LSHSS

Promoting Literacy in Students With ASD: The Basics for the SLP

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Teaching students to read is traditionally and rightly within the domain of the classroom teacher (Snowling & Stackhouse, 1996). Teachers, however, may not have had formal education specific to the language abilities of their students with autism spectrum disorder (ASD). The speech-language pathologist (SLP), in contrast, may feel confident to address oral language skills among these students but feel underprepared to address literacy objectives. The differing areas of expertise may help explain why the literacy needs of students with ASD are underserved; teachers and administrators around the United States have concerns about the adequacy of their literacy instruction for students with ASD (Koppenhaver, Pierce, & Yoder, 1995). SLPs are urged to help address this problem by modifying their existing speech-language interventions to include a literacy focus. The impetus for this modification includes changes to federal legislation, research findings that demonstrate that the oral language skills of students with ASD parallel their reading development, and the established understanding that oral language and literacy skills are "mutually enhanced by each other" (Sénéchal, LeFevre, Smith-Chant, & Colton, 2001, p. 444).

The reauthorization of the Individuals With Disabilities Education Improvement Act (IDEA) in 2004 requires schools to provide students with disabilities access to the general education curriculum, as well as to help those students achieve the academic standards specified in that curriculum. Students with ASD are increasingly being included in general education classrooms where attainment of literacy skills is a high priority (Simpson, Boer-Ott, & Smith-Myles, 2003). Addressing literacy skills within the broader context of an oral language intervention enables SLPs to support classroom literacy instruction, collaboratively helping students with ASD achieve curriculum standards; prepare for standardized tests of literacy (as required by the No Child Left Behind Act of 2001); and ultimately achieve higher levels of success in academics, employment, and other life skills. Furthermore, SLPs' understanding of the links between the oral language abilities and reading development of students with ASD positions them to serve as knowledgeable members of interdisciplinary literacy teams who are capable of illuminating and explaining certain reading difficulties. Most importantly, research shows that the promotion of reading skills helps some students with ASD advance their oral language

ABSTRACT: **Purpose:** This article provides a tutorial for speech-language pathologists (SLPs) concerning approaches for improving the reading skills of students with autism spectrum disorder (ASD). SLPs are encouraged to modify their role to include a literacy focus, not only because of inclusion and standardized reading tests, but also because SLPs offer skills to enrich the literacy skills of students with ASD.
Method: This article is organized to provide guidance on approaches associated with reading achievements in 3 stages of development: (a) emergent, (b) conventional, and (c) skilled reading. For each, we provide a brief overview of major achievements observed in students with typical development as well as a synopsis of what is currently known concerning the achievements of students with ASD. We then provide suggestions concerning specific approaches that can be used to further the reading and oral language skills of students with ASD within the particular stage.
Implications: This article suggests literacy interventions that target critical oral language and literacy skills that have been well documented as areas of need among many students with ASD. SLPs can draw on this information when designing and implementing transdiciplinary literacy interventions for this growing population of students whose literacy needs are currently underserved.

KEY WORDS: autism, Asperger syndrome, literacy, reading, comprehension

skills (Colasent & Griffith, 1998; Craig & Sexton Telfer, 2005; Koppenhaver & Erickson, 2003; Wolfberg, 1999).

The purpose of this article is to provide a tutorial for SLPs concerning approaches for improving the reading skills of students with ASD. It is organized to provide guidance on approaches associated with reading achievements in three stages of development: (a) emergent, (b) conventional, and (c) skilled reading. For each, we provide a brief overview of major achievements observed in students with typical development, as well as a synopsis of what is currently known concerning the achievements of students with ASD. We then provide suggestions concerning specific approaches that can be used to further the reading and oral language skills of students with ASD within the particular stage. A loosely structured stage model is illustrated because students with ASD are likely to "benefit from literacy instruction that incorporates the use of multiple instructional strategies that are carefully matched to the stages or phases of development" (Mirenda, 2003, p. 275). Readers should be aware, however, that stage models of reading acquisition oversimplify complex processes (Kamhi & Catts, 1999). Any attempts to sequence instruction should consider individual developmental variations (Teale & Sulzby, 1986).

EMERGENT READING

Major Achievements in the Emergent Reading Stage

The term emergent reading was first used by Clay (1966) to describe prereading behaviors of children. Since that time, our increased understanding of the intertwined relationships between reading, writing, and oral language has popularized the term emergent literacy (Teale & Sulzby, 1986). *Emergent literacy* is used here to broadly describe the period when students are developing those skills that precede independent reading (Sulzby, 1994). Ehri (1995) described two stages, the pre- and partial alphabetic, as occurring before students are able to read independently. In the *pre-alphabetic* stage, students who identify words do so based on their visual features rather than by connecting words, letters, or graphemes to their corresponding phonemes (Ehri & McCormick, 1998). Although some authors refer to words identified in this phase as "sight" words (Mirenda, 2003), these words should not be confused with "sight" words identified by conventional readers (Ehri, 1995). In the *partial alphabetic* stage, students are beginning to read words by connecting some, but not all, of the graphemes in words to their phonemes (Ehri, 1995). Realizing these graphophonemic connections is referred to as the "alphabetic principle" (Scarborough, 2003), which is a necessary precursor to decoding, the skill whereby students translate graphemes to phonemes (Whitehurst & Lonigan, 2003). Students with typical development who are in preschool and kindergarten generally will be working on these types of reading goals; students with special needs may not work on these types of goals until higher grades (Ehri & McCormick, 1998).

Many skill sets have been found to be predictive of students' reading ability. These include traditional literacy skills such as students' knowledge of print concepts (Scarborough, 2003), the alphabet and phonological awareness (Lonigan, Burgess, & Anthony, 2000), and oral language ability. Oral language skills that are predictive of reading have included students' broadly measured expressive and receptive language ability (National Institute of Child Health and Human Development [NICHD], 2005), vocabulary (Sénéchal et al., 2001), sentence/story recall (Scarborough, 2003), and discourse skills in both narrative and expository genres (Griffin, Hemphill, Camp, & Wolf, 2004). *Print concepts* refer to students' knowledge of the forms and functions of print, including book handling, awareness of environmental print, and written language terminology (Kaderavek & Justice, 2004). *Phonological awareness* refers to the ability to attend to the sound structure of language as distinct from its meaning. Components of phonological awareness include phonemic awareness (i.e., awareness of phoneme sequences that make up syllables and words, as evidenced in the ability to segment, blend, delete, or reorder phonemes) as well as awareness of the phonological structure of rhymes, syllables, words, and sentences.

Students developing typically and those with language delays in the absence of ASD are likely to achieve similar rates of learning among skills such as print concepts, alphabet knowledge, phonological awareness, and oral language (Boudreau & Hedberg, 1999; Sénéchal et al., 2001). Research further reveals that literacy interventions with typically developing preschool students positively affect their expressive vocabulary and oral narrative skills, emphasizing the reciprocal effects of literacy learning and oral language development during this period (Whitehurst et al., 1994; Zenenbergen, Whitehurst, & Zenenbergen, 2003).

What We Know About Emergent Reading Development in Students With ASD

In contrast to their peers with typical development, students with ASD are likely to exhibit an uneven profile in developing the varied continua of skills that are predictive of reading. For example, qualitative and databased case studies and individualized educational chart reviews reveal that some students with ASD may know the alphabet and/or be able to read some words despite also having language difficulties (Church, Alisanski, & Amanullah, 2000; Craig & Sexton Telfer, 2005; Diehl, Ford, & Federico, 2005; Koppenhaver & Erickson, 2003). We do not yet know what specific oral language abilities of children with ASD may contribute to their success in reading. Extrapolating from the broader literature on predictors of reading achievement, however, we will specifically address what is known about the vocabulary and oral narrative development of children with ASD.

With respect to vocabulary development, one study indicated that preschool children with ASD are severely delayed in their vocabulary relative to their nonverbal mental ages (Charman, Drew, Baird, & Baird, 2003). Although the discrepancies between nonverbal and verbal abilities often diminish with age in higher functioning individuals with ASD (Joseph, Tager-Flusberg, & Lord, 2002), the majority nevertheless continue to show limited vocabulary knowledge as adults (Howlin, Goode, Hutton, & Rutter, 2004). With respect to narrative development, the pragmatic aspect of oral narratives is challenging for students with ASD. Loveland, McEvoy, Tunali, and Kelley (1990) found that school-age students and adults with autism were more likely to include bizarre or inappropriate utterances during story retellings than were individuals with Down syndrome who were matched on verbal age. Students with ASD also have difficulty using evaluation in their personal narratives, and personal narratives appear to be more challenging than

storybook narratives for students with ASD (Losh & Capps, 2003). The additional challenge of personal narratives may reflect the greater requirement for generativity in formulating both the content and the structure of the narrative compared to one that is being told based on a storybook.

Intervention Suggestions for Students With ASD in the Emergent Literacy Stage

Findings from studies of students with ASD, coupled with indirect support drawn from what we know about the reading skills of students developing typically and those with learning disabilities, lend support for the use of several strategies. These strategies, which promote both oral language and reading skills in students with ASD, include avoiding reading readiness models, engaging in shared book readings, encouraging story retelling, creating dialogue around storybooks, teaching literacy in natural contexts, labeling objects and pictures to promote sight word reading, and reading and writing about language experience activities.

Avoid reading readiness models. Students entering school with limited verbal abilities, and older students whose communication difficulties persist, often have been excluded from standard literacy curricula because of misguided beliefs that they were incapable of learning to read (Colasent & Griffith, 1998; Koppenhaver & Erickson, 2003). This may be due, in part, to "reading readiness" perspectives that suggest that students must have mastered skills such as good oral language; shape, number, and color recognition; and letter identification before formal instruction in reading can occur (Mirenda & Erickson, 2000). Several qualitative and data-based case studies demonstrate that the promotion of reading skills helps some students with ASD advance their oral language skills (Broun, 2004; Colasent & Griffith, 1998; Craig & Sexton Telfer, 2005; Koppenhaver & Erickson, 2003; Wolfberg, 1999). This reminds us that just as there is no set time to begin to teach play, cognitive, social, or language skills, there is no set time to begin to teach reading. Spoken language abilities should not be viewed as a prerequisite for literacy learning.

Engage in shared book readings. In addition to being a source of enjoyment for many students, frequent and repeated readings of texts are believed to promote students' recognition of familiar schemas. Schema recognition underlies students' narrative and expository text comprehension (Englert & Hiebert, 1984; Mandler & Johnson, 1977). This encourages shared book reading interventions using both narrative and expository texts. Narrative story schemas generally are time related, include causal chaining of events and a protagonist's perspective, and encourage inference (Grabe, 2002; Kamberelis, 1999). As such, they present SLPs and teachers with an excellent context in which to model various types of evaluative language (see Table 1). SLPs and teachers should select narrative texts that have a well-developed structure with a logical sequence of events that culminates with a clear resolution and parallels the students' language development (Roth & Baden, 2001). Bellon, Ogletree, and Harn (2000) suggested using books that have simple pictures, a predictable story line, clear cause-and-effect relationships or goal-directed behavior by the protagonist, events that can be related to the students' everyday experiences to promote generalization, and elements that can easily be contextualized with manipulative props to use during readings (e.g., character puppets, figurines). Expository texts, which have a different structure than narratives, are generally written to transmit new facts and ideas to the reader (McCormick, 2003). These types of texts may be very helpful when teaching specific curriculum concepts or vocabulary. In addition, students with ASD often have particular areas of interest, such as trains, and may be highly motivated to listen to informational texts on the subject and willing to engage in conversations or other language and literacy activities built around such texts. Qualitative and databased case studies demonstrate that when students with ASD are included in frequent and repeated shared book reading interventions, some may have increases in their oral language and attention and decreases in echolalia, stereotypic behaviors, and verbal outbursts (Bellon et al., 2000; Colasent & Griffith, 1998; Koppenhaver & Erickson, 2003; Wolfberg, 1999).

Encourage story retelling. Story retelling promotes students' increasing recognition of narrative story schemas, their "sense of story" (Roth & Baden, 2001). An increased knowledge of the schema serves not only to help students increase their comprehension, but also to organize their oral narratives. SLPs and teachers can help students retell stories by using visual aids to break down the

Table 1. Modeling evaluative aspects of narratives (Losh & Capps, 2003; Reilly, Klima, & Bellugi, 1990).

Type	*Description*	*Examples*
Causative	Identifying causes for events or motivations for behaviors	"The eggs broke because the boy dropped the grocery bag." "Danny ran home so he could give his mother a hug."
Emotion and cognition	Label characters' internal states Explain internal states	"The dog is scared." "He *thinks* his frog is in the log." "Bailey is sad because he is too little to go camping."
Negatives	State conditions or situations that are contrary to expectations	"He didn't know he was touching a bear."
Hedges	Indicate uncertainty and/or the possibility of alternative outcomes or interpretations	"*Maybe* his Daddy will find the Beast."
Character speech	Adopt the character's perspective by speaking in the character's voice	"And the Beast said, 'I got you!'"
Onomatopoeia and sound effects	Draw listener's attention to story events	"The marbles went *CRRASHH* all over the floor"
Intensifiers and attention getters	Draw listener's attention to the importance of certain aspects of the narrative	"He was *very, very* happy to find his frog." "Wow! Look at that dog!"
Subjective remarks	Subjective evaluative remarks on some aspect of the narrative	"I think it they had a very exciting day." "What a scarey story!"

textual schemas and make them more explicit. For students who are not yet able to retell stories with a beginning, middle, and end, Roth and Baden suggested using a "DinoStory," whereby the head of the dinosaur represents the beginning of the story, the body represents the middle, and the tail represents the ending. Staskowski and Creaghead (2000) suggested retelling stories with visual cues such as pictures, puppets, and felt cutouts. Students should be encouraged to use the same manipulative props modeled by the SLP or teacher during their readings and retellings of selected texts. Although these techniques have not been specifically examined for students with ASD, schema recognition improves understanding and recall among typically developing students (Mandler & Johnson, 1977). Visual supports are believed to assist with this process in students with ASD because many of them have strengths in visual cognitive processing (American Speech-Language-Hearing Association [ASHA], 2006). In addition, the use of visual aids has been shown to promote text comprehension of familiar material in students with learning disabilities (Kim, Vaughn, Wanzek, & Wei, 2004).

Create dialogue around storybooks. SLPs and teachers can address oral language difficulties by crafting questions to ask students before, during, and after book readings. Students with limited expressive abilities should be provided with augmentative or alternative ways to respond. For example, the SLP or teacher may create visuals representing appropriate fields of answer choices or program answer choices in assistive devices. Questions should be reflective of the student's developmental level, with higher level language processing questions (presented in Table 2) used to the greatest extent possible. Many students and adults with ASD, including those with high-functioning autism and Asperger syndrome, can be described as having interpretive language difficulties characterized by failures to comprehend inferences and language subtleties such as metaphoric expression and ambiguity (Dennis, Lazenby, & Lockyer, 2001; Diehl et al., 2005; Griswold, Barnhill, Smith-Myles, Hagiwara, & Simpson, 2002; Minshew, Goldstein, & Siegel, 1995, 1997; Smith-Myles et al., 2002). It is not enough, however, to just select and ask higher level language processing questions. SLPs and teachers also must specifically demonstrate to students how they answer these types of questions and extract meaning from texts while they read, a process referred to as "think-alouds" (Baker, 2002). Think-alouds allow the SLP or teacher to explicitly describe the processes used by skilled readers. Through supportive dialogue used before, during, and after readings, SLPs and teachers can demonstrate how they monitor what they are reading and flexibly call on their own background knowledge to make inferences and resolve ambiguities by linking the text with their own life experiences. In addition, SLPs and teachers can use think-alouds to demonstrate repair strategies, which resolve comprehension difficulties via strategies such as rereading confusing portions of the text (Baker, 2002). The goal is for students to internalize these strategies. Although not specifically examined for students with ASD, engaging students in procedures that promote thinking aloud is a major factor in reading comprehension outcomes for student with learning disabilities (Vaughn, Gersten, & Chard, 2000), suggesting the potential benefits of using this strategy for students with ASD.

Teach literacy in natural contexts. Students with ASD may have difficulty understanding the function of literacy. SLPs and teachers are encouraged to promote these students' functional understanding of literacy by providing reading and writing instruction within natural contexts. For example, in a preschool classroom for students with autism, Koppenhaver and Erickson (2003) created flip charts with lyrics to use when singing songs with the students and encouraged the students to use literacy on a routine basis, such as by "signing in" to the classroom daily. Several qualitative and databased case studies reveal that when functional literacy tasks are built around routine events in the curriculum, rather than implementing isolated skills practice or activities that are used only sporadically, skills such as book handling, alphabet knowledge, written language attempts, and oral language improve for some preschoolers with autism (Koppenhaver & Erickson, 2003; Wolfberg, 1999).

Table 2. Reading comprehension development questions.

Level	*Definition*	*Examples*
Factual	Answers can be drawn directly from the words in the text (e.g., asking the student to identify details, cause-and-effect relationships, and sequence events that were explicitly stated in the text).	• Least difficult for students with ASD • Require only a surface interpretation • Appropriate for students with ASD for some purposes, but do not address core areas of language deficits
Interpretive	Answers require constructing inferences from the text (e.g., asking the student cause-and-effect questions not explicitly stated in the text, predicting how a sequence of events may unfold, and a main idea question that requires the synthesis of ideas).	• More difficult for students with ASD than factual level questions • Require looking "below the surface" of the text
Applicative	Answers require relating the text with the student's personal beliefs (e.g., asking the student how and why he or she would have reacted if he or she were in the situation of the character).	• Present significant difficulty even for high-functioning students with ASD • Require consideration of own internal states in imaginary circumstances
Transactive	Answers require taking the perspective of the characters or author (e.g., asking the student to state what he or she would do or say if he or she were in the shoes of one of the characters).	• May present the most difficulty for students with ASD • Require taking psychological perspective of another person

Note. Terms from Ruddell (2002). Interpretation as to how they may reflect students with autism spectrum disorder from Dennis et al. (2001), Griswold et al. (2002), Happé (1994), Minshew et al. (1995, 1997), Tager-Flusberg (1981), and Smith-Myles et al. (2002).

Label objects and pictures to promote sight word reading. Strategically using word labels may promote sight word learning in students with ASD. Koppenhaver and Erickson (2003) surrounded preschool students with autism in a plethora of functional sight words (accomplished by placing word labels directly on furniture, centers, toys, and personal belongings) and explicitly referred to them when appropriate. They also added words to their augmentative communication picture symbols. Databased case studies reveal that helping students to directly or indirectly associate words with their visual counterpart improves sight word recognition for some students with autism (Eikeseth & Jahr, 2001; Fossett & Mirenda, 2006; Koppenhaver & Erickson, 2003). This instructional strategy is referred to as picture-to-text matching.

Read and write about language experience activities. Students develop scripts based on familiar experiences in their personal lives. These scripts contribute to children's general knowledge and are called on when children link texts with their prior knowledge (Staskowski & Creaghead, 2001). Linking texts with students' prior knowledge is a necessary skill for text comprehension (Kintsch, 1998). Preceding, interspersing, or superceding language experience activities with literacy tasks seeks to help students with ASD develop scripts that contribute to their general knowledge as well as increase their understanding of literacy's functional purpose. Preceding an activity, the SLP or teacher can use a story to prepare the students. A preview story might read, "Today we are going to the grocery store. We will get on a bus. We will get off at the grocery store. We will buy food for a picnic. Then we will get back on the bus and come back to school." Interspersing literacy experiences during the activity, such as looking up the location of the grocery store in a phone book, finding the location on a map, and using a shopping list of different food labels to support the students during a grocery shopping excursion, may help the students' functional understanding of literacy's purpose. Following the activity, the SLP and teacher can include the students to the greatest extent possible in writing about the experience on a visual chart (i.e., a language experience story). Using a story outline, pictures, or other artifacts from the experience may help the students recount the experience and list the events in the proper sequence. Vocabulary specific to the experience, as well as print concepts such as writing from left to right, can be stressed. Completed versions of the story can be copied for the students to take home to their parents.

CONVENTIONAL READING

Major Achievements in the Conventional Reading Stage

The term conventional reading is used here to reflect the period when students are expected to read and draw meaning from familiar and unfamiliar texts independently (Snow, Burns, & Griffin, 1998). This involves students' word reading skills and their ability to construct meaning from texts. In terms of word reading, Ehri (1995) described two phases, the full and consolidated alphabetic, as being associated with independent reading. In the *full alphabetic* phase, students' growing knowledge of grapheme–phoneme correspondences enables them to decode unfamiliar words (Ehri & McCormick, 1998). Establishing grapheme–phoneme correspondences often is the focus of instruction in the first grade (Snow, Scarborough, & Burns, 1999). Words that are practiced frequently by linking graphemes to phonemes become recognizable automatically, what some call by "sight" (Ehri, 1995), that is, they are the sight words of the conventional reading stage. In the *consolidated* alphabetic phase, students are able to identify frequently reoccurring letter patterns such as morphemes, syllables, or subsyllabic units such as onsets and rimes (Ehri, 1995). Onsets are the beginning sounds of words, often consonants; rimes are the ending sounds, often vowels and consonants (Ruddell, 2002). This phase also may be called orthographic because letter sequences and spelling patterns are recognized without phonetic decoding (Kamhi & Catts, 1999). Students in this phase can read by analogy, the process of using known words to read new words based on shared letters (e.g., using knowledge of *beak* to read *peak*) (Ehri & McCormick, 1998). Second grade is when many students with typical development begin to consolidate frequently reoccurring letter patterns (Ehri, 1995).

For students who are developing typically, word reading ability generally develops parallel to their ability to construct meaning from texts (Nation, 1999). Research reveals that skills relating to phonological awareness are critical for students' word reading ability (NICHD, 2000), and that most students who struggle to acquire word reading skills have weaknesses in phonological awareness that may or may not be accompanied by more general language impairments (Eisenmajer, Ross, & Pratt, 2004). The roles of broader oral language skills are unclear in terms of students' word reading abilities but they are associated with students' reading comprehension (NICHD, 2005). Thus, SLPs and teachers should target word reading skills within contexts that also foster students' construction of meaning.

What We Know About Conventional Reading Development in Students With ASD

Research suggests that many students and adults with ASD can be characterized as having word reading skills that are advanced relative to their overall reading comprehension (Church et al., 2000; Diehl et al., 2005; Minshew et al., 1995, 1997; Smith-Myles et al., 2002; Wahlberg & Magliano, 2004). This profile parallels their relative strength in oral language in using language forms. Although there are students with ASD who fail to develop verbal communication skills and thus clearly have severe form difficulties, verbal students with ASD cannot be distinguished reliably on the basis of their syntax or phonology from other children matched for mental age. In addition, verbal students with ASD appear to advance through a normal sequence in their structural–linguistic productions (see Watson & Ozonoff, 2000, for a review). It is important to understand that the diagnosis of ASD is based in part on the presence of a communication disorder rather than a structural language disorder (Paul, 1995).

Most studies of reading in students with ASD have focused on children with higher intelligence quotients (IQs), but findings from a recent study of school-age students across a broader range of functioning levels illustrate the heterogeneity in reading profiles among students with ASD (Nation, Clarke, Wright, & Williams, 2006). Of the 41 children in the study, 32 had measurable reading abilities. Approximately two thirds of these "readers" had poor reading comprehension scores, but 12 of the 32 children also had poor word reading scores. Thus, not all children with ASD easily attain skills in word reading, and those who struggle will require

specific attention to this area of need along with their other language and literacy needs.

When students' word reading skills are exceedingly advanced compared to their text comprehension and chronological age, Nation (1999) describes them as having hyperlexia. Aram (1997) posited that language impairment underlies the reading comprehension difficulty. Although reported in clinical populations other than ASD (e.g. Snowling & Frith, 1986), the incidence of hyperlexia may be elevated among students with ASD rather than other development disorders (Grigorenko et al., 2002). Table 3 provides the characteristics of individuals with hyperlexia as defined in some recent reviews of the literature. The research community has not established or accepted an operational definition and assessment protocol for hyperlexia (Grigorenko et al., 2002; Nation, 1999).

Intervention Suggestions for Students With ASD in the Conventional Reading Stage

Many of the strategies recommended for emergent readers with ASD will continue to be appropriate in supporting students with ASD who are at the conventional reading stage. Additional strategies to facilitate the development of conventional literacy among students with ASD have been garnered from studies of children and adults with ASD as well as from research on students with learning disabilities and language impairments. These strategies, which address both oral language and reading skills in students with ASD, include promoting phonological awareness, using computer software, helping students construct meaning through dialogue, and matching the text with the language strategy.

Promote phonological awareness. Preliminary research suggests that students with ASD use quantitatively and qualitatively similar phonological cues to read words (Calhoon, 2001) and that verbal students with ASD are not disproportionately more challenged than their peers with typical development in developing phonological awareness (Bishop et al., 2004). This encourages SLPs and teachers to promote phonological awareness of students with ASD to help develop their word reading skills. Using visual aids may assist with this process. To teach grapheme–phoneme correspondences, Temple Grandin (1992), a successful livestock equipment designer who has autism, suggested using associative letter-to-sound pictures, such as a picture of a choo-choo train for the /tʃ/ sound, a cat for the hard /k/, or somebody praying for the long ā, /e/. To help students understand that words are made of syllables, Ruscher and Hammett (1997) recommended using one fourth of an egg carton, dressing it up as a caterpillar, and using the molds to illustrate the syllables in words. To teach reading by analogy, these authors recommended using flip chart books, with onsets on the left that can be paired with rimes on the right, and blocks with printed onset-rime sound patterns. Students with ASD have been found to use their knowledge of rime units when reading words, suggesting that analogy-based instruction may be especially beneficial (Calhoon, 2001). Although there is no direct support for using these strategies, many students with ASD have relative strengths in visual learning (ASHA, 2006), supporting the use of visual aids to teach word reading skills.

Table 3. Characteristics of hyperlexia.

Exceptional word reading skills that are well in advance of reading comprehension
Early onset of precocious word reading with unparalleled comprehension
A compulsive preoccupation with reading
Variable intellectual quotients including cognitive impairments
Generally score higher on Performance than Verbal composites on IQ tests
Delayed speaking, echolalia, and/or prosodic abnormalities
Able to read nonwords, dismissing overlearned sight vocabulary
Difficulty with rhyme may be due to limited expressive and receptive language skills

Note. Reviews of empirical studies adapted from Nation (1999) and Grigorenko, Klin, and Volkmar (2003).

Use computer software. There are an increasing number of word study software programs that support students in practicing their developing knowledge of the alphabetic principle and onset-rime manipulation. Some initial outcome data support the idea that computer-aided literacy instruction can increase phonological awareness, word reading, language expression, and enjoyment in students with ASD (Heimann, Nelson, Tjus, & Gillberg, 1995; Tjus, Heimann, & Nelson, 2001). Students with ASD also may be motivated to engage in word reading activities by having their own works personalized with images that have been read by a talking word processor or added via image libraries. SLPs and teachers should collaborate with their school's technology specialist to explore available options.

Help students construct meaning through dialogue. Using comprehension questions at the interpretive level and beyond (see Table 2), paired with SLP or teacher think-alouds (detailed in the emergent section), seeks to promote students' with ASD ability to construct meaning from texts. As students become increasingly capable of word reading, freeing up cognitive resources for text comprehension, they can be coached through their own process of answering inferential questions, comprehension monitoring, and repair (i.e., student think-alouds). Procedures that promote thinking aloud assist students with learning disabilities in comprehending texts (Vaughn et al., 2000), suggesting the potential benefit of this strategy for students with ASD.

Match the text with the language strategy. It is customary in the early elementary grades in public schools to use reading programs that focus on promoting word reading skills. Currently, these programs include books that have been engineered to provide text that is decodable, with specific reference to the skills that are being taught (Cunningham et al., 2005). SLPs and teachers will need to analyze these books for their language content and determine how and if they can be used to facilitate reading and listening comprehension for students with ASD. Research shows that students with adequate word reading abilities but poor spoken language comprehension are at risk for reading comprehension difficulties (Catts, Adolf, & Ellis Weismer, 2006). In younger grades, however, reading comprehension difficulties may not be apparent in children because reading comprehension tests are heavily dependent on children's word reading abilities (Catts et al., 2006). Conversely, classroom read-aloud texts may be too advanced for the students' language processing abilities, making them inappropriate for use when working on comprehension goals. SLPs are urged to familiarize themselves with their school's language arts curriculum in terms of the goals and materials used to promote reading and their appropriateness for efforts to support language development, and to find resources to supplement the standard curriculum materials when necessary to meet the individual needs of students with ASD.

SKILLED READING

Major Achievements in the Skilled Reading Stage

The term skilled reading is used here to reflect the period when students can "derive meaning from printed text accurately and efficiently" (Scarborough, 2003, p. 97). In this stage, students' word reading skills are developed enough that they should not interfere with their ability to construct meaning from texts (Snow et al., 1998). Cognitive resources can now be spent on the comprehension process (Scarborough, 2003). In regular education classrooms, third grade is when many students are expected to be able to learn from reading; content in subject areas becomes increasingly supplemented with textbooks (Snow et al., 1999). By fourth grade, most students with typical development are expected to learn from what they read (Snow et al., 1998).

In addition to adequate word reading skills, reading comprehension also requires vocabulary and broader language skills, prior knowledge, and the application of active mental strategies to help one make sense of the text (Caccamise & Snyder, 2005). Mental strategies may include questioning, predicting, mental image construction, relating the text to one's prior knowledge, monitoring one's comprehension, summarizing, and seeking clarification when necessary (Caccamise & Snyder, 2005). Reading comprehension difficulties can result from limitation in any of these skills. When students are struggling with reading comprehension because they do not know the vocabulary in the text, are not able to interpret the relationships among the words, or have an inadequate ability to make inferences, their "reading comprehension deficits are essentially oral language limitations" (Scarborough, 2003, p. 98). These deficits may be exacerbated if the student reads passively, failing to apply mental strategies during reading tasks (Caccamise & Snyder, 2005).

What We Know About Skilled Reading Development in Students With ASD

The majority of students with ASD do not become skilled readers because of difficulties with interpretive language that are evident in their oral and written language activities. This is the case for students with both autism and Asperger syndrome. One recent review of research concluded that the evidence is not convincing that higher functioning individuals who have been diagnosed with autism differ in predictable ways from individuals who have been diagnosed with Asperger syndrome (Macintosh & Dissanayake, 2004). As such, research findings may be applicable to both groups.

In terms of oral language, Tager-Flusberg (1981) found that students with ASD are more likely to interpret language literally than are students without ASD who are matched on verbal and nonverbal measures. When given props to act out sentences, students with ASD were more likely to act them out based on exactly what was said rather than what was more likely to occur in real world situations. Dennis et al. (2001) similarly found that students with high-functioning autism and Asperger syndrome were able to understand words that convey an internal state (e.g., know, remember, forget, think, believe) but failed to infer what they meant in context. This finding parallels Happé (1994), who found that students and adults with ASD have considerably more difficulty drawing inferences from stories in terms of character motives than do individuals with general cognitive impairments or typical development. These findings are consistent with several descriptive studies that have used standardized measures of oral language to examine the inferential abilities of students with high-functioning autism and Asperger syndrome. Griswold et al. (2002) found that students with Asperger syndrome scored considerably lower than the mean when answering questions requiring inference, prediction, and perspective taking related to characters and events. Similarly, Minshew et al. (1995, 1997) found that students and adults with high-functioning autism scored significantly lower than individuals with typical development (matched on full-scale IQ) on measures examining inferences, including metaphor and verbal absurdities.

In terms of reading comprehension, Wahlberg and Magliano (2004) found that adults with high-functioning autism have significantly more trouble recalling information from ambiguous texts than do participants with typical development matched on IQ. Several descriptive studies using formal and informal measures of reading comprehension support this finding. Smith-Myles et al. (2002) found that adolescents with Asperger syndrome incorrectly answered almost two thirds of the inferential questions on The Classroom Reading Inventory (CRI; Silvaroli, 1993), an informal reading inventory. Minshew et al. (1995; 1997) similarly found that students and adults with high-functioning autism scored significantly lower than individuals with typical development (matched on full-scale IQ) on standardized reading comprehension measures. Although some of these studies examined the ability of adults, it is reasonable to extend the findings to school-age students.

It is important for SLPs and teachers to realize that students with ASD may be able to answer reading comprehension questions at a factual level. This may explain why some students with ASD score within the normal range on formal measures of reading comprehension (Griswold et al., 2002). True reading comprehension, however, requires that students be able to make inferences. According to Kintsch (1998), a prominent researcher in the field of text comprehension, reading comprehension at the surface level, or directly from the words in the text itself, results in an impoverished and incoherent interpretation of the complete text. He argued that skilled reading requires a deep interpretation of the text, whereby students supplement the words in the text by drawing on their prior knowledge and experiences from long-term memory to construct inferences. Individuals with ASD appear challenged by their ability to make use of their prior knowledge to interpret ambiguous language in texts (Wahlberg & Magliano, 2004) and exhibit limited text monitoring while reading (O'Connor & Klein, 2004). It may be that the difficulty that individuals with ASD have making use of their prior knowledge to interpret ambiguous language leads to the poor text monitoring and reading comprehension skills that they exhibit (K. Erickson, personal communication, March 14, 2007).

The finding that students with ASD have reading comprehension difficulties at a deep, rather than surface, level runs parallel to evidence of their relative strengths in using language forms and weaknesses in language use. Collectively, these issues can be related to three prominent neuropsychological theories proposed to explain ASD: "Theory of Mind" (ToM), weak central coherence, and executive functioning. *ToM* has been defined as the ability to form representations of other people's mental states and to use these representations to understand, predict, and judge utterances and behavior (Baron-Cohen, Leslie, & Frith, 1985). Difficulties with ToM would influence one's ability to make inferences in written

language, particularly in narrative texts that depend on the reader's ability to assume the psychological perspective of the characters. *Weak central coherence* implies that an individual has difficulty in using context to derive meaning (Martin & McDonald, 2003). In other words, the theory of weak central coherence helps explain why students with ASD cannot infer meaning that is not stated explicitly but is inferred from the overall context of the text. Finally, *executive functions* comprise a system that enables us to adapt to new situations in a flexible manner (Martin & McDonald, 2003). Skilled reading requires students with ASD to flexibly adapt to changes in the text.

Intervention Suggestions for Students With ASD in the Skilled Reading Stage

Research on individuals with ASD, with typical development, and with learning disabilities offers direct and indirect support for several strategies to promote both oral language and reading skills in students with ASD at the skilled reading stage. These strategies include matching the text with ability, focusing on deep rather than surface questions, considering group reading, building background knowledge, linking texts with prior knowledge, using visual aids, and promoting text monitoring.

Match the text with ability. One way to maximize success in comprehending texts is by providing texts at the appropriate level of difficulty. This requires assessing the students' reading comprehension, listening comprehension, and word reading to illuminate specific areas of need and offer a profile of specific strengths and weaknesses that can then be used to help guide instructional choices (Carlisle, 1989). After determining students' levels of comprehension, the teacher should modify the content within the curriculum texts to a suitable level or supplement them with carefully chosen texts. This may involve using texts that are one or two grades below the students' word reading abilities. Control of task difficulty has been found to be a major factor in the achievement outcomes for students with learning disabilities (Vaughn et al., 2000), suggesting the potential benefit of this strategy for students with ASD.

Focus on deep rather than surface questions. Instructional activities using comprehension questions at the interpretive level and beyond should continue to be the focus for students with ASD (see Table 2). An emphasis on higher level interpretive language questions is not to suggest that factual level questions should be avoided. Factual level questions can be used to demonstrate specific knowledge of curriculum objectives, increase students' rate of success and level of motivation, and provide a starting place for students who are having grave difficulty when asked to infer from written texts. Factual questions, however, do not target difficulties with inference that are so prevalent among students with ASD. Improving the ability of these students to draw inferences is necessary for skilled reading (Kintsch, 1998). In addition to asking these types of questions, SLPs and teachers can help students by using the techniques detailed in the emergent and conventional sections.

Consider group reading. Paired or small-group reading with socially supportive, academically capable peers may help students with ASD comprehend texts. Paired or group reading approaches involve engaging two or more students in directed discussions with varying levels of adult scaffolding. Literature response groups, for example, position a small group of students to collectively share personal experiences similar to the characters in the story, and query how they interpreted a character's action and what they would do if they were the character in the story (Ruddell, 2002). In one study of school-age children with ASD, a reciprocal questioning approach (Palincsar & Brown, 1984) was used to improve the comprehension outcomes of students with ASD working first with their teacher to learn the strategy and then with their peers (Whalon, 2004). Using small interactive groups also has been a major factor in the reading achievement outcomes for students with learning disabilities (Vaughn et al., 2000).

Build background knowledge. The more students know about a topic, the more likely they will be to understand a text on that subject (Kintsch, 1998). This encourages SLPs and teachers to provide a solid knowledge base for the content in the texts before reading activities. In an effort to build the knowledge base, Colasent and Griffith (1998) presented a content overview before reading themed books to students with autism. Building background knowledge also may be accomplished through language experience activities or lessons that use expository texts. Many students with ASD have relative strengths in visual learning (ASHA, 2006), supporting the use of visual aids in the forms of semantic feature analysis, semantic maps, or Venn diagrams, which can be used to help support students in brainstorming and organizing known information related to a topic before reading. Different computer software packages also are available that support building background knowledge by providing introductory activities, such as presenting movies before full texts to read or supporting the reader in considering information related to a topic before reading. We encourage SLPs and teachers to consult with their schools' technology specialist to explore and evaluate software packages that provide this feature.

Link texts with prior knowledge. Presenting students with ASD with abstracts and titles for texts may help them to activate their prior knowledge. Wahlberg and Magliano (2004) found that adults with high-functioning autism were able to recall more information from reading passages that were preceded by concrete titles and abstracts. Using prereading questions may not be as effective a strategy. O'Connor and Klein (2004) found that prereading questions distracted from the focus of the text for some students with ASD, resulting in decreased text comprehension. This finding underscores the need to teach students with ASD to call on and flexibly apply their prior background knowledge while reading. Helping only to activate their prior knowledge may be insufficient.

Use visual aids. Visual aids can be used to help students improve their textual comprehension. Before readings, concept webs and Venn diagrams may be used to preteach reading content. Story maps or framed outlines can be used to highlight the textual schema before, during, and after reading a written narrative; knowledge of the textual schema assists with text comprehension and recall for students who are typically developing (Mandler & Johnson, 1977). The visuals chosen for this purpose should highlight familiar text schemas that parallel the text schema being used in the text (Staskowski & Creaghead, 2001). These types of visuals also should be consistent with the students' language abilities, which may require SLPs and teachers to create individualized visual aids for their students with ASD. Visuals also can be used to help students with ASD infer characters' thoughts. Wellman et al. (2002) found that using thought bubbles helped students with ASD increase their ability to correctly answer questions pertaining

to those characters' thoughts during verbally presented problem-solving tasks. SLPs and teachers can draw thought bubbles over copied pictures from texts or can have students with ASD draw character representations and accompany them with thought bubbles. Although there is no direct support for using these strategies, many students with ASD have strengths in visual cognitive processing (ASHA, 2006), and students with learning disabilities have been found to improve their reading comprehension of familiar material when assisted with visual aids (Kim et al., 2004). Visual aids always should be coupled with supportive, interactive dialogue. Rubin (2004) reminds us that some students with ASD are more likely to benefit from verbal supports, making a combined approach more appropriate.

Promote text monitoring. Students with ASD have been observed to quickly read through passages with few pauses and little rereading of certain sections (O'Connor & Klein, 2004). In addition to using the think-aloud protocols discussed in the emergent and conventional sections, presenting questions throughout a passage and not just at the end of a passage may help students with ASD monitor their text comprehension. O'Connor and Klein found that when they interspersed questions in a text that asked students to select an antecedent to a pronoun from a choice of three, or complete cloze questions about a segment of the text, students with ASD would pause and reread sections of the text to find the answer. O'Connor and Klein found that the use of the pronoun antecedent questions significantly increased postreading comprehension with a medium effect size ($\eta^2 = .42$). Although use of the cloze questions did help some of the participants with responses to postreading questions, more research is needed to determine the exact merits of using this technique.

CONCLUSION

In the context of the current scope of practice for the profession, SLPs are encouraged to modify their speech-language interventions to include a literacy focus for students with ASD. Research suggests that the literacy skills of many students with ASD parallel their oral language abilities. An understanding of the close relationship between the oral language and literacy needs of students with ASD positions the SLP to serve as a valuable member of an interdisciplinary literacy team. Furthermore, research suggests that through instruction directed at literacy objectives, the oral language skills of students with ASD improve. Unfortunately, minimal empirical research is available to guide SLPs and teachers in their efforts to teach students with ASD to read. This is troublesome because IDEA (2004) and the No Child Left Behind Act (2001) encourage educators to use proven methods. Although the suggestions presented within this tutorial lack strong empirical support, we argue that they are worthwhile because they target critical oral language and literacy skills that have been well documented as areas of need among many students with ASD. The information provided can enable SLPs and teachers to more precisely address the literacy needs of these students and to speak more confidently about why they chose their literacy interventions during meetings with parents and colleagues. In addition, the tutorial serves to alert SLPs and teachers to important research issues related to language and literacy instruction for students with ASD. Considerable future research will be required to fully establish effective ways of meeting the literacy needs of students with ASD. Recognizing this need, SLPs and teachers can play a role in advocating for such research. Until then, we offer a starting point to proactively address the literacy needs of this growing population of students.

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Received October 17, 2005
Accepted April 23, 2007
DOI: 10.1044/0161-1461(2008/004)

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