed to provide a sufficient description of participants to meet criteria specified in Reichow et al.'s (2008) rubrics. Collins and Stinson (1994) included a score on intellectual functioning but did not identify the measure, nor did they specify diagnostic criteria or a functional description to support an autism diagnosis. This resulted in a rating of unacceptable on participant characteristics. Birkan et al. (2007) did not identify criteria for the autism diagnosis but met all other requirements related to participant characteristics, resulting in a rating of acceptable on this dimension.

Two studies fell short in demonstrating experimental control, one because no linear graphs were provided to enable judgments about the immediacy and consistency of response to the intervention (Eikeseth and Jahr 2001), and the other because the number of demonstrations of experimental effects was insufficient (Fossett and Mirenda 2006). Eikeseth and Jahr (2001) also received an unacceptable rating on visual analysis because linear graphs were not provided.

Application of Criteria for Identifying EBP

To identify a practice as evidence-based, Reichow et al. (2008) recommended a minimum of (a) five single-subject studies of strong report strength conducted by at least three different research teams, in at least three different locations, and with a total sample size of at least 15 different participants; or (b) 10 single-subject studies of at least adequate research report strength that were conducted by at least three research teams, in at least three different locations, and included at least 30 participants across studies.

The five strong studies in the present pool met the first criteria for identifying EBP, with a total of 18 participants (14 males, 4 females), ranging in age from 5 to 13 years old ($M = 8.7$ years and $Mdn = 8.5$ years). Five different research teams in five locations conducted the studies. As was the case in the larger pool of nine studies, all participants had a diagnosis of autism and were described as having significant intellectual and verbal limitations, as well as little to no prior reading experience.

Across studies, visual analysis confirmed the effectiveness of intervention efforts. That is, linear graphs showed improvement in performance from baseline for all conditions, with high percentages of nonoverlapping data points between baseline and post-instructional phases. Descriptively, all students mastered taught words in at least one instructional condition, and most students demonstrated maintenance and transfer of learning in studies in which these outcomes were assessed. Although the available body of evidence was small, there were a sufficient number of

highest quality studies (i.e., five) to meet established standards for EBP.

At the same time, there were too few studies that used the same experimenter-supplied labels to identify any of the labeled interventions as established or even promising (see Table 1). Additional analyses, therefore, focused on elements of instruction within labeled interventions.

What Can We Learn About Effective Intervention Features From High Quality, Single-Subject Experimental Studies?

As mentioned above, too few studies used exactly the same researcher-supplied treatment labels to identify any as evidence-based. To determine whether there were commonalities in approach to teaching sight words, descriptions of the interventions were coded to identify elements of instruction that have been identified as effective in previous reviews (i.e., Browder et al. 2006b; Browder et al. 2009; Odom et al. 2003). Due to the small number of studies, all five strong studies had to include a particular feature for it to meet criteria for an established sight word practice. However, a feature could be identified as promising if common to at least three strong or adequate studies with a sufficient number of participants.

As shown in Table 2, all five of the strongest studies used massed trials instruction, including (a) presentation of a succession of items, (b) differential reinforcement of correct responses, and (c) one or more forms of systematic prompting to reduce or eliminate errors. All also used visual supports in the form of pictures and/or objects, meeting Reichow et al.'s criteria for an established EBP. Although there were an insufficient number of studies or participants to validate specific types of response and stimulus prompts as established, there were a sufficient number of studies ($n = 3$) and participants ($n = 9$) to identify use of least intrusive prompts, adult-directed intervention, and modifying task characteristics to align with student's interests/preferences as promising elements of sight word instruction. Family involvement was minimal, although two studies consulted families for sight word selection. No studies made use of positive behavior supports or self-monitoring, and only one study used videotaped modeling.

Discussion

Although many textbooks and articles written for practitioners recommend sight word instruction for students with

Table 2 Distribution of intervention features in six sight word studies rated strong or adequate in methodological rigor

Intervention features	Study					
	Birkan et al. (2007)	Hetzroni and Shalem (2005)	Kamps et al. (1990)	Ledford et al. (2008)	McGee et al. (1986)	Mechling et al. 2002
Massed trials instruction						
Response to succession of items	X	X	X	X	X	X
Differential positive reinforce-ment		X	X	X	X	X
Systematic prompting	X	X	X	X	X	X
Response prompts						
Constant time delay				X		
Progressive time delay						
Least intrusive prompts	X				X	X
Mixed			X			
Stimulus prompts						
Fading	X	X				
Shaping					X	
Adult-directed intervention	X		X	X	X	X
Family involvement		X		X		
Modifying task characteristics	X	X		X	X	X
Peer-mediated intervention			X			
Positive behavior supports						
Self-monitoring						
Videotaped modeling						X
Visual supports	X	X	X	X	X	X

autism, this study was the first to apply established criteria for evaluating the adequacy of the research base in support of this approach. In all, nine single-subject, experimental studies were identified and rated on methodological adequacy using criteria established by Reichow et al. (2008) for identifying EBP. Studies with sufficient rigor were then examined more closely to identify common instructional features. Below I discuss key conclusions with respect to (a) methodological considerations in identifying practices as evidence-based and (b) substantive findings regarding sight word instruction as an EBP for teaching students with autism to read words.

Methodological Considerations in Identifying Practices as Evidence-based

In the absence of an agreed-upon set of QIs for evaluating the adequacy of single subject research and a universally agreed-upon set of criteria for identifying EBP, it is important to acknowledge that the conclusions of this study derive from a particular set of standards. Although Reichow et al.'s evaluative method comprises similar quality indicators as have been identified by other authors, it remains possible that different conclusions would have emerged using a different approach.

That said, the evaluative method, which was developed specifically for research on interventions for individuals with ASD, was easy to use and reliable. Indeed, inter-rater reliability coefficients exceeded .90 even on initial trial runs, confirming its strength. The present study is the first to demonstrate the reliability of the method when applied (a) by a research team that did not include one of its authors, and (b) to a set of studies in the academic rather than psychosocial domain. This accomplishment, in itself, represents a significant contribution to the field, one that may encourage other investigators to evaluate the evidence base on other instructional practices for students with autism.

Quality of the Research Base

The nine single-subject, experimental studies in this review were published between 1986 and 2008. Clearly, all were published before Reichow et al.'s evaluative method was disseminated, and about half were published before the publication of Horner et al.'s (2005) article on QIs for single subject research. Therefore, it is not surprising that only five of nine (55%) studies satisfied the criteria to receive the highest quality rating. In this respect, the present results align with the findings of previous investigators who have undertaken the task of rating a body of research on methodological adequacy and reported mixed findings vis-á-vis quality (Cook et al. 2009).

What accounted for weak ratings on study quality? Consistent with Browder et al.'s (2009) findings, date of publication did not necessarily forecast quality. In the present investigation, one of the highest rated studies dated back to the 1980s, and a number of more recent studies fell short on some QIs. On the other hand, several omissions that led to weak ratings were in reporting rather than design, and so they might have been avoided had the QIs been articulated when the studies were completed. For example, Collins and Stinson (1994) failed to provide the name of the IQ test for the score that they included, and Eikeseth and Jahr (2001) did not include linear graphs. These were all problems that could have been avoided had the standards been available when the reports were published. Clearly, it is important for subsequent researchers to attend to guidelines that have now been disseminated regarding quality indicators for single-subject research and standards for evidence-based practice. It is also critical for journal editors and reviewers to be familiar with the quality indicators so that they can request information that is needed to make judgments about research quality and/or provide adequate journal space to enable necessary reporting.

Recommendations for Research

Two methodological recommendations for intervention research emerged from the process of conducting this review, both aimed at facilitating syntheses of single-subject studies involving students with autism. First, a consistent set of marker variables for describing participants with ASD needs to be developed and applied. Researchers interested in the heterogeneous group of students with ASD might learn from the experience of researchers who began studying another heterogeneous group of students in the 1960s, students with specific learning disabilities. After over 25 years of struggling with noncomparability of samples across studies, a professional committee finally prescribed a set of standards to follow in describing participants of research on specific learning disabilities (Rosenberg et al. 1992).

In the field of ASD, Lord et al. (2005) already recommended use of standard measures of autism to facilitate comparison of results across studies; it remains to be seen how many researchers heed the call. In the present pool of studies, only two included scores on a standardized autism scale. Furthermore, although all studies provided descriptive information about participants, inconsistencies in score metric (e.g., standard scores, mental age) made it difficult to compare samples across studies. When reporting results of academic interventions, it is particularly critical to identify the instructional history and level of attainment of participants on the targeted skill, and to indicate how and

why individuals were selected for participation. Without such information, it is challenging to account for variations across studies in results and to make sound judgments about generalizability. In the present pool of studies, analyses of the effects of student characteristics and instructional history could not be completed due to the small the number of studies and participants, as well as to inconsistencies across studies in how students were described. Identification and dissemination of a set of marker variables for describing participants with ASD, including instructional history and selection criteria, would greatly facilitate future syntheses of results across studies.

As a second methodological recommendation, a consistent set of guidelines for reporting results of single-subject research is needed. Research reports that contributed to the present investigation did not consistently include the data needed to compare the magnitude of effects across studies (e.g., number of words mastered per hour of instruction, number of trials to mastery). Although there is still resistance to quantitative synthesis among some single-subject researchers, meta-analyses are becoming more commonplace, particularly in the field of autism. In the present pool of studies, some graphic displays were less than optimal for counting data points and narratives lacked supporting data to disambiguate results displayed in graphs. In addition, while all investigators identified number of sessions, session length was often not indicated nor was it always clear how many trials within a session a student needed to master each word. Without such data, it was impossible to compare studies on instructional time needed for each student to acquire a new word or to achieve a particular outcome (e.g., matching a word to a picture versus reading a word aloud). Identification and dissemination of guidelines for reporting and displaying effectiveness data would greatly facilitate future single-subject research syntheses.

Sight Word Instruction as an EBP for Students with Autism

Analyses of intervention features across methodologically rigorous studies provided evidence in support of a massed trials approach to sight word instruction featuring student response to a succession of items, systematic prompting, differential positive reinforcement, and use of visual supports (e.g., pictures, concrete objects). These are some of the practices that have previously been identified as effective for teaching sight words within the broader population of students with cognitive disabilities (Browder et al. 2006a, b) and for teaching skills other than word identification to students with autism (Odom et al. 2003, 2007). In addition, there was sufficient evidence to identify use of least intrusive prompting, adult-directed intervention, and modifying task characteristics as promising elements of sight word instruction.

In identifying EBP, however, it is not enough to simply count studies. Conclusions must be qualified to take into consideration characteristics of the sample of students who were targeted for sight word instruction and the outcomes of instruction that were assessed. In other words, for whom is sight word instruction an evidence-based practice, and for what purposes?

For Whom is Sight Word Instruction an EBP?

Results described in this review were based exclusively on the subset of students within the autism spectrum who were targeted for sight word intervention in prior single-subject studies with an experimental design—those with an autism diagnosis, significant cognitive and verbal limitations, and limited to no prior reading experience. No studies in the present pool included (a) students with diagnoses within the spectrum other than autism, (b) higher functioning students with autism, or (c) lower functioning students with autism but average word recognition skills. Indeed, some students with autism have strengths in the area of sight word acquisition. Logically, interventions for these students should focus on higher level decoding skills, fluency, or comprehension—not on sight words.

For what Purpose(s) is Sight Word Instruction an EBP?

All study participants learned to read prescribed sets of words, even those who had no prior history of reading instruction and who were described as nonverbal. This is a notable finding to share with IEP teams that do not currently prescribe reading instruction for some students with autism due to their cognitive and oral language deficits. As a number of authors have noted, practitioners working with students in this subgroup may need to abandon a traditional readiness approach in which printed words are not introduced until students have rudimentary verbal skills and until they demonstrate mastery of color, shape, and letter identification, concepts about print, and phonological awareness (e.g., rhyming and sorting words by beginning sounds) (Lanter and Watson 2008; Mirenda 2003). Picture-text matching activities, for example, may be a logical next step for students who use pictorial communication systems, opening the door to concurrent development of literacy and oral language.

At the same time, it is important to note that studies addressed a narrow set of reading outcomes. No investigations assessed outcomes other than number of explicitly taught words that were either recognized (e.g., matched to a picture), read aloud, and/or used to perform a functional task. Although sight word instruction has been identified as having several potential benefits, the current research base

has yielded evidence bearing on only one: enabling students to use explicitly taught printed words to perform functional tasks such as selecting items on a menu, reading environmental signs or following directions. No studies in the present pool evaluated other potential benefits of sight word instruction such as developing understanding of the communicative intent of print, enhancing motivation to learn to read, or using sight word knowledge as a starting point for instruction on alphabetic concepts and principles.

In identifying outcomes that have been addressed in research on interventions for students with autism, Lord et al. (2005) distinguished between general areas of development and specific behaviors. They used the example of improvement in communication through use of a visual system (Picture Exchange Communication System or PECS), noting a progression from research on specific behavioral outcomes to research on more general outcomes. For example, studies might look first at a child's ability to learn and use the system in a teaching situation (most specific outcomes), then at use and initiation of use of the system in different contexts, and finally at whether use of the system results in general changes in the child's social or language skills (most general outcomes).

Clearly, sight word studies for students with autism have focused on the first step: assessing whether students can learn to read specific words in an explicit and controlled teaching situation. Among these studies, several investigators have assessed generalization of knowledge to functional tasks but still within well-defined and strictly controlled contexts. Although one research report included anecdotal evidence of continued progress in reading (i.e., Fossett and Mirenda 2006), none of the single-subject studies in the present pool assessed child-initiated use of word reading skills once words were learned or spillover effects to oral language and more naturalistic reading tasks. Although sight word instruction alone is not apt to be sufficient for students to meet high literacy standards within the general education curriculum, the potential for participation in sight word instruction to make a difference in improving literacy and communication outcomes for students with autism and significant cognitive and verbal limitations is an empirical question that should be investigated in subsequent research. To advance, we need longitudinal research—studies that follow students over longer periods of time to investigate the course of development in students who participate in sight word instruction and to identify ways that teachers can build on initial sight word knowledge to achieve broader literacy goals.

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