EFFECTS OF ADAPTED INSTRUCTION ON THE ACQUISITION OF LETTER-SOUND CORRESPONDENCES AND SIGHT WORDS BY PRE-ADOLESCENT/ADOLESCENT LEARNERS WITH COMPLEX COMMUNICATION NEEDS AND AUTISM SPECTRUM DISORDERS

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ABSTRACT

Successfully learning to read and write is not an isolated skill, but rather a complex process of integrating and applying component skills and knowledge (Adams, 1990). The ultimate goal of literacy interventions is to support an individual to independently read, extract meaning, and learn from connected text (Carnine, Silber, Kame’enui, & Tarver 2010; Duke & Carlisle, 2011). Reading and writing skills are especially important for individuals with complex communication needs (i.e., CCN, speech skills that do not meet their daily communication needs). With literacy skills, individuals can use a range of communication options, fully participate in society, and potentially change attitudinal barriers (e.g., low expectation, lack of inclusion). Knowledge of letter-sound correspondences and sight words are needed in order to read and write and are two important components to early literacy instruction (Carnine et al., 2010; Gabig, 2009). Two studies were conducted in order to investigate the impact of adapted instruction on the acquisition of letter-sound correspondences (Study 1) and sight words (Study 2), by older learners, with severe disabilities, autism spectrum disorder, and CCN. A multiple baseline across behaviors (letter-sound sets or sight word sets) research design was used to evaluate the effects of the adapted instructions. All three participants (ages 9 to 18) for Study 1 demonstrated positive gains from baseline, with two out of three participants reaching criterion for the 12 letter-sound correspondences targeted during instruction. Two learners from Study 1 participated in Study 2 and reached criterion for acquisition of 12 personally relevant sight words targeted during instruction. Results of these studies provide evidence that older learners with limited past literacy success, severe disabilities, autism spectrum disorder, and CCN can acquire letter-sound correspondences and sight words through direct instruction combined with meaningful and motivating activities. Results, social validity, educational implications, and future research directions are discussed.

Keywords: literacy, augmentative and alternative communication, autism spectrum disorder, letter-sound correspondence, sight words, adolescents
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CHAPTER ONE
Introduction and Review of the Literature

No single intervention will have as dramatic effects on a student’s future as a solid foundation in literacy (Heller, Fredrick, Tumlin, & Brineman, 2002). The acquisition of reading and writing skills are key, for all individuals, as these skills support the ability to communicate effectively; access knowledge; gain independence; participate fully in educational and employment opportunities; access a range of leisure pursuits; use a variety of technology; foster relationships; and exercise choice (Houston & Torgesen, 2004; Light & McNaughton, 2013). Reading and writing skills are especially important for individuals with complex communication needs (i.e., CCN, speech skills that do not meet their daily communication needs) (Benedek-Wood, 2010; Fallon, Light, McNaughton, Drager, & Hammer, 2004; Foley & Wolter, 2010; Light & McNaughton, 2013).

With access to literacy skills, individuals with CCN are no longer reliant on communication partners to provide symbols to represent messages they wish to share (Fallon et al., 2004; Light & McNaughton, 2013). Rather, with literacy skills, individuals can use a range of communication options (including mainstream technology like social media and texting), independently generate and share their own messages, and potentially change attitudinal barriers (e.g., low expectation, lack of inclusion). As Light and McNaughton (2013) stated, “Given the importance of literacy skills, it is encouraging to find clear evidence that individuals with CCN can indeed learn to read and write despite their limited access to speech” (p. 310).

Unfortunately, most students with CCN demonstrate significant difficulties with reading and writing when compared to typically developing peers (Koppenhaver & Yoder, 1992; Sandberg, 2001), and outcomes indicate the majority of individuals with CCN are unable to read or write at grade level (Koppenhaver & Yoder, 1992; Foley & Wolter, 2010). These reading deficits persist through adolescence into adulthood. Currently, up to 90% of individuals with CCN enter adulthood without acquiring
Factors Affecting Literacy Learning

Intrinsic and extrinsic factors impact successful literacy outcomes for individuals with CCN (Foley & Wolter, 2010; Light & McNaughton, 2013). Literacy learning is more challenging for individuals with CCN as they may have vision, hearing, motor, cognitive, speech and language impairments (or a combination of these impairments) that limit their ability to: (a) visually and auditorily discriminate between letters and their sounds, (b) manipulate and attend to material, (c) understand directions, (d) produce spoken output, (e) use working memory, and, (f) apply experiences and world knowledge (Light & McNaughton, 2013). Intrinsic challenges are not reasons to disregard or abandon literacy instruction. Rather, concerted efforts should be made to ensure individuals are provided with adapted and evidence-based instruction in order to maximize literacy and communication outcomes (Light & McNaughton, 2013).

Extrinsic factors can exacerbate the challenges an individual faces in literacy learning. Extrinsic factors can include limited language and literacy experiences (Light & Kelford-Smith, 1993), inadequate literacy instruction (both in terms of quantity and quality) (Koppenhaver, Evans, & Yoder, 1991), low expectations (Koppenhaver & Yoder, 1992), and limited certainty of evidence to guide adapted literacy instruction (Foley & Wolter, 2010). Yet all learners have a right to literacy intervention across the lifespan (Erickson, Koppenhaver, & Yoder, 2002). Given the intrinsic and extrinsic factors and history of poor literacy outcomes for individuals with CCN, it is critical to investigate interventions for improving the reading skills of individuals with CCN. Furthermore, it is important to investigate any specific considerations that are potentially required for certain populations (e.g., autism spectrum disorders).

Considerations specific to ASD

Individuals with autism spectrum disorders (ASD) contribute to the heterogeneous group of individuals with CCN and the growing needs in the special education and the general education
population (Goodman & Williams, 2007). As prevalence rates for ASD continue to increase (Center for Disease Control, 2014), the need for teachers and researchers to develop and identify best practices for teaching students with ASD is of utmost importance. This includes an urgent need to provide and develop instructional activities that support the acquisition of reading skills in order to support optimal educational outcomes and prepare individuals for independent vocational and recreational social opportunities.

**Intrinsic factors**

Diagnosis of ASD now requires impairment in two core areas of development including persistent social communication and social interaction deficits and restricted or repetitive behaviors (DSM-5; American Psychiatric Association, 2013). To qualify for a diagnosis of ASD using the Diagnostic and Statistical Manual of Mental Disorders- Fifth Edition (DSM-5) criteria, a child must exhibit deficits in all social-communication areas (e.g., nonverbal communicative behaviors for social interaction, developing, maintaining, and understanding relationships, and/or adjusting to social context). Delays in social communication and interaction often lead to lower academic performance, maladaptive behavioral issues, and deficits in functional living skills (Gillham, Carter, Volkmar & Sparrow, 2000). Intrinsic factors, like limited speech and language skills, observed with the diagnosis of ASD place these individuals at-risk for reading difficulty (Fey, Catts, & Larrivee, 1995). As many as 50% of learners with ASD never develop functional speech (Lord & Paul, 1997) and the majority of individuals with ASD demonstrate language delays (Kjelgaard & Tager-Flusberg, 2001). Difficulties in these areas (i.e., producing and/or comprehending language) are likely to have serious implications for these individuals learning how to read and participating in reading and writing instructional activities (Benedek-Wood, 2010).

In addition to speech and language delays, intrinsic factors related to behavior can impact reading acquisition for learners with ASD. Individuals with ASD many have: (a) deficits in social interaction, impacting interaction and response during instruction (Benedek-Wood, 2010), (b) a restricted repertoire of interests leading to difficulty in engagement in new tasks or tasks of limited interest; (c) attention
issues, potentially impacting acquisition of new skills and generalization across different contexts (American Psychiatric Association, 2013); and, (d) maladaptive behavioral issues, negatively impacting the participation of learners (Blischak, 1994). Again, implicit difficulties with these characteristics that are likely observed with a diagnosis of ASD can affect overall reading outcomes and participation in reading and writing instructional activities.

**Extrinsic factors**

In addition to intrinsic factors, extrinsic factors that individuals with ASD and CCN encounter can contribute to poor literacy outcomes. Extrinsic factors like inadequate literacy instruction (both in terms of quantity and quality) (Koppenhaver et al., 1991), low expectations (Koppenhaver & Yoder, 1992), and limited world knowledge and experiences (Koppenhaver & Erickson, 2009), are barriers to optimal outcomes for individuals with severe disabilities including those with CCN and ASD. As Lumsford and colleagues (1990) stated, “Literacy is a right and not a privilege: a right that has been denied to an extraordinary number of our citizens” (p.2).

People characterized as having extensive disabilities, including those with CCN and ASD, have historically been viewed as incapable of developing literacy skills (Morgan, Cuskelly & Moni, 2011). Therefore, literacy instruction has often either been denied to them or provided in ways that did not meet their learning needs. As previously stated, although a growing body of research has demonstrated that individuals who use AAC can learn to read when provided with appropriate evidence-based instruction (Light & McNaughton, 2009b), the overall outcomes remain poor related to those with CCN obtaining literacy (Mirenda & Erickson, 2000).

Continued poor outcomes are potential contributors to continued low expectations or lack of literacy goals for individuals with CCN and ASD. For example, in a qualitative study with special education teachers, Ruppar, Gaffney and Dymond (2015) found that not all teachers saw literacy as a realistic goal for their students with severe disabilities. As one teacher reported, her goal was “exposure”
when teaching literacy and indicated that literacy was “a bonus,” as she did not “see a relationship between literacy and participation in everyday self-help skills” (p. 220).

The unique intrinsic factors, coupled with low expectations, impact the prior knowledge and experiences that individuals with CCN and ASD ultimately bring to literacy instruction. Morgan and colleagues (2011) postulated that a person’s literate identity is shaped through prior knowledge, past experiences, and literacy practices. Prior knowledge and world experiences are often reduced, as less meaningful interactions and opportunities for exposure without drill and testing are seen with individuals with severe disabilities (Mirenda & Erickson, 2000). Reading experiences of individuals with ASD and CCN are often provided based on “readiness” (Mirenda & Erickson, p. 352), rather than an emergent literacy instructional model. Reading and writing are not solely learned through direct instruction of discrete skills, rather during thousands of hours of meaningful interactions – learning about the functions and forms of print and then refined with systematic instruction (Mirenda & Erickson, 2000). Yet, unfortunately, too often individuals with ASD spend years learning “prerequisite” skills (e.g., shape, number, and color recognition; letter identification) prior to the introduction of explicit literacy instruction (Ruppar, Dymond, & Gaffney, 2011; Mirenda & Erickson, 2000).

Considerations specific to older learners

Due to the “readiness” model or lack of acknowledgment of literacy as a functional skill for individuals with severe disabilities (including those with CCN and ASD) (Ruppar et al., 2011), individuals may be older when they first participate in literacy instruction. As Light and McNaughton (2009b) stated:

Individuals with AAC needs may be older when they first have the opportunity to participate in conventional literacy instruction, either because they missed out on these instructional opportunities at a younger age or because they required additional time to develop basic communication skills. There is evidence that individuals with AAC needs can benefit from literacy instruction at any age” (p. 7).

Specific considerations for older learners, including pre-adolescents and adolescents with CCN and ASD, include understanding past experiences and prior knowledge (including negative or
unsuccessful learning experiences) as well as motivation. The extrinsic factors are often exacerbated as an individual progresses through school; potentially with years of inappropriate instruction or lack of instruction, coupled with lower and lower expectations due to lack of progress or success. Unsuccessful learning experiences impact future literacy instruction. Literacy experiences that are not adapted to meet individuals’ needs lead to lack of success – success in achieving the target skill and success in creating appropriate and correct neural networks required for many literacy skills (Adams, 1990). Literacy instruction for older learners often work to re-build correct neural networks through repeated successful opportunities (Cunningham, Nathan, & Raher, 2011). In addition, older learners rarely reach fluent and automatic knowledge of foundation skills (Menon & Hiebert, 2011), impacting skills that build upon these foundations skills. When the foundation skills are not fluent and automatic, more cognitive resources are required to complete a task (e.g., lack of fluent letter-sound correspondence knowledge impacts the cognitive resources required to decode a constant-vowel-constant word) (Rasinski, Reutzel, Chard & Linan-Thompson, 2011).

Although important for all individuals, especially important for older learners, literacy instruction should be motivating, interesting, and age-appropriate (Foley & Wolter, 2010). Additionally, it should be personally relevant (Light & McNaughton, 2013), incorporating interests of the individual when possible. Combining recommended practices from Light and McNaughton (2013) and Koppenhaver (1992), literacy instruction targeted for adolescent learners should be: (1) organized around a meaningful activity; (2) responsive to developmental needs/interests and age appropriate; (3) based on prior research of effective reading instruction; and, (4) supportive of multiple and interesting opportunities to continue to expand knowledge and learning.

**Literacy Instruction Experiences of Individuals who use AAC**

Home and school environments may limit literacy learning opportunities by making literacy a lower priority due to the immediate needs related to care routines (Koppenhaver & Yoder, 1992; Light & Kelford Smith, 1993). Literacy instruction in classroom environments has been reported to differ
significantly for students who use AAC compared to instruction for speaking peers (Koppenhaver & Yoder, 1992). According to one study, students with severe communication disabilities received an alarmingly limited amount of reading “instruction” (17-29 minutes per day), significantly less than their nondisabled peers (Koppenhaver & Yoder, 1992). Additionally, as individuals with severe disabilities (including those with CCN and ASD) continue through school-based educational opportunities, literacy instruction opportunities often decrease; instruction typically focuses on a specific type of literacy instruction as well. The specific type of literacy instruction often lead towards life-skills-linked literacy instruction or solely sight word instruction (Ruppar et al., 2011). Browder and colleagues (2006) found that out of 138 identified intervention research articles for individuals with significant disabilities, only 18 studies focused on any type of phonics instruction. Blischak (1994) reported that most reading instruction for individuals with moderate to severe disabilities targets sight word skills rather than phonological awareness and decoding skills. Blischak (1994) maintained that if students need to rely on sight word skills alone, they would be unable to read words unfamiliar to them and therefore a cap would be placed on their literacy learning. These finding are consistent for individuals with CCN and ASD, as much of the research on reading instruction for children with ASD has focused on sight-word reading instruction (Browder, Wakeman, Spooner, Ahlgrim-Delzell, & Algozzine, 2006; Koppenhaver & Erickson, 2009; Spector, 2011).

Many teachers do not believe or realize that students with severe disabilities and complex communication needs, who rely on the use of AAC, are capable of learning phonetic and word attack strategies (Mirenda, 2003; Ruppar et al., 2011). This belief potentially stems from the dichotomous relationship between speaking (or not being able to) and phonics instruction (typically taught through the production of sounds and blending/segmenting sounds orally). Parents and teachers may have little reason to think that the development of literacy skills is an attainable goal if they do not have access to (seen or experienced) effective evidence-based curricula adapted to meet the needs of students who require AAC (Light & McNaughton, 2009b). One of the reasons that individuals with complex communication needs
do not participate in literacy instruction and do not acquire literacy skills is that teachers/SLPs are not
versed in literacy instruction that is adapted to meet the unique and complex communication needs (Light,
McNaughton, Weyer, & Karg, 2008). In order to develop appropriate instructional programs and
interventions for individuals with CCN, information from four areas should be considered: (1) theoretical
frameworks for the reading process, including understanding what “good readers” do; (2) the content of a
beginning reading program (i.e., what to teach); (3) general instruction procedures (i.e., how to teach);
and, (4) necessary adaptations for intervention (i.e., how to adopt instruction, including changes to typical
literacy instruction for individuals with CCN).

**Theoretical Framework for the Reading Process**

Successfully learning to read and write is not an isolated skill, but rather a complex process of
integrating and applying component skills and knowledge (Adams, 1990). Furthermore, reading is an
interactive task that requires readers to call on background experience, knowledge, and language
understanding (Mirenda & Erickson, 2000). Many theories of reading exist. These theories have led
teachers to a variety of beliefs about instructional choices to help children develop successful reading
strategies. The majority of reading theories can be categorized into three main types of reading models:
bottom-up (Gough, 1972), top-down (Goodman, 1967), and interactive (Adams, 1990; Stanovich, 1980).
In bottom-up models, the meaning of the text is contained only in the printed text itself. Individuals learn
and acquire literacy by progressing from the parts of language (letters) to the whole (meaning) (Samuels
& Kamil, 1984), starting with sounds/symbols, then words, then meaning. Therefore with bottom-up
instruction, teachers would begin with teaching phonics first (with letters of the alphabet and the sounds
these letters represent) before beginning to introduce other skills. With the top-down model
(Goodman, 1967), readers play an important part in constructing meaning. Text meanings are influenced
by experiences and prior knowledge the reader brings to reading, rather than the meaning based on an
exact interpretation of the text (Smith, 1971). Therefore with top-down instruction, teachers would
support literacy in meaningful contexts and real life situations in which reading and writing are used to get things done.

In interactive literacy models (Adams, 1990; Rumelhart, 1980; Stanovich, 1980), all parts of the reading processes, as Adams (2004) states, “simultaneously issue and accommodate information to and from one another” (p. 1224) and there is an aim for balance between explicit teacher-directed instruction and student-centered learning. Interactive usage-based models, like Adams (1990), provide a good framework for explaining the performance of successful readers while accounting for individual variation (van Balkom & Verhoeven, 2010) and the heterogeneity that individuals with ASD and CCN bring to the reading context. Interactive usage-based models account for influences of extrinsic factors that draw upon higher-level knowledge (i.e., experiential knowledge, context) and intrinsic factors that draw upon lower-level knowledge components like vocabulary and letter sound knowledge.

More specifically, Adams (1990) presented a model for the process of reading; Adams’ model influenced the studies that will be discussed in future chapters. Again, the model is neither top down nor bottom up, but instead interactive (Roberts, Christo, & Shefelbine, 2011). The model posits that reading is an interactive process that involves four types of processing: (1) orthographic processing, (2) phonological processing, (3) meaning processing, and (4) context processing (see Figure 1-1). Each area of processing represents knowledge and skills that support the interactive reading process. The lines with arrows represent the patterns and ways in which the processors relate and interact (Adams, 1990). The more frequently a pattern of activity has occurred (lines with arrows between processors), the stronger the bond between the processors will be (Roberts et al., 2011). Ultimately, it is integration of these interrelations (the bonds) that is responsible for automatic and fluent reading (Adams, 2004).
Orthographic Processor

The orthographic processor is a component of the reading system that receives information from the print that the reader encounters (Adams, 1990; 2004). Adams (2004) reported that, “Skillful readers visually process nearly every letter and word of text as they read” (p. 1226). The orthographic processor forms, stores, accesses, processes, and identifies letters and letter patterns (Cunningham et al., 2011). As learners repeatedly encounter letter patterns, they develop associations between adjacent letters and learn common letter sequences. Through experience, these learned associations and sequences support a “holistic” (Adams, 2004, p. 1227) and efficient manner of reading. Yet, as a starting point, Adams (1990) emphasized that readers must learn to identify letter-sound correspondences before beginning instruction on reading words (decoding). Learning letter-sound correspondences supports the need for automization of visual perceptions and phonological code retrieval of written word forms, as these skills play a central role in the decoding process (van Balkom & Verhoeven, 2010). This additionally highlights the importance of teaching learners about letters (the print) and their sounds during the early stages of reading.
Phonological Processor

In addition to the orthographic processor, which receives information from print, a good reader also uses the phonological processor to obtain information from speech (Adams, 1990). The phonological processor has two roles. First, it attaches pronunciation to the letter sequences by providing an alphabetic back-up system, supplying, as Adams (1990) states, “a redundant processing route- that is critical for maintaining the speed as well as accuracy of word recognition necessary for productive reading” (p. 159). Second, it supports text comprehension by providing on-line memory for individual words (Smith, 1971). The interactions between the phonological processor and the orthographic processor “run in both directions” (Adams, 1990, p. 157). For example, the orthographic processor “sends” the visual image of print to the phonological processor, the phonological processor attaches a pronunciation to this image, and due to the bi-directional relationship the phonological processor “sends” it back to the orthographic processor (Adams, 2004).

Meaning Processor

Good readers integrate their knowledge and understanding of the meaning of the word when engaging with text (Adams, 1990). When familiar patterns of letters are read, the meaning processor, if the meaning is known, is activated and attaches meaning to the word (Adams, 1990). When a reader attaches meaning to print (i.e., activating both the orthographic processor and the meaning processor), the speed with which a reader processes and recognizes a word increases. Yet, some individuals have receptive language deficits. Vocabulary instruction has shown to result in increases in word knowledge and reading comprehension. The number of times a learner encounters a word is a strong predictor of how well they will learn it (Adams, 2004). Multiple and meaningful experiences with words are important for expanding meaning processing and linking orthography to the words.

Context Processor

As described by Adams (2004), “…the context processor is in charge of construction of a
coherent, ongoing interpretation of the text. In particular, it is responsible for priming and selecting word meanings that are appropriate to the text” (p. 1230). Skilled readers use the context processor to help make the most of the information from text, as efficiently as possible (Adams, 2004). Context processing plays an important role in: increasing the reader’s speed, recognizing text, and helping the reader attach accurate meaning to the text. The context processor works closely with the orthographic and meaning processors to facilitate word recognition and to ensure that accurate meanings are attached to the text (e.g., correct interpretations of words that have more than one meaning) (Adams, 1990). The interaction between the orthographic and context processor can assist the reader in recognizing words depending on the predictability of the context and application of intrinsic world knowledge. As with all network connections in the Adams model, the more opportunities and repetitions, the stronger the activations for prediction.

In summary, the more information the reader can attach to the word, the more efficiently the learner will recognize and comprehend the word, resulting in skillful reading (Adams, 1990). Adams emphasized that the orthographic, phonological, meaning and context processors are all connected and interact simultaneously. The interconnectedness impacts the speed in which a reader recognizes words and is dependent on the reader’s familiarity with the: (a) letter sequences (i.e., orthographic processor), (b) pronunciation of the word (i.e., phonological processor), (c) meaning of the word (i.e., meaning processor), and (d) interpretation of the text surrounding the word (i.e., context processor) (Adams, 1990; Benedek-Wood, 2010).

**Evidence-Based Beginning Reading Instruction: What to Teach?**

It is well recognized that learning to read is complex and involves practice and instruction in order to decode and understand written text. Overall, the National Reading Panel (2000) suggested that reading instruction is most effective when it incorporates explicit instruction in alphabetics (which includes phonemic awareness and systematic letter-sound correspondence instruction), methods to improve fluency, and ways to enhance comprehension (including vocabulary instruction). Additionally,
Adams (1990) suggests that learners need to develop automatic word recognition skills by the second or third grade in order to ensure foundational literacy skills essential for becoming successful readers (Adams 1990; Snow, Burns, & Griffin, 1998). Word recognition in reading refers to:

…the process that transforms print into speech and includes both the identification of words by their visual configuration, called sight word identification, and the ability to apply phonetic decoding strategies to sound out unfamiliar written words, referred to as word attack or decoding skill (Gabig, 2009, p. 68).

During the early stages of learning to read, the major focus of literacy instruction includes accurately recognizing words and applying decoding strategies to unfamiliar words (Chall, 1983). When considering starting points for formal reading instruction, researchers have consistently found that explicit instruction, in both phonics and phonemic awareness (Adams, 1990; Carnine et al., 2010; Chall, 1996) and developing automatic and robust sight word vocabularies (Gabig, 2009), play critical roles in becoming a skilled and successful reader.

When readers automatically recognize words, cognitive resources are freed up to construct meaning. If word recognition is not automatic, cognitive resources are redirected to word identification rather than to sustaining memory of words preceding the troublesome word. Word identification is defined as, “a cognitive process of making print-to-sound links to translate both familiar and unfamiliar printed words in their pronunciations” (Mirenda & Erickson, p. 351). The translation of the familiar and unfamiliar words does not need to involve oral speech. Moreover, the translation is typically subvocal (i.e., inner speech that occurs during silent reading) in skilled readers (Adams, 1990). Familiar and irregular words are translated automatically without conscious attention of the reader. Unfamiliar and regular words are mediated, or decided by the reader using a variety of phonic strategies. In order to become skillful readers individuals with CCN must be able to, as Light and McNaughton (2013) stated:

Read both regular words (i.e., words that are made up of letters that can be decoded using knowledge of letter sounds and sound blending, such as cat) and irregular words (i.e., words that cannot be easily be decoded using knowledge of letter sounds and sound blending, such as light) (p. 333).

The importance of each subskill in the process of literacy acquisition, such as identifying sight
words in isolation or identifying the sounds in a word to sound out an unknown word, is determined by how much they assist the reader to understand larger text --- that is, intervention starting points and subskills of reading instruction should work towards the long term goal of reading with comprehension (Mirenda & Erickson, 2000). As individuals with CCN increase the number of words they can translate automatically (read by sight), a mutually beneficial relationship is observed; their reading fluency and comprehension increases as well (Cunningham et al., 2011). Sight word reading is one way that an individual can begin to build word recognition and identification skills. Yet, instruction in sight word recognition should supplement, not replace, instruction in phonics-based approaches. As Browder and colleagues (2006) concluded, literacy intervention is most effective if sight word recognition is paired with instruction in decoding/phonics skills. During the early stages of phonics instruction, individuals first learn letter-sound correspondences (Adams, 1990; National Reading Panel, 2000) and then learn how to apply letter-sound correspondences to read and spell words (Adams, 1990; Ball & Blachman, 1991). The specific components of each approach will be discussed in future chapters; phonics (letter-sound correspondences) for Study 1 and sight words for Study 2.

**General Principles for Effective Literacy Instruction**

The National Reading Panel (2000) found effective literacy programs support the acquisition of phonics skills, fluency, and comprehension through a combination of: (a) direct instruction; (b) numerous opportunities for practice and feedback, (c) appropriate supports and scaffolds; and (d) meaningful and motivating literacy contexts.

**Direct Instruction**

Direct instruction has received strong support in the literacy research literature in past and recent decades (e.g., Adams, 1990; Benedek-Wood et al., 2015; Camine et al., 1997; Chall, 1983; Light & McNaughton, 2013). The principles of direct instruction, as summarized by Rosenshine (2012) include: (a) breaking learning into small steps through systematic instruction, (b) guided practice, whereby scaffolding and feedback is use to support minimal practice of errors, (c) active student participation, and
(d) scaffolds and the release to student independence. Direct instruction approaches are often criticized for instruction of skills in isolation, and thereby lack of authentic literacy experiences and generalizable results (Kameenui & Simmons, 1997). Yet, direct instruction can be provided in combination with meaningful and motivating literacy contexts. The National Reading Panel (2000) found that explicitly teaching students that words are made up of sounds (i.e., phonemic awareness), and that sounds are represented by letters (i.e., knowledge of letter-sound correspondences), produced significant gains in students’ reading skills.

**Opportunities for Practice and Feedback**

Minimal practice of errors is important for building strong and correct neural activations (Adams, 1990). Providing immediate feedback allows individuals to learn from their response (Rosenshine, 1997). Further, corrective feedback (Browder & Xin, 1998) in reading has been found to support reading accuracy and acquisition of reading skills (e.g., sight words, Browder & Xin, 1998). Additionally, multiple opportunities to practice supports automaticity, which is critical for becoming a successful reader. As Adams (1990) states, “children should read lots and often” (p. 135). This concept extends to opportunities for practice of skills, like word recognition and letter-sound correspondences.

**Appropriate Instructional Scaffolds**

Research indicates both errorless learning (Carnine et al., 2010) and independent opportunities for practice (Cunningham et al., 2011) are important for literacy instruction. Instruction should provide appropriate scaffolds, ranging from models of the skill, to guided practice (i.e., where the student is given some supports during a structured practice time), and then ultimately independent practice of the targeted skill with feedback from the instructor. Providing students with models can help them learn faster (Rosenshine, 2012). Additionally, Rosenshine (2012) found that successful teachers spend more time guiding students’ practice, presenting small amounts of materials at a time, and checking for understanding. Guided practice should ensure high rates of success during this type instruction. As the learner demonstrates high success rates, above 80%, scaffolds should be reduced and independent
practice should follow. Independent practice provides additional reviews with the task, with less prompting from the teacher and more time for the learner to independently arrive at solutions (Rosenshine, 2012).

**Motivation**

Successful teachers provide instruction in a way that reflects the belief that all students can learn and that uses materials that incorporate interests that are personally relevant (Light & McNaughton, 2013). For older individuals with a history of literacy failure, it is even more important that personally relevant and motivating learning opportunities be included from the beginning of instruction activities. By igniting the individual’s motivation to participate through meaningful materials, the instructor can potentially foster the learner’s intrinsic motivation, which could in turn foster increased engagement in literacy activities (Light & McNaughton, 2013).

**How to Teach? Considerations and Adaptations for Students with CCN**

As with motivation, additional intrinsic and extrinsic factors often limit the participation of learners with CCN in typical reading programs (Light & McNaughton, 2013). Typical reading programs often require an oral and/or written response during instruction and assessment (Benedek-Wood, 2010; Fallon et al., 2004; Light & McNaughton, 2009b). Because learners with CCN typically demonstrate limited or no natural speech, they often experience difficulty participating in many of the reading programs frequently used in classrooms (Foley, 1993; Light & Kelford Smith, 1993).

It is often necessary to provide adaptations for learners with CCN in order to increase their participation during literacy intervention to maximize their learning (Benedek-Wood, 2010; Browder et al., 2006; Blischak, Shah, Lombardino, & Chiarella, 2004; Coleman-Martin, Heller, Cihak, & Irvine, 2005; Fallon et al., 2004; Light & McNaughton, 2009b; 2013; Millar, Light, & McNaughton, 2004). Researchers have found that with appropriate and adapted instruction individuals with CCN can benefit from literacy instruction, and more specifically, from phonics (letter-sound correspondence) and sight word instruction (Blischak et al., 2004; Coleman-Martin et al., 2005; Flores, Shippen, Alberto, & Crowe,
For letter-sound correspondence tasks, the researcher/professional can state the sound (phonologically recoded for the learner) and ask the learner to select the targeted letter from a field of options. For sight word tasks, the researcher/professional can provide pictures options and ask the learner to select the picture that corresponds to the written word. These adaptations support participation of the learner and do not require the learner to produce an oral response, that is, to say the letter sound or sight word orally. Additionally, considerations in regards to the words selected, the order in which sounds are taught, instructional scaffolding (i.e., model, guided practice, and independent practice), and corrective feedback are important in order to foster optimal outcomes (Light & McNaughton, 2013) (see the procedure sections for both studies for more information).

**Purpose / Research Questions**

As Lindsay (1989) stated, “Teaching literacy skills is the single most empowering thing that we can do for individuals who require [augmentative and alternative communication (AAC)] (p. 5).” The ultimate goal of reading is to independently extract meaning and learn from connected text (Carnine et al., 2010; Duke & Carlisle, 2011). Typically literacy instruction begins by targeting basic reading subskills (e.g., letter-sound correspondences and sight word reading) to build foundational knowledge. Without direct instruction to teach sound-letter connections and sight words, students could potentially lack automatic word recognition skills, an important foundation for literacy. Subsequently, students with CCN will continue to be at risk for poor literacy outcomes (Benedek-Wood, 2010; Sandberg & Hjelmquist, 1996). While a growing body of literature has documented the benefits of adapted reading instruction for learners with CCN (e.g., Blischak et al., 2004; Fallon et al., 2004; Johnston, Buchanan, & Davenport, 2009; Light & McNaughton, 2009b; Millar et al. 2004), limited research has focused on teaching phonics skills (Benedek-Wood, 2010; Browder, et al., 2006; Koppenhaver & Erickson, 2009) or sight words (Spector, 2011) to pre-adolescents and adolescents with severe disabilities, CCN, and ASD who have had limited literacy success. Furthermore, rarely both types of instruction are provided to learners.

The purpose of Study 1 was to investigate the impact of adapted instruction on the acquisition of
letter-sound correspondences by pre-adolescent and adolescent learners with severe disabilities, CCN, and ASD. Specifically, the primary research question was: What is the effect of adapted instruction on the acquisition and maintenance of letter-sound correspondence skills by pre-adolescents and adolescents with severe disabilities, autism spectrum disorder and complex communication needs? The purpose of Study 2 was to investigate the impact of adapted instruction on the acquisition of sight words, by pre-adolescent and adolescent learners with severe disabilities, CCN, and ASD. Specifically, the primary research question for Study 2 was: What is the effect of adapted instruction on the acquisition, generalization, and maintenance of sight words by pre-adolescents and adolescents with severe disabilities, complex communication needs, and autism spectrum disorders? In addition, both studies provide social validation information on the perceptions of professionals regarding the effectiveness and acceptability of the interventions.
CHAPTER TWO

Study 1 – Letter Sound Correspondences

As noted earlier, reading is a complex process of deriving meaning from written text (NRP, 2000). In order to derive meaning from written text, successful readers have to develop skills that precede conventional literacy but are paramount to positive outcomes (Nopprapun & Holloway, 2014). One of the skills successful readers must develop is letter-sound correspondence, or the understanding that sounds (or phonemes) are associated with letters (or graphemes) of the written language that encodes speech (Light & McNaughton, 2009b). Successful readers use these foundational skills to apply their knowledge of letter and sound relationships to decode unfamiliar written words, by recognizing the letters in words and associating each letter with its corresponding sound. The National Reading Panel (2000) describes the foundational skill of phonics, or use of the code (letter-sound correspondences) to recognize a word, as one of the critical components necessary for the development of independent reading skills and one of the strongest predictors of future reading ability.

Although letter-sound knowledge is a strong predictor of beginning reading, it is recognized as a challenging skill to acquire (Ehri, 1983; Adams, 1990). In order to be successful at acquiring letter-sound correspondences, learners need to remember letter shapes and fleeting sounds by pairing abstract visual appearances with labels that lack any meaning (Ehri, 1998). Intrinsic and extrinsic factors that individuals with CCN bring to the learning context may add substantially to the challenges associated with the task (Foley, 1993). For example, letter-sound knowledge is traditionally taught by presentation of a printed letter and the learner labeling (through oral production) the sound the letter makes (Barker, Saunders, & Brady, 2012). Without appropriate adaptations, the inability of individuals with ASD and CCN to respond orally limits participation in common letter-sound correspondence instructional activities. A lack of knowledge by teachers in how to best adapt instruction due to limited speech contributes to the reasons
that phonics instruction is rarely provided for students with severe disabilities (Benedek-Wood et al., 2015; Light & McNaughton, 2013). An additional reason includes low literacy expectations— the belief that letter-sound correspondences are so abstract and would be too hard for someone with severe disabilities to learn— so the opportunity to learn is never presented. As one administrator, in a qualitative study that examined obstacles to literacy for individuals with CCN, stated:

“There is the attitude out there like “What’s the need for education for this child?” I could see someone saying, nobody can understand them, so what difference does it make... I think society has no expectations for these kids. People with severe disabilities are often labeled as not being able to do many things cognitively, even though many people with these disabilities...are able to learn to read. It just has to be presented in different methods.” (Zascavage & Keefe, 2004, p. 231)

Fortunately, more recently, a small number of researchers have investigated different methods for teaching early literacy skills, including letter-sound knowledge, by adapting instruction for persons with ASD and CCN. The adaptations of tasks do not require spoken responses and support participation via alternative response modes (e.g., pointing to pictures, letters, words, or use of a speech output device) to allow participation by individuals with limited or no speech (Benedek-Wood et al., 2015). For example, Benedek-Wood and colleagues (2015) investigated the effects of adapted instruction on the acquisition of six letter-sound correspondences by three young children, ages 3-5, with ASD and limited speech. Instructional sessions were 15 minutes and included modeled, guided, and independent practice. Nonoverlap of All Pairs (NAP) analysis showed evidence of medium to strong treatment effects for the adapted instruction. More specifically, participant one acquired four letter-sound correspondences after 3.5 hours of instruction and demonstrated an overall gain of +64%. The second participant acquired four letter-sound correspondences in 6.5 hours of instruction and demonstrated an overall gain of +66%. The third participant acquired all six letter-sound correspondences after 9 hours of instruction and demonstrated the highest gain score of +81%.

For older individuals, Bailey, Angell, and Stoner (2011) reported that a structured intervention package resulted in some improvements on the acquisition of 18 letter-sound correspondences for four individuals, including three adolescents with ASD and limited speech. Instruction included three groups of six letter-sounds and instructional sessions lasted approximately 25 minutes broken into two parts: (1)
5 minutes for a group phoneme-loaded book reading activity, and (2) 20 minutes for individual phoneme lessons that included 10 steps (ranging from letter-sound correspondences skills to decoding). Participants outcomes varied from overall gains of a decrease of -1% to an increase of +43% accuracy. Similar to Bailey and colleagues (2011), Ahlgrim-Delzell, Browder and Wood (2014) also investigated a structured intervention package. This intervention packaged (GTP curriculum) focused on phonics and incorporated a number of skills (e.g., phoneme identification, phoneme segmentation, blending, sight words). In addition, a GoTalk 32 Express communication device (with eight levels and three different targeted phonemes) was used as part of the intervention, across reading tasks. The study included three individuals, two with ASD (7 and 8 years of age respectively and both non-verbal). All students had participated in a phonics curriculum prior to being enrolled in the study. Therefore, baseline means were high for letter-sound correspondence tasks (mean 50% and 36% respectively) prior to instruction. Yet, participants demonstrated overall positive gain increases (+37% and +30% respectively) across the three levels of intervention in comparison to baseline.

Overall, current letter-sound correspondence research for individuals with ASD and CCN ranged in: (a) age (i.e., 3 years old to 15 years old), (b) the number of letter-sound correspondences targeted during the instruction (e.g., 6, 18, 24), (c) components included in the instruction (e.g., voice output, other pre-literacy activities like phoneme segmentation), and, (d) outcomes (e.g., overall differences from baseline after initiation of instruction ranged from a decrease of 1% to 81%, with the three younger individuals with ASD and CCN demonstrating the highest overall positive gains).

There remains little information as to whether current interventions would translate to effective, efficient, and appropriate interventions for older individuals with severe disabilities, ASD, and CCN. There is paucity in the research focusing on phonics in reading instruction for individuals with severe disabilities, despite the fact that research on reading points to the importance of these skills (NRP, 2000). The research on teaching students with CCN phonics skills is even sparser, this lack of research is especially apparent for older learners with moderate or severe disabilities and ASD. Browder, Wakeman,
Spooner, Ahlgrim-Delzell, and Algozzine (2006) reported that almost 90% of published research for students with moderate to severe disabilities focused on acquisition of functional sight words.

Individuals who use AAC often underachieve in their development of becoming successful readers in disproportionate rates, in relation to their abilities in other aspects of functioning (Sanberg, Smith, & Larsson, 2010); these findings are not surprising considering the lack of evidence based instruction and limited opportunities to engage in phonic approaches to reading. Given the importance of reading, the intrinsic challenges that are inherent with individuals with moderate and severe disabilities with ASD and CCN, and the fact that letter-sound knowledge is a predictor of future reading ability, it is imperative that effective interventions that target letter-sound knowledge are developed and provided for these individuals (Nopprapun & Holloway, 2014). Instruction in letter-sound correspondence, for older individuals with severe disabilities, ASD, and CCN can serve as a starting point for the development of foundational skills for reading. This starting point aims to (a) build a foundation to reach the goal of reading; independently deriving meaning from text (Carnine et al., 2010) and (b) foster future use of an orthographic communication system, whereby these individuals use mainstream communication modalities and generate novel messages rather than depending on preselected symbols or words (Light & McNaughton, 2009b).

**Aims and Research Questions**

As a first step in developing a more comprehensive approach to literacy instruction (i.e., instruction in phonics as opposed to solely sight words) for older individuals with severe disabilities, ASD, and CCN, the current study focused on teaching letter-sound correspondences to this population. The intervention provided direct instruction in letter-sound correspondence (LSC) in the context of meaningful and motivating activities along with adaptations to accommodate the needs of individuals with CCN. This study investigated the (a) effectiveness, (b) efficiency, and (c) social validity of the identified literacy instruction on the acquisition and maintenance of letter-sound correspondence skills by older individuals with severe disabilities, ASD, and CCN. More specifically, the research questions for Study 1 included: What is the effect of adapted instruction on the acquisition and maintenance of 12
letter-sound correspondences by pre-adolescents/adolescents with severe disabilities, autism spectrum disorders, and complex communication needs?

**Study 1: Method**

**Research Design**

Study 1 utilized a single subject multiple probe design, with replication across letter sound sets to evaluate the effectiveness of an adapted literacy instruction (Horner, Carr, Halle, McGee, Odom, & Wolery, 2005). The independent variable for Study 1 was the adapted letter sound correspondences instruction. These instructional procedures were based on three major sources of information: (a) recommendations by National Reading Panel (2000) for teaching phonics skills, (b) principles of effective instruction (e.g., Archer & Hughes, 2011; Rosenshine, 1997), and (c) adaptations for participants with CCN (e.g., Blischak, et al., 2004; Light & McNaughton, 2009b). The primary dependent variable in this study was the participants’ accuracy of identification of a letter-sound correspondence (when presented with a target letter sound orally and four letter card choices). The study involved three phases in order to measure the participants’ performance: (a) baseline, (b) intervention, and (c) maintenance.

Use of single subject designs afford evaluation of the efficacy of an intervention that includes participants from a heterogeneous population (i.e., individuals with CCN), as each participant serves as his or her own control (Light, 1999; Richards, Taylor, & Ramasamy, 2014). A multiple probe design was more appropriate for this study than other designs that involved withdrawing a treatment or reversing a target behavior; participants learned behaviors that were not expected to return to baseline (Richards et al., 2014). Further, this design involved multiple repeated measures over time, which allowed for investigation of the process of skill acquisition (i.e., letter-sound correspondences) in addition to the final outcome (Light, 1999).

A multiple probe design across behaviors was used to evaluate the effects of the adapted instruction, with each participant, on three letter sound sets. This design required systematic introduction of the intervention on three or more behaviors (i.e., the letter sound sets) with the same participant, in the same setting (Richards et al., 2014). An across behaviors design was selected as the adapted instruction
was expected to produce a similar and independent effect on each of the dependent variables (letter sound sets).

More specifically, a multiple-probe across behaviors design was used. It allowed periodic measurements of baseline probes by presenting baseline probes at intermittent intervals, rather than on a daily basis. This design was a practical alternative to the multiple baseline design. The design potentially minimized the likelihood of participant fatigue or boredom during baseline (Richards et al., 2014).

**Participants**

**Recruitment**

Ethics approval was obtained from the Human Research Protection Program prior to commencement. Participants were recruited through direct contact with speech-language pathologists and other professionals who worked with individuals with autism spectrum disorders and complex communication needs (i.e., school teachers) in central Pennsylvania. The professionals were contacted through (a) personal conversation, (b) emails, (c) social media (e.g., Facebook), and (d) letters. Professionals were asked to nominate students who might benefit from instruction on letter-sound correspondences. After obtaining names of individuals who met the selection criteria, letters explaining the study and consent forms were sent to families. Parental permission for the nominated students was obtained.

**Selection Criteria**

Participants who met the following selection criteria, from teacher report, were included to participate in further screening procedures by the researcher. Teachers filled out a communication questionnaire created for this study (see Appendix C). After review of questionnaires, potential participants were screened for inclusion in the study if they met the following criteria: (a) had a diagnosis of autism spectrum disorder (ASD), (b) were at least seven years of age, (c) presented with speech and communication skills that did not meet all of their daily communication needs, (d) followed one-step directions, (e) were symbolic communicators with use of at least ten words/signs/picture icons expressively, (f) identified fewer than 10 letter sounds correspondences, (g) lived in homes in which
English was the first language, and (h) demonstrated unimpaired or corrected vision and hearing within normal limits.

**Screening Criteria**

In order to gather more information on current levels of performance for skills related to literacy, the following procedures were completed by the researcher, with each potential participant: (a) letter sound correspondence screening assessment; (b) picture selection; (c) *Test of Early Communication and Emerging Language* (TECEL); and (d) speech intelligibility sample (when appropriate). In order to participate in the study, learners had to: (a) identify less than 10 letter sound correspondences on the screening assessment; (b) exchange a photo during the picture identification task; (c) be able to follow 1-step directions on the *Test of Early Communication and Emerging Language* (TECEL); and (d) be less than 50% intelligible at the single word level, to unfamiliar listeners, if using speech as a primary mode of communication. See Table 2-1 for a summary of the demographic information, including the screening results.

**Letter-Sound Correspondences.** In order to better understand the potential participants current level of performance with letter-sound correspondences and to select letter-sounds for the study, a screening for all 26 letters of the alphabet was completed. Letter cards, 2 x 2-in in size, were used to assess letter-sound correspondences. The letter cards included lowercase letters presented in black print using 80-point Arial font, on a yellow background. The letter cards were laminated so that the cards could be used repeatedly. During the Letter-Sound Correspondence Screening Assessment, the researcher stated the sound for a letter (e.g., “mmmm”) and asked the participant to touch the letter that made that sound from a field of four letters. In the screening, each letter-sound correspondence was probed three times. For the purposes of this study, knowledge of a letter sound was defined as correct identification of the letter-sound in at least 2 out of 3 opportunities.

**Picture Selection.** In addition to letter sound screening, the researcher assessed if potential participants were able to provide a response by selecting (i.e., pointing or exchanging) a photograph from a field of four. Pictures were used instead of letters, as the participants were more likely to know the
stimulus items and thus participate in the task. Additionally, this task was used to gather information on the participants’ ability to follow task directions after models were provided. The researcher used photographs from Google Images, each on a 3 x 3-in. card with a white background. This task required the participants to follow one-step directions (e.g., “Give me the picture of ‘dog,’”), for 10 trials. The researcher previewed each choice, orally labeling each item while pointing to the corresponding photograph. After two models of the task, the participant was required to listen independently to the target word, identify the correct photograph (from a field of four), and then give the picture that corresponded to the spoken word to the researcher. Common Constant-Vowel-Constant (CVC) words (e.g., cat, dog, pig, bus) were used during this task.

**Test of Early Communication and Emerging Language (TECEL).** The *Test of Early Communication and Emerging Language* (TECEL) (Huer & Miller, 2011) was used to gather information on current levels of communication, assess early communication behaviors and emerging language abilities, and confirm and elaborate on communication information provided by the teachers. The TECEL was selected as all participants had complex communication needs. This test accommodates and accounts for multimodal responses and therefore did not require modifications as most standardized communication measures would. The TECEL is normed for infants and toddlers up to 24 months old and can be used with older individuals with moderate-to-severe language delays for qualitative information and raw score comparisons. The test included teacher report through an interview, a classroom observation by the researcher, and engagement with the participant with objects and pictures.

**Intelligibility Test.** Participants that used speech as a primary form of communication were screened for an intelligibility rating from unfamiliar partners. Speech intelligibility was assessed using 25, randomly selected stimulus items from *The Expressive One Word Test*. The participants described, using one word, the item on the page. The responses were recorded using a hand-held audio recorder. To assess the speech intelligibility, unfamiliar listeners (three Masters students in speech-pathology) transcribed the responses by the potential participants. The number of correct words divided by the total words was used
to determine intelligibility levels. Participants that scored below 50% intelligible, at the one word level, with unfamiliar partners, were included in the study.

**Participant profiles**

Teachers, speech-language pathologists, and family members nominated a total of eleven potential participants. After participating in the screening procedures, eight participants did not meet the screening criteria, as they were able to identify more than ten letter sounds. The remaining three students met all of the required selection and screening criteria and participated in Study 1.

The three participants for Study 1 were all male and ranged in age from 9 to 18 years of age. Two of the students were Caucasian and one student was African-American. All of the participants had ASD and complex communication needs. All the participants lived in central Pennsylvania and attended schools that had ASD support services. When available, the participants’ IEPs were reviewed for relevant language and literacy goals and assessments. A summary of relevant demographic information for each participant is provided below (see Table 2-1). Pseudonyms are used to protect the privacy of the participants.

**Table 2-1: Summary of demographic information for participants in Study 1**

<table>
<thead>
<tr>
<th></th>
<th>Chad</th>
<th>Nate</th>
<th>Collin</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>10 years; 10 months</td>
<td>18 years; 7 months</td>
<td>9 years; 6 months</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td>Male</td>
<td>Male</td>
<td>Male</td>
</tr>
<tr>
<td><strong>Disability</strong></td>
<td>ASD</td>
<td>ASD</td>
<td>ASD</td>
</tr>
<tr>
<td><strong>Grade</strong></td>
<td>5th</td>
<td>11th</td>
<td>4th</td>
</tr>
<tr>
<td><strong>Childhood Autism Rating Scale (CARS)</strong></td>
<td>Moderately Abnormal</td>
<td>Severely Abnormal</td>
<td>Severely Abnormal</td>
</tr>
<tr>
<td><strong>Vision</strong></td>
<td>No reported concerns; Functional vision</td>
<td>Functional vision Cortical Vision Impairment, score of 7 (0= No functional vision and 10= Typical functional vision)</td>
<td>No reported concerns; Functional vision</td>
</tr>
<tr>
<td><strong>Hearing</strong></td>
<td>No concerns reported; Functional hearing</td>
<td>No concerns reported; Functional hearing</td>
<td>No concerns reported; Functional hearing</td>
</tr>
</tbody>
</table>
### Motor
- Ambulatory
- Able to isolate an index finger point

### Communication Modes
- Physical communication
- Gestures
- Spoken word approximations
- Rote spoken utterances
- PCS\(^1\) for schedules

### TECEL Score

<table>
<thead>
<tr>
<th>Most recent standardized assessments administered by school SLP per IEP report</th>
<th>Raw Score: 31</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testing from 2014: ROWPVT-4(^2)</td>
<td>Raw Score: 35</td>
</tr>
<tr>
<td>Standard Score: &lt;55</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Age Equivalent: 2 years, 6 months</td>
<td>Not applicable</td>
</tr>
<tr>
<td>EOPVT-4(^3)</td>
<td>Raw Score: 25</td>
</tr>
<tr>
<td>Standard Score: &lt;55</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Age Equivalent: 1 year, 9 months</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

### Picture Selection
- Able to exchange a photograph
- Able to point to a photograph
- Able to exchange a photograph

### Letter-Sound Correspondences
- 2
- 2
- 0

### Reported behavior challenges
- Impulsiveness
- Limited time on task
- Escape/Avoidance
- Screaming
- Flopping to the floor
- Hand biting
- Self-injurious behaviors (e.g., head banging and hitting, arm slapping)
- Screaming
- Escape/Avoidance

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1. Picture Communication Symbols (PCS) are colored line drawings developed by Mayer-Johnson used in many high and low tech augmentative communication systems or supports

### Chad

At the time of the study, Chad was age 10 years, 10 months. He was diagnosed with ASD. He had functional hearing and vision, as reported by his mother and teacher. Chad was mainstreamed in a fifth grade classroom for specials (i.e., music, gym), math, and reading; however, he was not academically competitive. Literacy instruction in school was provided in the mainstream setting as well as in an ASD support class. Literacy instruction had previously focused on letter sound correspondences and sight word recognition skills. For example at the time of the study, Chad was working on three sight words from the
pre-primer Dolch word list during his mainstream reading block. Chad’s personal aide (who had worked with Chad for three years) reported that he had difficulty with these tasks, especially retaining the skills from one day to the next. Chad’s teacher reported that he enjoyed participating in literacy-based activities, but was frustrated easily and often took to what she described as “impulsively guessing.”

Chad’s teacher indicated he most commonly used physical communication (e.g., pulling someone toward something), gestures (e.g., shaking his head to indicate “yes” or “no,” smiling, laughing, removing himself/walking away from non-preferred tasks), and over 20 spoken word approximations to communicate. Chad rarely initiated or labeled using speech, but he did use speech for rote phrases that are used across contexts and partners (e.g., “look at this,” “I do that,” “I want that”). Through observation and teacher report, it was clear that when Chad communicated novel utterances, or single words with limited context, his speech was unintelligible to familiar communication partners. Based on the intelligibility screening of Chad’s speech, at the single word level, he was 28% intelligible to unfamiliar listeners. Per school report and observation, Chad was willing to participate in sound imitation tasks, yet his speech was notable for final sound deletions (e.g., \( \text{dog} \rightarrow \text{do} \)) and process errors (e.g., substitution, fronting). Chad primarily communicated to express wants and needs and respond to questions from adults. He did not typically communicate with classroom peers, communicate for social closeness purposes, or use social etiquette terms.

Chad’s teacher reported that he was able to follow one-step directions and two or three-step directions if they were routine (e.g., toileting, arriving/leaving school). He was able to write numbers 1-20, identify some colors, shapes, and letter names when presented with 3-6 images. In 2014 he scored a Standard Score of <55 (age equivalent, 2 years 6 months) on the ROWPVT-4 (administered by the school SLP). Chad used a visual schedule to assist in transitioning to and from places as well as between different tasks. Additionally countdown boards were used with reinforcements to increase motivation and sustain time on task. Chad’s impulsiveness and limited time on task were reported as his challenging behaviors. His teacher and family reported that he enjoyed using the computer (e.g., educational games
and YouTube), playing Wii, and participating in outdoor activities. Refer to Table 2-1 for a summary of Chad’s background information.

**Nate**

Nate was age 18 years, 7 months when Study 1 began. Per the vision specialist’s report, Nate had functional vision to participate in academic tasks, yet did have a diagnosis of Cortical Vision Impairments. Nate did not receive vision therapy, as he scored a 7 on the *Roman-Lantzy Cortical Vision Impairment Scale* (the scale includes scores from 0-10 and 10 represents typical vision). Per teacher report, he had functional hearing to participate in academic tasks and communication exchanges. Nate attended the local high school and participated in a substantially separate ASD support classroom throughout his day. More specifically, Nate was in a classroom with one other individual and participated in individualized activities throughout the day that lasted between 5-20 minutes. He had a 1:1 aide that accompanied him throughout the day. Nate’s teacher described the majority of the activities that Nate participated in throughout the day as being “life skills focused” (e.g., sorting laundry, watering plants, putting caps and lids on appropriate containers). Opportunities for literacy were provided through stories read to Nate during free choice time as well as reading comprehension questions (with “yes” and “no” responses) after a listening to a story read by his teacher or aide. When provided with the opportunity to engage in a preferred activity, Nate would often choose to have someone read to him, take a walk, listen to music, or swing on the classroom swing.

When asked to describe his receptive language skills, his teacher reported that he was able to follow routine-based one step directions. He demonstrated understanding of his own name, family members’ names, and familiar objects. He was able to answer simple comprehension questions about a book that was read aloud to him with a “yes/no” response. For example, when *Charlotte’s Web* was read to him, Nate was able to answer (using a “yes/no” response) the following questions: Is Charlotte a character in the story? Is Charlotte a pig? Did the story take place at a school? According to IEP progress notes, for reading comprehension questions Nate responded to “who” questions with 45% accuracy,
“what” questions with 60% accuracy, “when” questions with 57% accuracy, and “where” questions with 50% accuracy.

Nate had no functional speech. He vocalized, using mainly open vowel sounds. Per teacher report and observation, some vocalizations were associated with pleasure or displeasure, but Nate did not imitate sounds. Nate had access to three choice boards with PCS line drawings. The boards ranged from 2-8 icons per display, presented in a grid. The PCS line drawings were presented with black background and white text for high contrast effects. The choice boards were used to request preferred items (e.g., scooter, swing, drink, cracker, walk, eat, iPad) and regulate behavior (e.g., more, all done, leave me alone). Nate selected his choice by pointing to the icon with his right index or middle finger. Nate did not have access to vocabulary for social etiquette language, questions, comments, or social closeness; therefore he did not communicate for these purposes. Additionally, Nate never self-initiated use of the choice boards, instead he responded by pointing when asked a question by his teacher or aide (e.g., What do you want?). Nate primarily communicated through physical communication and body language. For example, Nate would walk over to the swing if he wanted a break or walk to the bookshelf and then bring a selected book to his aide to read. When enjoying a task or expressing pleasure, Nate would maintain attention to the task and occasionally smile. When frustrated, upset, or finished with a task, Nate often got up and walked away, screamed, bit his hand, or fell to the floor. Nate’s teacher reported these previously mentioned behaviors were Nate’s most challenging behaviors and impacted learning the most. Refer to Table 2-1 for a summary of background information.

Collin

Collin was age 9 years, 6 months when the study began. He had functional hearing and vision, as reported by his teacher. Collin attended a local elementary school and participated in a substantially separate ASD support classroom throughout the majority of his day. Collin was included with his age-matched peers for lunch, music, and gym. Collin participated in individualized activities throughout the day that lasted between 5-10 minutes. These activities ranged from sensory play to matching numbers and letters through file folder activities. Opportunities for literacy were provided through letter naming and
matching tasks. When provided with the opportunity to engage in a preferred activity, Collin would often choose to bounce on a yoga ball, listen to music on an iPod, or play in the sensory room (e.g., jump on a mini trampoline, lay in a bean bag, swing in the hammock swing).

When asked to describe his receptive language skills, his teacher reported that Collin was able to follow some routine-based one-step directions (e.g., go get the iPod, put on your shoe). Collin’s ability to follow directions was variable and dependent on his willingness to participate in preferred and less preferred tasks. He demonstrated understanding of his own name and some familiar objects. He did not always respond when his name was called. He was most successful with demonstrating understanding during familiar and repetitive tasks (e.g., sorting and matching tasks with colors and letters). Collin did not consistently respond to simple Wh-questions (e.g., “What do you want? What is it?”) by pointing to appropriate line drawing in a communication notebook.

Collin had no functional speech. He vocalized, but did not imitate sounds. Collin had access to a communication binder with a combination of 20 line drawings and photographs to represent common items. The photos and line drawings were velcroed to designated locations within a tabbed page (e.g., food, play, music). Each page had four to six icons. Per teacher report, Collin consistently used four icons (snack, drink, music, and break) by removing the icon from the binder page and giving the icon to a communication partner. Collin primarily communicated with his communication book to request preferred items (e.g., snack, music) and regulate behavior (e.g., I need a break). Collin did not communicate for the purposes of social etiquette, asking questions, making comments, or social closeness. He has self-initiated use of the communication book for use of the 4 symbols (snack, drink, music, and break), but most often relied on the prompts, “Go tell me with your book,” “What do you want?” or “What do you need?” Overall, Collin primarily communicated through physical communication and body language. For example, Collin would pull an aide over to where he was bouncing on a yoga ball and take his or her hand and place it on the CD player if he wanted the song to be changed. Collin was able to communicate with a few idiosyncratic signs, approximations for “more” and “help,” yet the signs were prompt dependent as well. When enjoying a task or expressing pleasure, Collin
maintained attention to the task, smiled, and vocalized. When frustrated, upset, or finished with a task, Collin often got up and walked away, screamed, or engaged in self-injurious behaviors (e.g., hitting his head, slapping his arm). Refer to Table 2-1 for a summary of Collin’s background information.

**Materials**

**Instructional materials**

Each session included letter-sound probes, direct instruction on target letter-sound correspondences (LSCs), and two extension activities (LSC book and LSC folder). All stimuli were based on 12 target letters and their corresponding sounds (i.e., the letter-sounds that were used in the instructional program). The researcher selected 12 LSCs from letters sounds not yet acquired by the participants demonstrated during the screening assessment. From this list of unknown letter sounds the researcher used guidelines adapted from Carnine and colleagues (2010) and Light and McNaughton (2009b) to group the letters into three sets of four, by: (a) selecting letters that are more frequently used letters (e.g., a, m, t) before less frequently used letters (e.g., q, x, z), (b) separating letters that are visually similar (e.g., b and d), (c) separating letters that are auditorily similar (e.g., g and k), (d) one vowel per set, (e) selecting two continuous sounds (e.g., m, a) per set, and (f) selecting two non-continuous sounds (e.g., p, t) per set. See Table 2-2 for a list of the letter-sounds per set.

**Table 2-2: Letter-sound selected per Letter Sound Correspondence Set**

<table>
<thead>
<tr>
<th>Letters per LSC Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSC Set 1</td>
</tr>
<tr>
<td>a, m, p, t</td>
</tr>
<tr>
<td>LSC Set 2</td>
</tr>
<tr>
<td>r, c, i, g</td>
</tr>
<tr>
<td>LSC Set 3</td>
</tr>
<tr>
<td>o, l, h, d</td>
</tr>
</tbody>
</table>

**Probe and direct instruction**

Probe and direct instruction letter cards were adapted from the materials developed by Light and McNaughton (2009b). Stimuli for probe and instructional tasks included a 2 x 2-in laminated letter cards per targeted letter sound. The letters for the letter cards were printed on yellow paper in black, 80-point,
Letter-sound correspondence extension activities

The researcher incorporated multiple activities into the instructional sessions in order to provide the participants with consistent, repeated practice with the targeted LSC and to apply knowledge of the letter sound(s) to a range of meaningful instructional activities; bringing top down and bottom up literacy approaches. As Tallal and colleagues (1991) stated, “highly consistent, repetitive input must be given over an intense period of time so that consistent patterns of neuronal activation occur repetitively, building specific stimulation patterns to “represent” the input from the environment in the brain” (p. 93). Use of activities that included personally relevant and motivating topics were incorporated in instructional opportunities through extension activities to assist with motivation and sustained interest (Light & McNaughton, 2009b).

**LSC book.** LSC books (extension activity one) were created in a Microsoft® Office Word document with portrait orientation to provide a: (a) joint context in which the learner and adult were interacting with print, (b) opportunity for the learner to be exposed to vocabulary related to the initial phoneme/grapheme, (c) meaningful context to instruct letter-sound awareness, and (d) opportunity to incorporate phonemic awareness activities (e.g., emphasis on target letter sound matching the initial letter sound of the word represented by the photograph). The LSC book was intended to bridge top-down and bottom-up approaches by building and activating meaning and context processing while targeting skills at the level of the orthographic and phonological processing.

The LSC books included color photographs that represented words that began with the targeted LSC (e.g., a picture of a ‘pig’ for the /p/ sound). The words that were selected for the book were either of personal relevance/interest or commonly encountered words that began with the targeted LSC. The researcher used photographs from Google Images to represent the words. When possible, to increase motivation and task engagement, images related to personal interests were used (e.g., Minecraft creations of the target words). Each page of the LSC book included the letter sound at the top of the page highlighted in yellow, one photograph, and text of the word with the initial letter (target LSC)
highlighted. The printed page was placed in a clear sheet protector. A piece of hard Velcro was placed on the sheet protector below the picture and text (Benedek-Wood, 2010). The pages were assembled together with a piece of string in order to create a book. This activity additionally included LSC cards identical to the cards described previously, except these cards had a piece of soft velcro attached to the back of each card (Benedek-Wood, 2010). The Velcro allowed the participants to attach the target letter to the page of the book, after being presented with an array of four letter cards to choose from.

**LSC folder.** The letter-sound folder (extension activity two) also attempted to bridge top-down and bottom-up approaches by building and activating meaning and context processing, while targeting skills at the level of orthographic and phonological processing. Specifically, the task aimed to develop relevant vocabulary related to each LSC. Biemiller (2011) states, “adequate vocabulary is a necessary (though not sufficient) condition for comprehension of any written text” (p. 208). A manila folder with 10 Velcro dots was created to facilitate the activity. The learner identified the targeted letter from an array of four letter cards and then put the letter card next to an image the represented a vocabulary concept (or word) that began with the targeted LSC. Again, the words that were selected for the book were either of personal relevance/interest or commonly encountered words that began with the targeted LSC. When possible, the words/images that were selected were varied across the book and folder activity, in order to provide more related vocabulary concepts. The images were represented in the form of photographs/clip art pictures from Google Images or Boardmaker © icons (e.g., an icon of a ‘monkey’ or ‘moon’ for the letter sound /m/). This activity provided opportunities for the participant to be exposed to vocabulary related to the letter sounds to incorporate phonemic awareness activities (e.g., emphasis on target letter sound matching the initial letter sound of the word represented by the photograph) and to target the instructional skill in a variety of tasks to promote generalization (Barker et al., 2012).

**Additional materials**

The researcher used reinforcements and visual schedules that were currently being used within the classrooms to structure the instructional sessions and ensure consistency with classroom practices. The researcher reviewed all materials with the participants’ teachers before beginning the study in order
to verify that all the materials were appropriate for the students. Additionally, a video camera and tripod were used to record sessions.

**Procedures**

There were three phases in Study 1, baseline, instruction, and maintenance. All of the sessions took place in a school classroom and were conducted by the researcher. Each session, within each phase of the investigation, lasted 15-30 minutes. Sessions took place between 1- 4 times per week, depending on participants’ schedules. The specific procedures for each phase of the investigation follow.

**Baseline Phase**

Baseline measures (probes) were taken prior to the start of the instructional phase in order to establish the participants’ current levels of performance on the dependent variable (correct identification of LSC). Baseline data were taken for all three of the LSC sets that were selected for the intervention phase, for each participant. During each baseline session, each LSC was probed twice within each LSC set (i.e., eight probes per set, for a total of 24 probes per baseline session). The order in which the letters were presented, placement of the target letter, and placement of the three non-target letters (i.e., foils), were randomized. In addition, no confirmatory feedback was provided when a selection was made.

Baseline measures were taken for a minimum of five sessions for each participant (for each LSC set) and continued until there was no evident trend of increasing performance (Richards et al., 2014). The researcher used visual inspection (Kennedy, 2005) to ensure that the baselines demonstrated a decreasing trend and were stable before introducing the intervention. Stability was operationally defined as a range of 0% to 38% (one point above chance levels and up to two points below chance levels). Due to the small size of letter sets (a choice between four letters), it was important to allow for some variability around chance levels (25%) with the participants responses during the baseline phase. After intervention began with LSC Set 1, the remaining letter sets were probed on an alternating basis, for each participant.

**Intervention Phase**

Following the establishment of stable baselines across LSC sets for each participant, the participants each began the intervention phase of the investigation with LSC Set 1 (while keeping the
remaining LSC sets in baseline) (Richards et al., 2014). The participants entered intervention phases with LSC Sets 2 and 3 as soon as criterion was reached for LSC Sets 1 and 2 respectively. The treatment criterion was defined as correctly identifying LSCs with a minimum of 75% accuracy (6 out of 8 letters) on probe tasks for three consecutive sessions. Attainment of criterion was determined by analyzing the data using visual inspection (Kennedy, 2005). Additionally, the next LSC set was not introduced until a minimum of one instructional session, per letter sound, was provided.

Each session lasted approximately 30 minutes, which included 10 minutes for probes (either instructional or baseline probes) and approximately 20 minutes of instructional activities. More specifically, the 20 minutes of instruction included two parts: (1) 10 minutes of explicit instruction and (2) practice with LSC (5 minutes for the LSC book activity and 5 minutes for the LSC folder activity); a minimum of 20 trials per the targeted LSC. The assessment probes for instruction and baseline always occurred prior to instruction. The researcher provided instructional sessions 1 to 4 days per week, averaging approximately 40 minutes of instruction per week. The procedures for the intervention phase are discussed below in more detail and in the order that events occurred during the sessions: (a) LSC probes, (b) explicit instruction on targeted LSCs, (c) LSC book, and (d) LSC folder activity.

**LSC probes**

A probe was administered on the targeted LSC set before every instructional session. The probes were always the first task of the session in order to measure what the participant retained from the previous instructional sessions. Baseline probes of untaught LSC sets (e.g., Set 2 or Set 3 when targeting Set 1 LSCs) were administered on an alternating basis approximately every three sessions, with probes of the subsequent set administered closer together as criterion was reached in the targeted LSC set. The procedures for the probes used during intervention were identical to those provided during baseline assessments. Each probe contained two trials for each of the four LSC from one of the sets (e.g., a, m, p, t or r, c, i, g). This equaled a total of 8 trials per probe. The presentation of the four LSC cards (for each trial) was randomized. Additionally, when possible the researcher recorded the targeted LSC, field of options, and participants’ responses.
Explicit instruction on targeted LSCs

After the probes were completed, explicit instruction was provided for the targeted LSCs, adapted from guidelines outlined by the Accessible Literacy Learning (ALL) Curriculum developed by Light and McNaughton (2009b) and research by Benedek-Wood (2010). Instructional activities for teaching letter-sound correspondences included the following steps: (a) introducing and modeling the targeted LSC, (b) modeling of the LSC task, (c) providing guided practice in LSC, and (d) providing independent practice with feedback. Following best practices to support explicit instruction, new LSCs were introduced one at a time (Rosenshine, 1997). Instructional sessions included 10 trials with the targeted LSC and five review trials of any previously learned LSC. Once a participant independently identified the LSC (i.e., selecting the corresponding letter when presented with the targeted letter-sound correspondence) with at least 80% accuracy (8 out of 10 trials) for two consecutive independent practice sessions (Benedek-Wood, 2010), a new LSC was introduced.

Instructional steps

Explicit instruction involved four steps (i.e., introducing and modeling the LSC, modeling the task, providing guided practice, and providing independent practice with feedback) adapted from procedures outlined by Benedek-Wood (2010). To introduce a new LSC, the researcher pointed to the letter and stated its sound, then showed the participant a picture card (with at least two pictures) of words that began with the target sound (e.g., touchdown, tiger) while emphasizing the target sound (e.g., /t/).

The researcher provided a model prior to beginning the activity. The researcher first talked through the task (e.g., “I am going to say a sound (state sound). Look at the letters and give me the letter that makes that sound”). The task was modeled by: (a) tracking each of the letters with a left to right motion under the letter cards or touching each letter, (b) pointing to the target letter, and stating the target sound, and (c) having the participant give the correctly identified letter to the researcher.

Next, the researcher provided guided practice with massed trials. That is, the participant received multiple opportunities to practice selecting the newly introduced LSC so that the participant received supported opportunities to perform the task successfully and build appropriate associations by correctly
identifying the LSC a number of times. Initial trials began with a reduced field (e.g., 2 letter cards) and the researcher stating: “I am going to say a sound. Give me the letter that makes that sound.” The researcher waited for the participant to respond, pausing for 3 to 5 seconds, and then pointed to the correct letter. Instructional scaffolding continued during guided practice and included use of a smaller field size (i.e., only presenting two cards), pausing and looking expectantly for a response, pointing to the correct response (if needed), and providing feedback based on the participant’s response (Browder & Xin, 1999). More specifically, when correct, the researcher would provide feedback to confirm the correct response by saying, “Good job. You picked the letter that says ‘aaa.’” When incorrect, the researcher would say the sound of the letter selected, and then either prompt the learner to try again or point to the correct response (e.g., “No. This letter says /b/. I want the letter that says /a/. Let’s do it again, this letter says /a/ (pointing to the letter). You give me this letter.”). As the participant demonstrated two to three correct responses independently, the researcher gradually increased the field size of options and provided 10 trials of independent practice. If LSC were previously taught, the researchers reviewed previously learned LSC (total of 5 trials from any previously learned set) prior to the start of the extension activities (Cunningham et al., 2011).

**LSC book.** The letter sound book activity consisted of five trials. Together, the researcher and the participant looked at the book. The researcher: (a) stated the target sound; (b) uncovered the picture on the page; and (c) stated the picture’s name by reading the text aloud (emphasizing the target sound and tracking the text with finger). The participant was then prompted to find the letter that matched the target sound, among a field of two to four choices. After correctly selecting the letter sound, the letter sound card was added to the book page (under the picture and text). For example, “‘aaaa’. Apple starts with aaaa. Look, the aaaaapple is red. Can you find the letter that says ‘aaaa’?” The researcher provided feedback similar to explicit instruction trials (see above). When necessary, the researcher supported the participants in attaching the target letter card below the corresponding picture in the book if needed. These steps were repeated for each of the five pictures.

**LSC folder activity.** During the letter sound folder activity, a manila folder containing five
pictures that began with the selected target letter sound (e.g., apple, astronaut for /a/) was presented. To expand exposure to vocabulary, when possible, the words used in the folder activities did not overlap with the words that were used in the LSC book activity. After the researcher labeled the five pictures, the participants were prompted to select a picture from the folder (e.g., “pick a picture” or “give me the apple”). Once selecting a picture, the participants were presented with letter cards and provided directions (e.g., “Apple starts with /a/. Give me the letter that says /a/.”). After the participant chose the correct letter, they were prompted to put the letter by the image representing a vocabulary concept (e.g., “Let’s put ‘aaaa’ by the picture of the apple.”). Feedback was provided based on the participant’s response (e.g., “You are right, that is /a/,” or “Try again, I said /a/. You picked /b/, let’s find /a/.”). Help was provided, if needed, to find the correct LSC card and secure the LSC card by the correct photograph/image. These steps were repeated for each of the five pictures.

**Maintenance Phase**

Maintenance data were collected on the LSC probe task. Maintenance data were collected at two points in time, documenting short term and long-term maintenance after the intervention for the letter sound set was completed. Short-term measures were collected approximately five to ten days after criterion was met for the LSC set for which instruction was provided. The LSC that were previously introduced were included in explicit instruction (5 trials of previously learned sounds), and due to this, the short-term maintenance data could have resulted in higher levels of performance, as the individual continued to receive input and feedback related to these LSCs. After meeting criterion for all three LSC sets, long-term maintenance measures were collected at two and six weeks after the intervention for Chad and Nate to determine if the participants continued to correctly identify the LSCs at or above criterion levels. The probes measuring maintenance were identical to the probes used during baseline and intervention.

**Procedural reliability**

A research assistant assisted with review of the procedures to evaluate procedural integrity. In order to calculate procedural integrity, the researcher randomly selected 20% of the video recorded
sessions for: (a) probes, (b) instruction, and (c) maintenance. During a training session, together the research assistant and researcher watched a session and completed a checklist. Disagreements were discussed and upon reaching 90% agreement, the research assistant watched the randomly selected sessions independently and completed a procedural reliability checklist (Appendices J and K) for 20% of the recorded sessions. The researcher calculated procedural integrity by dividing the number of steps performed correctly by the total number of steps. Procedural reliability for the probe sessions was 99% (range 97% to 100%) for baseline, 98% (range 96% to 100%) for intervention, and 97% (range 89% to 100%) maintenance.

Measures and Data Analyses

The primary dependent variable in Study 1 was the participants’ performance on the LSC probes; data were analyzed to determine both acquisition and maintenance of the identification of LSCs targeted during intervention. The probes were conducted during (a) baseline, (b) intervention, and (c) maintenance phases in order to measure the participants’ performance (a) before intervention, (b) during intervention, and (c) after intervention respectively. LSC probes included two trials, of each of the four target letter-sounds from a set (e.g., Set 1: a, m, p, t; Set 2: i, r, c, g; Set 3: o, l, h, d). This provided an opportunity of 8 correct responses for each letter set (with chance level at 25%).

When assessing the participants’ performance, a letter sound was presented orally (e.g., /a/, pronounced as “aaa” as in “apple”) and the participants were required to select the letter representing the letter sound from a field of four choices. Although the researcher completed phonological recoding, this adaptation supported participation of learners with complex communication needs, as this alternative method of responding (selection of the letter card) did not require the use of natural speech (Benedek-Wood, 2010; Light & McNaughton, 2009b). A selection (of the targeted card) during the probe tasks and instruction was defined as the participant choosing one letter card by either: (a) picking a letter card from the array and giving the letter card to the researcher after the researcher presented the sound orally or (b) pointing to a letter card from the array after the researcher presented the sound orally. A correct response was defined as an independent selection, of the correct letter, within 5 seconds of the researcher’s
presentation of the sound (Benedek-Wood, 2010) with only one or less self-correction (i.e., touching an incorrect letter first, and then the correct letter without assistance) (Crowley, McLaughin, & Kahn, 2013). If the participant missed the letter-sound the first time it was scored as an error unless they self-corrected without assistance or redirection. Incorrect responses included: (a) exchanging or pointing to an incorrect letter, (b) exchanging or pointing to a letter after more than one self-correction, (b) exchanging or pointing to more than one letter at one time, and (c) providing no response within 5 seconds. Spontaneous self-corrections were permitted in this study as self-corrections are allowed in many language and literacy assessment measures (e.g., Peabody Picture Vocabulary Test – Fourth Edition (PPVT-4), Dynamic Indicators of Basic Early Literacy Skills (DIBELS)).

**Data Analysis**

The data were graphed and visually inspected for changes in the level, trend, and slope (Richards et al., 2014). The graphs were analyzed to determine: (1) the percentage of non-overlapping data (i.e. the percentage of data points in the intervention phase that did not overlap with any data points in the baseline phase); and (2) the slope and level of change in skills across the three phases of the study (baseline, instruction, and maintenance). Percentage of non-overlapping data (PND; percentage of intervention phase data points that exceed the highest datum point in the baseline phase) was selected as it provides easily interpretable and meaningful outcomes (Scruggs, Mastropieri, Cook, & Escobar, 1986) and is a commonly used effect size calculation method (Wendt, 2009). Interventions with PND scores of 90% or above are considered highly effective, between 70%-90% are fairly effective, between 50%-70% are questionable and below 50% are termed unreliable (Scruggs et al., 1986). The trend, level, and slope at the intervention phase were compared to those at baseline to determine, in general, the effects of the adapted instruction on the acquisition of targeted letter-sound correspondences. The trend, level, and slope in the maintenance condition were compared to those in intervention and baseline to determine the long-term maintenance effects of the adapted instruction, upon completion of the intervention.

Additionally, an error analysis was conducted on probe tasks to investigate the learners’ patterns of
responses, potentially leading to specific considerations for future interventions (e.g., difference between continuous and non-continuous letter-sounds).

**Data Reliability**

To ensure the integrity and consistency of data recording, sessions were video taped when possible. In order to calculate interobserver agreement, the researcher randomly selected 20% of session probes from each of the phases of the study. The second coder was a first year Masters student in speech-language pathology. He was trained on the data coding procedures using videos (not included in the randomly selected 20%) until a reliability of 90% or better was achieved for the dependent variable. The data reliability score was determined for the probes and instructional sessions by using the point-by-point agreement approach (Kazdin, 2010). The researcher calculated the exact number of agreement across all trials, divided this number by the total number of agreements plus disagreements and omissions, and then multiplied this number by 100 to obtain a percentage (Benedek-Wood, 2010; Kazdin, 2010). Data reliability for the probes included: baseline, 96% (range 88% to 100%); intervention, 100%; and, maintenance 98% (range 88% to 100%).

**Social Validity**

The social validity of the results was assessed to examine the real-life functionality of the intervention (Schlosser, 1999) as well as the acceptability of the goals, procedures, and outcomes (Cooper, Heron, Heward, 2006). After the intervention was completed, a questionnaire was distributed to three professionals (i.e., classroom teachers), all of who worked with the participants, in order to assess the social validity of the study. The questionnaire was adapted from Benedek-Wood (2010) and included a 5-point Likert Scale for five questions and three open-ended questions (see Appendix N). The questionnaire asked the professionals to indicate their level of agreement (1-strongly disagree to 5-strongly agree) regarding their perceptions of the intervention and the participants’ performance on LSC tasks. Additionally, the questionnaire asked the lead teachers to describe any benefits of the intervention they observed, any modifications they would have made to the intervention, any lessons within the class that they created based on observing the adapted instruction, and any aspects of the intervention they
would change.

**Study 1 - Results**

Results for participants’ correct responses on the three LSC sets (a total of 12 letter-sound correspondences) are presented in Figures 1, 2 and 3. The results are presented, per participant, according to the main research questions: (a) the effect of adapted instruction on the acquisition of letter sound correspondences; (b) the maintenance of these effects long term; and (c) the social validity of the results. Overall, all three participants demonstrated low and stable baseline performance, across letter sound sets, on their correct identification of the target LSCs. Increases in correct responses and maintenance of skills were seen for all the participants. Individual differences and variations were observed; each participant’s results will be discussed.

**Participant’s Performance on Letter-Sound Correspondence Tasks**

**Chad**

Figure 2-1 displays the percentage of LSC in each set identified correctly by Chad during the baseline, treatment, and maintenance conditions. Each probe included eight trials for the dependent variable from the targeted LSC set. Acquisition of the LSC set was defined as a minimum of 75% (6 out of 8) of the LSCs accurately identified for three consecutive sessions. Chad’s responses during baseline were consistent, identifying between zero (0%) and three (38%) LSCs per set correctly. For LSC Set 1 (a, m, p, t), a stable baseline was established over six probes and six sessions. The mean percent accuracy for baseline for LSC Set 1 was 17% (range 0% to 25%). Chad demonstrated substantial improvement as a result of instruction, with mean accuracy of 75% (range 50% to 100%); demonstrating a notable increase of +58% correct (calculated by comparing the average of baseline to the average of intervention). Chad reached criterion for LSC Set 1 after five sessions (approximately 1 hour and 40 minutes of instructional time), yet not all of the letter sounds had been introduced, therefore one more session was provided prior to moving on to LSC Set 2. A stable baseline was established after six sessions and held stable for 12 sessions and 10 probes for LSC Set 2 (c, r, i, g), with a mean percent accuracy of 21% (range 13% to 38%). A substantial improvement was also seen for LSC Set 2 as a result of instruction; demonstrating a
notable increase of +54% correct. For LSC Set 2, the mean percent accuracy for intervention was 75% (range 63% to 100%). Chad required six instructional sessions (approximately 2 hours of instruction) to reach criterion for LSC Set 2. LSC Set 3 (h, o, l, d) was held stable for 19 sessions and 16 probes, averaging 25% correct (range 0% to 38%). Chad also required six instructional sessions (approximately two hours of instructional time) to reach criterion for LSC Set 3 and averaged 75% correct (range 50% to 100%); demonstrating a gain of +50% correct. Chad demonstrated 100% non-overlapping data between baseline and intervention conditions for all LSC sets.

Short-term maintenance probes were conducted between three and ten days after reaching criterion, per letter sound set for Chad (see Figure 2-1). Long-term maintenance probes were conducted two weeks and one month following the completion of letter-sound correspondence instruction for all three letter sound sets. Chad was able to maintain criterion level for all five maintenance probes for LSC Set 1, averaging 90% correct for LSC Set 1 and ranging in accuracy from 75% to 100% on LSC identification tasks. LSC Set 2 and 3 were similar to Set 1. Chad was able to maintain criterion at all five probes, ranging from 75% to 100% accuracy, averaging 88% correct for LSC Set 2 and 81% correct for LSC Set 3. Chad demonstrated 100% non-overlapping data between baseline and short-term and long-term maintenance conditions, across all LSC sets.
Figure 2-1: Percentage of letter-sound correspondences identified correctly by Chad out of 8 trials in probe tasks.
Nate

Figure 2-2 displays the percentage of correct identification of letter sound correspondences during the baseline, intervention, and maintenance conditions for Nate. Each probe included eight trials for the dependent variable in the targeted LSC set. For LSC Set 1 (a, m, p, t), a stable baseline was established over five sessions and probes with an average of 18% correct (range 0% to 25%). Nate reached criterion for acquisition of LSC Set 1 after 16 sessions (approximately 4 hours and 20 minutes of instructional time), yet more sessions were completed to introduce all letter sounds prior to starting instruction for Set 2. Nate averaged 59% correct for the intervention phase of LSC Set 1 (range 25% to 75%); a positive gain of +41% (calculated by comparing the average of baseline to the average of intervention). A stable baseline was established after five sessions for LSC Set 2 and was held stable for 21 sessions and 12 probes, averaging 19% correct (range 0% to 38%). Nate needed eight instructional sessions to reach criterion for Letter Sound Set 2 (approximately 2 hours and 40 minutes) and averaged 63% correct for the intervention phase (range 50% to 88%); an overall gain of +44% correct. For LSC Set 3, a stable baseline was established over six sessions and was held stable over the course of 28 sessions and 10 probes, averaging 13% correct (range 0% to 25%). Nate needed five instructional sessions to reach criterion for LSC Set 3 (approximately 1 hour and 40 minutes), averaging 70% correct (range 50% to 88%); an overall gain of +57% correct. Nate demonstrated 88% non-overlapping data for LSC Set 1, 88% non-overlapping data between baseline and instruction for LSC Sets 2, and 100% non-overlapping data for LSC Set 3.

Short-term maintenance probes were conducted between three and ten days after reaching criterion, per letter sound set for Nate (see Figure 2-2). Long-term maintenance probes were conducted two weeks and one month following the completion of letter sound correspondence instruction for all three letter sound sets. Nate was able to maintain criterion level for all LSC Sets, ranging in accuracy from 75% to 100% correct. The averages for the maintenance conditions across LSC sets were: 93% correct (range 88% to 100%) for LSC Set 1, 90% correct (range 88% to 100%) LSC Set 2, and 87.5% correct (range 75% to 100%) for LSC Set 3.
Figure 2-2: Percentage of letter-sound correspondences identified correctly by Nate out of 8 trials in probe tasks.
Collin

Figure 2-3 displays the results of the correct identification of LSCs during the baseline, intervention, and maintenance conditions for Collin. As with Chad and Nate, each probe with Collin included eight trials for the dependent variable for the targeted LSC set. For all LSC Sets, a stable baseline was established over five sessions. Collin’s responses during baseline were consistent, identifying correctly between zero (0%) and three (38%) of LSCs across trials per set. For LSC Set 1 (a, m, p, t), a stable baseline was established over five sessions and probes. The mean percent for baseline for LSC Set 1 was 5% correct (range 0% to 13%). Collin demonstrated improvement as a result of instruction, with mean percent accuracy of 44% (range 13% to 75%). An overall gain of +70% was observed (calculated by comparing the average of baseline to criterion in order to accommodate Collin’s learning curve). Collin reached criterion after 30 sessions for LSC Set 1 (approximately 8 hours of instructional time). Collin demonstrated 90% of non-overlapping data between baseline and instruction with LSC Set 1.

A stable baseline was established after five sessions for LSC Set 2 and was held stable for 35 sessions and 25 probes, averaging 16% correct (range 0% to 25%). Collin showed positive gains after the introduction of adapted LSC instruction on LSC Set 2, averaging 34% accuracy (range 13% to 63%). Unfortunately intervention had to be discontinued due to the end of the school year prior to Collin meeting criterion for LSC Set 2. Collin did show gains after approximately 1 hour and 20 minutes of intervention with LSC Set 2. For LSC Set 3, a stable baseline was held over the course of 34 sessions and 17 probes, averaging 9% correct. Collin did not attend the extended school year summer program therefore the study was discontinued prior to initiation of instruction with LSC Set 3.

Limited maintenance measures are available for Collin due to the end of the school year. Two short-term maintenance probes were conducted after Collin reached criterion for LSC Set 1 (see Figure 2-3). Collin was able to maintain the criterion level for this probe, averaging 75% correct. No other maintenance measures were gathered before data collection was ended with Collin.
Figure 2-3: Percentage of letter-sound correspondences identified correctly by Collin out of 8 trials in probe tasks
Social Validity Survey Outcomes

A social validity survey was completed by a total of three teachers. All respondents (100%) marked strongly agree for all Likert-type statements related to intervention and improvements. The statements the teachers responded to included: (a) The student’s reading skills (specifically LSC skills) improved as a result of the intervention; (b) This intervention could be implemented in a classroom; (c) The reading intervention would be beneficial for other children with autism spectrum disorders; (d) The student seemed to enjoy participation in the literacy tasks; and, (e) The reading intervention is something I would like more training with. Results indicated that overall, the intervention was valuable, practical, and could potentially be generalized to other providers. Additionally, specific information that was provided by the teachers in the open-answer section of the survey is summarized below, per participant.

The results of the social validation measures for Chad indicated that his teacher viewed positive gains in Chad’s knowledge of letter sound correspondences. She indicated that the treatment was appropriate for Chad and others in her classroom. Specifically, she was interested in keeping the materials for future students and mentioned that she adapted some of the ideas (e.g., guided practice techniques, book and folder activities) that were used in the study for instructional materials for other academic topics (e.g., number identification).

Nate’s teacher also viewed positive gains in Nate’s knowledge of letter sound correspondences. She indicated that the intervention was appropriate for Nate and was happy that he was finally able to demonstrate progress on literacy goals. She reported that Nate’s behavior and time on task was best during this literacy instruction time, compared to other tabletop activities (e.g., sorting and matching). She took this as a sign that he found the intervention and materials motivating. Nate’s teacher also modeled literacy activities (e.g., sight words) and other instructional materials (e.g., counting money, telling time) after instructional practices that were used in this study (e.g., guided practice and use of a choice board).

Although Collin did not finish the study, the results of the social validation measures indicated that Collin’s teacher viewed positive gains in his knowledge of letter sound correspondences. She
indicated that the intervention was appropriate for Collin and was happy that he was being challenged and participating in literacy instruction. She noted that she had increased expectations of Collin as a result of the study; trying more academic-related tasks with him due to his time on task and success in Study 1. She was interested in keeping the materials for future practice for Collin and other students. She adapted some of the ideas for current instructional materials (the books and folders) for other topics (e.g., number identification).

**Study 1-Discussion**

Study 1 examined the effects of providing adapted instruction on the acquisition of letter sound correspondences (LSCs) with three individuals with severe disabilities, autism spectrum disorders (ASD), and complex communication needs (CCN). A functional relationship was established between the LSC intervention and the percent of correct responses on the LSC task. A functional relationship can be described as an effect formed in experimentation where the change in the dependent variable (i.e., identification of LSCs) can reliability be produced by the independent variable (i.e., LSC intervention) and the change is not likely due to the influences of other factors (e.g., other treatments, maturation) (Cooper et al., 2006). Each participant demonstrated changes in level and increases in trend from baseline to intervention, for the total percent of correct responses on the LSC task. This change in level and trend occurred across the letter-sound sets where intervention occurred for each participant (e.g., LSC Sets 1, 2, and 3 for Chad and Nate, and LSC Sets 1 and 2 for Collin). Additionally, minimal occurrences of overlapping data were observed, demonstrating a clear and medium to high effect of the LSC intervention.

**Effectiveness of Letter Sound Correspondence Instruction**

The study adds to the very limited research base related to phonics instruction for learners with ASD and CCN by examining the use of adapted instructional practices (Benedek-Wood, 2010; Fallon, et al., 2004; Light & McNaughton, 2009b) for older learners (ages 9 to 18) with severe disabilities. Chad and Nate were successful in achieving the established criterion across all three letter-sound sets (for a
total of 12 targeted LSCs). Although Collin did not meet criterion for all letter sets, positive change did occur from baseline for LSC Set 1 and 2 prior to the study being discontinued due to the end of the school year. Furthermore, Chad and Nate were able to maintain the targeted LSCs at and above criterion for short-term and long-term maintenance probes (e.g., long-term probes at 2 and 6 weeks) following the completion of instruction.

Other researchers have investigated the effectiveness on instruction of acquisition of LSCs for learners who use AAC (Benedek-Wood et al., 2015; Fallon et al., 2004), yet it is difficult to make comparisons to these studies due to participant differences (e.g., younger children, children with cerebral palsy not ASD). In comparison to studies targeting LSCs for older individuals with ASD (e.g., Ahlgrim-Delzell et al., 2014; Bailey et al., 2011), participants in this study started with lower baseline levels and less literacy experiences. More specifically, all participants in this study demonstrated low levels of accuracy in baselines, ranging from zero (0%) to three (38%) correct responses, yet the participants with ASD in the study by Ahlgrim-Delzell and colleagues (2014) had baseline levels ranged from 36% to 50% accuracy. Additionally, based on inclusion criteria for the study by Ahlgrim-Delzell and colleagues (2014), participants were required to have completed or be enrolled in a foundation literacy program. One of the participants with ASD and CCN included in the study by Bailey and colleagues had approximately 50 sight words. This is in stark contrast to the participants in this study, who demonstrated knowledge of less than five sight words and letter-sound correspondences. Despite the lower literacy levels and lower accuracy levels at baseline, larger gains were observed from baseline levels to intervention, across the letter-sound sets for the participants in comparison to previous studies with older individuals with ASD and CCN (e.g., Bailey et al., 2011 and Ahlgrim-Delzell et al., 2014). The two participants that completed all letter sound sets demonstrated increases of 50% or greater from baseline to intervention (when comparing the average of the baseline phase to the average of the intervention phase), across letter sound sets, whereas results for participants in the study by Bailey and colleagues (2011) ranged from a decrease of 1% to increase of +44% across letter sound sets. Ahlgrim-Delzell and colleagues (2014) found overall gain increases from baseline to intervention that ranged from +30% to +37%. The percent of non-
overlapping data for the current study were comparable or higher to these two studies as well, from 88% as the lowest percent non-overlapping data (produced by Nate on LSC Set 2) to 100% non-overlapping Data (produced across all sets for Chad and for LSC Set 3 for Nate).

The effectiveness of the LSC intervention in this study may be attributed to several aspects of the design of the instructional program that are supported by research. Sandberg and Hjelmquist (1996) suggested that even with reasonably well-developed phonological awareness, without direct instruction to teach sound-letter connections, students with severe communication disabilities would be at risk for poor literacy skill development. The participants in this study were provided with explicit instruction including frequent opportunities to practice the target letter-sounds in each instructional session (Cunningham et al., 2011), guided and independent practice (Cunningham et al., 2011; Light & McNaughton, 2009b; Rosenshine, 1997), and feedback on their responses (Browder & Xin, 1998; Rosenshine, 2012). The lessons were structured to target only one new concept (i.e., LSC) at a time (Rosenshine, 1997) and additionally each lesson included a review of previously taught target letters (Millar et al., 2004; Rosenshine, 1997).

Adaptations were made to support participation of individuals with CCN. For example, the target letter sound was said out loud by the researcher, thus the researcher completed the phonological recoding for the participants. Research has shown that individuals with CCN have difficulty with tasks requiring articulatory rehearsal (Foley, 1993) and the adaptations made in this study to support individuals with CCN could have additionally contributed to the success of the participants; albeit potentially impacting future literacy learning as ultimately the individuals need to recode independently during decoding tasks (Light & McNaughton, 2013). Modifications for learners with CCN often result in having participants indicate a response by pointing or exchanging pictures, or letters, as was the case in this study. These modifications change the nature of the task, and, provide a closed set of choices (a field of four letter cards in this study). Therefore, the response could be correct based on chance (Barker, Saunders & Brady, 2012). Since the probe trials were out of four choices, the level of chance was 25%. To reduce chance and variability, each LSC within a LSC set was probed twice, making percent accuracy scores out of a total of
eight rather than four. These required adaptations and chance levels do not occur when individuals without CCN participate in LSC tasks using speech, as an open answer format. The number of foils, and inherently, the chance level is a way in which investigators have differed when teaching individuals with CCN letter-sound correspondence tasks (e.g., 9 (Blischak et al., 2004), 7 (Johnston et al., 2009), 6 (Benedek-Wood et al., 2015), 4 (Ahlgrim-Delzell et al., 2014).

Chad and Nate were successful reaching criterion for all LSC sets and maintained these skills for six to ten weeks after intervention ended. Chad and Nate potentially could have reached criterion faster had intervention sessions been increased per week (e.g., daily, as recommended by National Reading Panel (2000)). Collin took the longest to reach criterion for LSC Set 1. Intrinsic factors were discussed previously, for example no speech (Card & Dodd, 2006; Foley & Pollatsek, 1999) and limited receptive vocabulary (Kjelgaard & Tager-Flusberg, 2001), as to potential factors that impacted his acquisition, yet extrinsic factors, like the instruction, could have impacted his outcomes. Collin, like Chad and Nate could have benefitted from more consistent instruction (e.g., daily instruction, or instruction completed by the researcher three times a week and two times by the teacher). Collin may have additionally benefited from more trials of explicit instruction, review of previously learned LSC per session, and different letter sounds set combinations (e.g., all continuous sounds instead of a combination of continuous and non-continuous in each set).

**Efficiency of Letter Sound Correspondence Instruction**

The adapted instruction in this study was not only effective, but it was also relatively efficient given the participants’ severe disabilities. Chad demonstrated an immediate effect with initiation of intervention. For example, with LSC Set 1, Chad’s highest baseline point was at chance levels, 25% accuracy, yet after initiating intervention Chad identified 4 out of 8 probes correctly and maintained higher than 50% accuracy in subsequent intervention probes. He needed five or six instructional sessions (approximately 2 hours of intervention) to meet and maintain criterion across the letter-sound sets. Collin and Nate did not demonstrate immediate treatment effects after the implementation of the intervention for LSC Set 1. Collin and Nate both demonstrated a consistent slow increase their performance on the LSC
probes. The number of instructional sessions that were necessary to meet criterion, per letter set, was reduced for Nate per set, reaching criterion with LSC Set 3 was the fastest. Collin did not have enough instructional sessions with LSC Set 2 to make definitive statements in regards to performance patterns, but Collin participated in 19 instructional sessions before having one probe at 63% for LSC Set 1, yet he required only three instructional sessions to reach one probe of 63% for LSC Set 2.

Collin had the most significant speech impairments and challenging behaviors (i.e., reduced attention, escape behaviors, self injurious behaviors), as well the most limited receptive language skills (as evident from the teacher report, observations, and TECEL). These factors could have all contributed to the amount of instructional time that was required for Collin to reach criterion for LSC Set 1. It is important to note, anecdotally, Collin demonstrated positive changes in regards to behavior and literacy skills. When starting literacy instruction with Collin, he did not sit at a table for academic tasks. Collin transitioned from refusal to sit at the table to participating in 30-mins of adapted literacy instruction over the course of the study. In addition, when starting with Collin, he did not attend to print in the adapted books or turn the pages in the adapted books. By the completion of LSC Set 1, Collin was pointing to the words and pictures on the pages of the adapted books and assisting with turning the pages.

Collin’s positive gains, yet slower rate of acquisition contributes to the notion that learning LSCs is a challenging task (Adams, 1990), particularly for learners with CCN (Foley, 1993), yet this is not a reason for exclusion from evidence-based instruction. Chad and Nate’s acquisition and maintenance of the selected LSCs supports previous more general research with individuals with CCN that has demonstrated that individuals with CCN can acquire LSCs when provided with appropriate instruction (e.g., Benedek-Wood, 2010; Blischak et al., 2004; Coleman-Martin et al., 2005; Fallon et al., 2004; Foley, 2003). Overall, this study suggests that even with minimal instructional time, evidence-based and adapted instructional techniques can be effective in teaching LSCs as a first step toward the development of literacy skills for older individuals with severe disabilities, ASD, and CCN.

**Patterns of Errors in Acquisition of LSCs**

Error analyses were conducted for each participant post hoc to determine areas of particular
difficulty and to suggest instructional improvements to address these challenges. Trends did occur across LSC sets and participants. Two out of three participants demonstrated the most errors and greatest difficulty with the non-continuous sounds (e.g., /t/ and /p/) and least difficulty with continuous sounds (e.g., /m/ and /a/). For one participant, Nate, the error patterns potentially more closely aligned with location errors (items in the second position) and personal relevance. For example, the lowest percentage of errors occurred with letter-sounds that are associated with his name or family members names: (a) LSC Set 1 was /m/, (b) LSC Set 2 /g/, and (c) LSC Set 3 /h/. The errors patterns made by the participants have potential implications for the order in which LSCs should be introduced, with consideration of personal relevance and continuous sounds taught prior to sounds that are not continuous, and are consistent with suggestions by other researchers (e.g., Carnine et al., 2010; Light & McNaughton, 2009b). Error patterns did differ slightly from some previous LSC research. For example, Bailey and colleagues (2011) noted that the majority of the errors were more visual in nature (e.g., n, h, i, l) versus auditory (e.g., /t/ and /p/), like found in this study. This difference could be due to the conscious grouping of letter sounds of visually dissimilar letters in a set (e.g., a, m, p, t) based on previous research (Carnine et al., 2010; Light & McNaughton, 2009b).

**Implications**

Phonics-based literacy instruction should be provided to individuals with CCN, including those with severe disabilities who are older and have experienced limited literacy success. Five components of the instruction seem to be critical for individuals with CCN, as seen in this present study and other research (e.g., Benedek-Wood, 2010; Fallon et al., 2004). These five components include: (1) integration of personally relevant, meaningful, and motivating materials (Light & McNaughton, 2013); (2) sufficient time for instruction (NRP, 2000); (3) multiple opportunities to practice the targeted skill; (4) adaptations to assessment and intervention tasks to support full participation for individuals with limited or no speech (Benedek-Wood, 2010; Fallon et al., 2004; Light & McNaughton, 2009b); (5) use of instructional techniques that have been found to support successful acquisition of letter-sound correspondences (e.g., limited opportunities for errors, corrective feedback) (Adams, 1990; Browder & Xin, 1998; Light &
McNaughton, 2009b).

Previous research studies with individuals with ASD and CCN that have investigated letter-sound correspondence acquisition and studies have varied in terms of which letter-sounds and the number of letter-sounds to target in intervention. Teachers providing instructional practices for learners with severe disabilities should carefully consider the sequence for which letter-sound correspondences are introduced. Selection for the sequence should be based on assessment of current skills, personal relevance (e.g., letter-sounds in their name) (Benedek-Wood, 2010), as well as research findings from this study and others (e.g., Carnine et al., 2010). For example, starting with continuous sounds before sounds that are not continuous might support the learner by providing a sound that can be sustained versus fleeting in nature. These considerations are especially important for older learners who have had a history of failed literacy experiences. Teachers should monitor student performance and, if needed, provide more scaffolds (e.g., reduced field, more opportunities per session) in order to promote success during instruction and the intrinsic motivation to continue to engage in literacy tasks.

**Limitations and Future Research**

This study contributed to the very limited research base on teaching phonics, including, letter-sound correspondence skills to individuals with severe disabilities, ASD, and CCN. Yet, as with all research studies, there are several limitations to the investigation that should be considered. First, due to the small sample size used with single case experimentation, this study lacks overall external validity with limited ability to generalize to other participants, outside of the study. Future research should replicate findings from this study, adding more participants to work towards establishing a stronger evidence-based to support the current intervention. Second, the study occurred in the participant’s classrooms, with the researcher as the interventionist, not the classroom teacher. To extend the ecological validity of the findings and to promote generalization, future research should expand to include teachers implementing this intervention with their students in natural environments. Third, the probes presented challenges, as chance levels were high (25%). In addition, the design of the study required frequent probes and all three participants struggled with motivation during the probe task throughout the study, as similarly reported by
Ahlgim-Delzell and colleagues (2014). Future research should explore alternative options for probes to potentially increase engagement and outcomes during this evaluative task.

Previous research was used to create letter-sound set groupings, yet all participants received the letter-sound sets in the same order. Future research might consider modifications to groupings of letter-sound sets, order of presentation of letter sounds, feedback, and review in order to observe impacts on overall effects, immediacy of effects, and maintenance of the observed effects from intervention. Finally, the purpose of the study was to focus on LSCs, yet it is acknowledged that other skills must also be taught (e.g., phonemic awareness, share reading activities) to promote acquisition of literacy. The intervention did include meaningful opportunities to practice LSC (e.g., LSC books, folders), yet this skill is only one of the skills required to becoming a successful reader. It is unknown whether the individuals in this study will go on to decode and read connected text with comprehension. Future research, including longitudinal measures, is needed to observe the acquisition of successful literacy for individuals with moderate and severe ASD and CCN, such as the participants in this study.

**Conclusion**

Findings from this study suggest that individuals with severe disabilities, ASD, and CCN can learn phonics through systematic and evidence-based instruction. There are several factors that may have contributed to the positive impact of the LSC instruction. The instruction included (a) instructional content recommended by the National Early Literacy Reading Panel (2000); (b) evidenced-based teaching practices (e.g., explicit instruction, guided practice) (Rosenshine, 1997); (c) considerations of personal motivation and adolescent learners (Light & McNaughton, 2013); and (d) adaptations for participants with CCN, eliminating the need for an oral response during LSC instruction (Benedek-Wood et al., 2015; Fallon et al., 2004; Light & McNaughton, 2009b). The study contributes new information for a population that commonly experiences low expectations (Ruppar et al. 2011; Zascavage & Keefe, 2004) and lack of appropriate instruction (Light & McNaughton, 2013). With adapted instruction in letter-sound correspondences, all individuals that participated in this study were able to make positive gains from baseline. Two out of three participants met criterion for acquisition of 12 letter-sound correspondences.
and maintained the skills they learned intervention. Despite intrinsic and extrinsic challenges that older individuals with severe disabilities bring to the literacy context, with very limited instructional time, the participants in this study were able to increase foundational literacy skills (e.g., letter-sound correspondences) with access to adapted instruction.
CHAPTER THREE

Study 2 – Sight Words

Sight word reading is a common starting point for beginning readers, including individuals with autism spectrum disorders (ASD). Sight word reading can provide a foundation upon which more abstract reading skills, like alphabetic principles (i.e., understanding that words are composed of letters that represent sounds and using letter-sound knowledge to retrieve the pronunciation of unknown words (Ehri, 1992)), can be built. It can also give individuals a sense of accomplishment and enable students to perform functional tasks (e.g., reading environmental signs, items on a menu, recipes) (Spector, 2011). Sight word reading is the process of reading words, automatically at a glance, without analysis of the individual letters and sound correspondences in a given word (Adams, 2011; Carnine et al., 2010).

In the early stages of learning to read, individuals need to develop skills in word recognition, including phonetic decoding and sight word identification (Ehri, 1992; Gabig, 2009). The most obvious benefit of phonetic decoding is that this skill enables readers to sound out the unknown words they encounter in print (Adams, 2011). Although decoding is an important skill, many words in the English language cannot be decoded because either (a) the sounds of the letters are unique to that word (or a few words) (e.g., night, color, work), or (b) the student has not yet learned the letter-sound correspondences in the word (Carnine, et al., 2010). Sight word reading may also be beneficial for individuals with ASD and complex communication needs, because it may provide a mechanism for teaching the communicative intent of print and therefore expanding communication options and access to orthographic-based communication supports (e.g., letter board) and technology (e.g., social media, email, text).

Impairments in word recognition are more prevalent in individuals with ASD than the general population (Spector, 2011). Sight word reading is one way that an individual can bolster word recognition skills. Yet, instruction in sight words should supplement, not replace, instruction in phonics-based
approaches for individuals with ASD and complex communication needs (CCN). As Browder and colleagues (2006) concluded, literacy intervention is most effective if sight word instruction is paired with decoding/phonics-based approaches.

In sight word learning, readers develop orthographic knowledge, whereby they are able to visually recognize a word as a whole. This differs from phonic approaches, whereby readers explicitly analyze the relationship between each individual letter and sound within the word (e.g., /cat/ vs. /c/ /a/ /t/). In whole-word sight word instruction, students are taught words as logographs (Spector, 2011). Through multiple exposures to a word, learners build connections between the word’s unique visual pattern, associated label, and meaning (Adams, 2011). Identification of words by visual configuration can later expand with the addition of decoding skills. Through application of repeated decoding and strong letter-sound correspondence knowledge, words that once took up resources in short-term memory by requiring the use of sequential recoding of letters into sounds, now become part of long-term memory; automatically bound together and instantly recognized as sight words (Gabig, 2009).

Sight word instruction often includes whole-word instruction from lists of frequently encountered non-decodable (e.g., was, green, we) and decodable words (e.g., dog, ball), taught through memorization drills (e.g., Dolch List, Fry List, Edmark List) (Spector, 2011; Weakland, 2013). Yet, for individuals with CCN, Light and McNaughton (2013) recommended that sight word instruction begin with frequently encountered words based on interests (e.g., TV and movie characters, places visited) and activities (e.g., music, sports) in an individual’s life. These words, based on personally relevant and motivating vocabulary, potentially activate or build associated meanings in an individuals mental lexicon, where concepts and vocabulary information about each word are stored (Gabig, 2009). Additionally, frequently encountered words based on interests and activities are more likely to be imageable (i.e., able to represent the sight word in graphic form) in comparison to non-imageable words commonly found as first words on many sight word lists. For example, when comparing high interest words (e.g., iPad, juice, Elmo, and Frito) to words commonly found on high frequency sight word lists (e.g., this, is, a, and we), the former are more imageable than the latter. Imageability of words is important, as it can assist in instruction by
providing alternative options for responses (e.g., matching text to the correct photograph) and additional contextual support for connecting meaning to the task and targeted words (Light & McNaughton, 2009b; Spector, 2011).

The predominant form of reading instruction for students with moderate and severe intellectual disabilities is sight word instruction (Browder et al., 2006; Browder & Xin, 1998). In a meta-analysis of 128 studies of reading instruction for students with moderate and severe cognitive disabilities, Browder and colleagues (2006) found that 75% of studies addressed sight word instruction. A number of studies have demonstrated that learners with a range of disabilities, cognitive impairments, and CCN can learn to recognize sight words with appropriate instruction (Birkan, McClannahan, & Krantz, 2007; Browder et al., 2006; Browder & Xin, 1998; Fossett & Mirenda, 2006; Light, McNaughton, Weyer, & Karg, 2008). Instructional techniques that yield evidence for effective sight word instruction for individuals with moderate and severe disabilities, including some individuals with ASD, include use of: massed trials, systematic prompting, visual supports (e.g., pictures and objects), error feedback, and adult-directed intervention (Browder et al., 2006; Browder & Xin, 1998; Spector, 2011).

Yet limited research exists in relation to sight word instruction for older individuals with ASD and CCN. Spector (2011) reviewed single-subject research from 1980 to 2009 for sight word instruction with individuals with ASD. Spector (2011) found only nine single-subject sight word studies for individuals with ASD. Of the nine, six of these studies included individuals with ASD without CCN; including instructional and/or assessment tasks that required spoken responses (e.g., Birkan et al., 2007; Collins & Stinson, 1994; Kamps et al., 1990; Ledford, Gast, Luscre, & Ayres, 2008; McGee, Krantz, & McClannahan, 1986; Mechling, Gast, & Langone, 2002). Three of the nine studies included at least one participant with ASD and CCN (e.g., Eikeseth & Jahr, 2001; Fossett & Mirenda, 2006; Hetzroni & Shalem, 2005), yet the methodological rigor and certainty of evidence is limited in the study by Eikeseth and Jahr (2001) (e.g., no graphs for the single subject design were provided).

Fossett and Mirenda (2006) conducted a study with two older individuals. One of the two participants had limited speech and ASD. They compared two instructional conditions to teach 10 sight
words (five sight words per condition). The study measured the changes in the participants’ ability to match pictures of objects (e.g., car, horn, egg, keys) to printed words in paired associate and picture-to-text matching conditions. The picture-to-text matching condition was more effective than the paired associate condition. For the participant with ASD and CCN, it supported the acquisition of 5-8 sight words. Hetzroni and Shalem (2005) used a different instructional approach and investigated the effectiveness of a computer-based intervention to teach eight common food logo sight words (in Hebrew) to six individuals, ages 10-13 years old, with ASD and CCN. After intervention, all of the children were able to identify the eight sight words and some were able to generalize their skills to daily activities in the classroom.

In a more recent study, Crowley, McLaughlin and Kahn (2013) studied the effects of a direct instruction flashcard system and Reading Racetracks (a game-like format to teach sight words) to teach unknown Dolch sight words (22 words for Participant 1 and 18 words for Participant 2). Two elementary students with ASD were enrolled in the study and both the individuals in the study used speech to communicate although one participant was learning how to use an iPad with AAC software. Both interventions improved sight word identification skills successfully for both participants.

Van der Meer and colleagues (2014) investigated the use of mobile technology with systematic instruction to teach picture and word matching with one 10-year old male with ASD and CCN. A single subject multiple probe, across four literacy tasks, design was used to teach 12 functional sight words (e.g., socks, shirt, horse, cat, pizza). Results indicated that the participant successfully learned picture and word matching with an iPad as the response mode, yet the certainty of evidence is limited as generalization was observed across the tasks (as observed by rising baselines in two of the four tasks).

Despite research indicating that sight word interventions are common approaches used in literacy instruction for individuals with moderate and severe disabilities, limited research includes older learners with ASD and CCN. Although there is some evidence that sight word interventions have produced positive results for picture to text matching for individuals with moderate and severe cognitive impairments, ASD, and CCN (e.g., Fossett & Mirenda, 2006; Hetzroni & Shalem, 2005), at present, gaps
in the research exist related to interventions that maximize the effectiveness and efficiency of acquisition of literacy skills, including sight words learning, for older individuals with ASD with CCN. Previous studies that investigated the acquisition of sight words by older learners with ASD and CCN varied in regards to: (a) intervention approaches (e.g., direct instruction and computer-assisted instruction); (b) scaffolds (e.g., fading, time-delay, use of feedback); and, (c) sight words selected (e.g., Dolch words, common food logos, and labels for objects). There is an urgent need to better understand the effects of adapted instruction in sight word reading for older individuals with severe disabilities, ASD, and CCN.

Aims and Research Questions

Study 2 was designed to evaluate the effects of adapted instruction on sight word reading of pre-adolescents/adolescents with severe disabilities, ASD, and CCN who had struggled to learn sight words despite years of intervention. Participants in this study had been enrolled in sight word instruction for a number of years, yet demonstrated limited sight word knowledge. More specifically, the participants were reported to read less than five sight words each. Given the benefits of sight words, the purpose of this study was to investigate the impact of adapted sight word instruction (including the selection of personally relevant, imageable, and highly motivating words), with individuals with severe disabilities, ASD, and CCN who were non-literate. Specifically, the primary research question was: What is the effect of adapted instruction on the acquisition, maintenance, and generalization of single sight word reading by pre-adolescents and adolescents with ASD and CCN? In addition, social validation measures were collected on the perceptions of professionals (i.e., teachers) regarding the effectiveness and acceptability of the adapted sight word instruction.

Method

Research Design

A single subject multiple probe research design, replicated across behaviors (i.e., word sets) was implemented with two adolescent/pre-adolescent learners with severe disabilities, ASD, and CCN. The rationale and benefits of a single subject design, specifically a multiple probe design across behaviors, described previously for Study 1, are maintained for Study 2. The independent variable for Study 2 was
the evidence-based adapted instruction in sight word reading and the dependent variable was the percentage of correct responses on sight word probes. The study had four phases and sight word assessment probes occurred in all phases: (a) baseline, (b) intervention, (c) generalization, and, (d) maintenance.

**Participants**

**Selection Criteria**

Ethics approval was sought and obtained from the Human Research Protection Program prior to commencement of the study. Parental consent was obtained for participation in the sight word intervention. The two individuals who completed Study 1 (Chad and Nate) were invited to participate in Study 2 after the completion of Study 1. Both participants met the following selection criteria: (a) had a diagnosis of ASD, (b) were at least seven years of age, (c) presented with speech and communication skills that did not meet all of their daily communication needs, (d) followed one-step directions, (e) were symbolic communicators with use of at least ten words/signs/PCS expressively, (f) lived in homes in which English was the first language, and (g) demonstrated unimpaired or corrected vision and hearing within normal limits per IEP or parental/teacher report, and (h) were nonliterate (read fewer than 10 words or identified fewer than 10 sight words from the Dolch Word Pre-Primer list). After obtaining consent, identified participants were screened by the investigator to determine final eligibility for participation.

**Screening Criteria**

All participants were screened prior to Study 1; see Table 3-1 for the outcomes of this screening. Chad started Study 2 two weeks after Study 1 ended. Nate started Study 2 as soon as Study 1 was completed. The following procedures were completed with each participant prior to the start of Study 2 in order to gather more information on levels of literacy and language performance, subsequent to the completion of Study 1. With each potential participant, screening occurred for: (a) sight word knowledge; (b) letter-sound correspondence knowledge; (b) speech intelligibility re-assessment (when appropriate);
and, (d) receptive language skills. See demographic Table 3-1 for a summary of the new screening results for Study 2 and see demographic Table 2-1 for relevant demographic information from Study 1.

Table 3-1: Summary of demographic information for participants in Study 2

<table>
<thead>
<tr>
<th></th>
<th>Chad</th>
<th>Nate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>10 years; 10 months</td>
<td>18 years; 7 months</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td>Male</td>
<td>Male</td>
</tr>
<tr>
<td><strong>Disability</strong></td>
<td>ASD</td>
<td>ASD</td>
</tr>
<tr>
<td><strong>Grade</strong></td>
<td>5th</td>
<td>11th</td>
</tr>
<tr>
<td><strong>Communication Modes</strong></td>
<td>Physical communication</td>
<td>Physical communication</td>
</tr>
<tr>
<td></td>
<td>Gestures</td>
<td>Line drawings (PCS icons) on choice boards</td>
</tr>
<tr>
<td></td>
<td>Word approximations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rote spoken utterances</td>
<td>Vocalizations</td>
</tr>
<tr>
<td></td>
<td>PCS for schedules</td>
<td></td>
</tr>
<tr>
<td><strong>Intelligibility</strong></td>
<td>32% intelligible at the single word level to unfamiliar partners</td>
<td>Not Applicable</td>
</tr>
<tr>
<td><strong>Letter Sound Correspondence</strong></td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td><strong>Dolch Word Screening</strong></td>
<td>2 words read correctly</td>
<td>3 words read correctly</td>
</tr>
<tr>
<td><strong>PPVT – III (B)</strong></td>
<td>Standard Score: 42</td>
<td>Standard Score: 40</td>
</tr>
<tr>
<td></td>
<td>Age Equivalent: 3.11</td>
<td>Age Equivalent: 3.2</td>
</tr>
</tbody>
</table>

**Sight Word Knowledge.** The Dolch word pre-primer word list was selected as a screening tool.

The Dolch word lists are commonly used sight word lists made up of frequently used English words (Weakland, 2013). The Dolch word lists were selected as the teachers of the participants indicated that the students had experience working with sight words selected from the Dolch lists. Additionally, the teachers indicated that the participants knew a limited number of sight words; therefore the pre-primer list was selected as a screening tool. The pre-primer Dolch word list consisted of 40 commonly seen words in text (e.g., a, and, blue, go, jump, play, read, see, the, two, up we, you). The words from the list were printed in black, Arial, 80-point font and laminated. The words were presented in groups of four on a table, with a word with a similar initial letter provided per group (e.g., big, blue, can, and). The researcher stated a word orally (e.g., “big”) and asked the participant to touch/give the word from a field of four.
Letter Sound Correspondence Knowledge. During the LSC screening, the researcher stated the sound for a letter (e.g., “aaaa”) and asked the participant to touch the letter that made that sound from a field of four letters. A screening for all 26 letters of the alphabet was completed, with three trials for each letter. For the purposes of this study, knowledge of a letter sound was defined as correct identification of the letter-sound in 2 out of 3 trials.

Speech Intelligibility. Participants that used speech as a primary form of communication were screened for an intelligibility rating from unfamiliar partners. To assess the speech intelligibility, procedures were modified from Fallon and colleagues (2004) and followed the same steps as in Study 1. Twenty-five randomly selected stimulus items from The Expressive One Word Test were presented to the participants. The participants were to describe, using one word, the item on the page. The responses were recorded using a hand-held audio recorder and unfamiliar listeners (two Masters students in speech-pathology) transcribed single word responses by the potential participants. The number of correct words divided by the total words was used to establish intelligibility levels, and then the scores were averaged across the two listeners. Participants that scored below 50% intelligible with unfamiliar partners were included in the study.

Language Skills. Current expressive communication skills, understanding of single-word vocabulary, and ability to follow directions were formally assessed using the Test of Early Communication and Emerging Language (TECEL) and Peabody Picture Vocabulary Test-III (PPVT-III). No modifications were made to the standardized tests. Participants that were able to follow one-step directions were included in the study.

Participant profiles

All three individuals from Study 1 met the criteria for Study 2, but Collin did not attend the extended school year summer program. Therefore, Study 2 had only two participants, Chad and Nate. As described in Study 1, the two participants in this study were diagnosed with autism spectrum disorder (ASD) and complex communication needs (CCN). One participant was Caucasian and one student was
African-American. Both students were male and lived in central Pennsylvania, attending schools that had ASD support services.

At the start of Study 2, Chad was 11 years, 3 months of age and could consistently identify 10 letter-sound correspondences and two sight words from the Dolch word list (i.e., red, see). Based on the intelligibility screening, he was 31% intelligible to unfamiliar partner. He received a Standard Score of 42 (age equivalent 3.11) for the PPVT-III and was able to follow one-step directions. Nate was 19 years of age and could identify 12 letter-sound correspondences and read three sight words from the Dolch word list (i.e., see, blue, red). He received a Standard Score of 40 (age equivalent 3.2) for the PPVT-III and could follow one-step directions. Refer back to Table 2-1 for a summary of the key demographic information for the participants and see above (Table 3-1) for a summary of the outcomes of the screening prior to Study 2. The same pseudonyms from Study 1 are used with Study 2 in order to protect the privacy of the participants.

Materials

Instructional materials

Target Words

All stimuli used across the phases of the study were based on 12 targeted sight words, individually selected for each participant (see Table 3-2 for a list of words per participant). The words were selected through: (a) discussion with the teachers; (b) classroom observation; and, (c) review of the participants’ AAC displays. The words were selected and grouped into three sets of four words, for a total of 12 sight words for each participant. The 12 target sight words were selected and organized into groups based on the following criteria, the words had to be: (a) 4-6 letters in length, (b) imageable (e.g., “horse” not “the”), and, (c) motivating and personally relevant. In addition, each group of four sight words had to contain two words that shared the same initial letter (e.g., swing, snack, ipad, jump) and use all lower case letters (Carnine et al., 2010). Previous research indicates that learner often use partial connections to decipher words (Mason, 1980; Ehri, 1998) including visual and phonetic cues. In order to reduce chances levels of accuracy based on initial letter cues (either visual or phonetic), lower case letters were used

...
(even for words that are typically capitalized) and sight words sets contained two words that shared the same initial letter.

Table 3-2: Word lists, per participant, for sight word instruction

<table>
<thead>
<tr>
<th>Sight Word Set 1</th>
<th>Sight Word Set 2</th>
<th>Sight Word Set 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chad</td>
<td>Nate</td>
<td></td>
</tr>
<tr>
<td>mario</td>
<td>swing</td>
<td>ball</td>
</tr>
<tr>
<td>movie</td>
<td>snack</td>
<td>book</td>
</tr>
<tr>
<td>juice</td>
<td>jump</td>
<td>game</td>
</tr>
<tr>
<td>cookie</td>
<td>jump</td>
<td>luigi</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chad</td>
<td>Nate</td>
<td></td>
</tr>
<tr>
<td>dog</td>
<td>swing</td>
<td>walk</td>
</tr>
<tr>
<td>cat</td>
<td>music</td>
<td>water</td>
</tr>
<tr>
<td>ipad</td>
<td>book</td>
<td>piano</td>
</tr>
</tbody>
</table>

**Picture and Word Stimuli**

Stimuli for assessment probes and direct instruction incorporated (a) laminated text cards and (b) photographs or line drawings for each targeted sight word. The laminated text cards were printed in black Arial, 80-point font on yellow paper. The picture icons were printed in color and cut to 2 in. x 2 in. squares. Symbolstix (Crick Software Inc., 2015) representations were used for assessment and intervention and photographs from Google images were used for assessment and generalization probes. Symbolstix were selected for this study because: (a) a line drawing representation was available for all of the target sight words; (b) participants had been exposed to Symbolstix representations on an iPad for communication and behavioral support; and, (c) no instruction was necessary, as both participants were able to identify with representations with 100% accuracy prior to the start of the instruction.

**Instructional Materials**

A variety of materials were used for the instructional activities. These activities included: (a) direct instruction; (b) sight word book; and, (c) sight word folder. These instructional sessions incorporated multiple direct instruction trials and two extension activities to provide the participants with the opportunity to apply knowledge of sight words to a range of literacy activities (Rosenshine, 2012).

Direct Instruction. As previously mentioned, stimuli for direct instruction incorporated (a)
laminated text cards and (b) Symbolstix line drawings for each targeted sight word. The laminated text cards were printed in black Arial, 80-point font on yellow paper. The Symbolstix icons were printed in color, cut to 2 in. x 2 in. squares, and laminated.

**Sight word book.** The sight word books were created in a Microsoft® Office Word document with portrait orientation and included color photographs from Google Images that represented the targeted sight word. Each page of the book included an image (e.g., dog drinking water) with the text of the targeted sight word highlighted under the image (e.g., dog) The printed page was placed in a clear sheet protector and assembled with a piece of string.

Provision of repeated instructional trials and response feedback are important parts of sight word instruction (Harris & Sipay, 1990; Spector, 2011). Harris and Sipay (1990) also suggested that for those who need repetition, it is important to remember that, “to be effective, repetition should not be monotonous drill but should be presented so as to maintain the child’s interest and encourage accurate perception” (p. 439). Therefore, sight word books were created with characters and themes that were personally relevant to each child. For example, Nate loved animals. For his Set 3 words (piano, water, type, walk), the book included an image of a dog, per page of the book, performing the action (e.g., a dog walking, a dog typing) or with the object (e.g., a dog drinking water). Additionally, the sight word books were used to provide: (a) a joint context for interaction, (b) exposure to a range of representations of the targeted sight word, and, (c) a more meaningful and motivating context for learning. The sight word books, like the letter-sound books in Study 1, attempted to bridge a top-down and bottom-up approach by building and activating meaning and context processing while targeting orthographic and phonological processing (Adams, 1990).

**Sight word folder.** The strategies used to teach a skill can impact the overall effectiveness of the intervention, as well as the generalization and/or maintenance of the skill. Researchers often “train and hope” or “train to criterion and hope” rather than actively promote generalization (Schlosser & Lee, 2000). Like the sight word book, the sight word folder activity was also designed with consideration of meaning and context processing while targeting skills at orthographic and phonological levels. In
addition, this activity was included to directly target generalization of the sight words to different representations.

Manila folders with 10 Velcro dots were created to facilitate this sight word extension activity. Five text cards for each sight word were created. The text cards were laminated, printed on yellow background in black, Arial, 80-point font. In addition, five, 2 in. x 2 in. icons that represented each targeted sight word were printed, cut, and laminated. The texts and icons were organized by a single sight word per folder (e.g., “swing” folder or “mario” folder). The icons varied in representation from photographs/clip art pictures to Google Images or Symbolstix © icons. The icons for generalization were not used in this task, but the Symbolstix images that were used for intervention probes were included. This activity provided opportunities for the learner to be exposed to a variety of representations of the word, ideally moving the learners beyond simple paired associate learning of the targeted sight words with a single picture representation (Fossett & Mirenda, 2006).

Additional materials

As with Study 1, the researcher also used reinforcements and visual schedules that were used within the classrooms at the time of the study. Materials used in the study were verified for appropriateness and personal relevance through discussions with the classroom teachers. Additionally, a video camera and tripod were used to record sessions.

Procedures

Study 2 had four phases: baseline, intervention, generalization, and maintenance. All of the sessions for Study 2 took place in a school classroom, were conducted by the researcher, and occurred during a 6-week extended summer school program. Each session, within each phase of the investigation, lasted 15-30 minutes. Three to four sessions took place per week, depending on participants’ schedules, for a total of approximately 60-80 minutes of instruction per week. Due to time constraints, two intervention sessions often occurred on the same day, with a break in-between the sessions. During the break between sessions, the participants looked at books, listened to music, or participated in different academic tasks. The specific procedures for each phase of the investigation follow.
Phase I: Baseline

Baseline measures (assessment probes) were taken prior to the start of the second phase (instruction) in order to establish levels of performance on the participants’ accuracy of reading the 12 targeted sight words, prior to instruction. Each probe targeted each of the four words in the set, twice, in random order. More specifically, there were eight trials per set, for a total of 24 trials across three probes (8 trials for each probe for the 3 word sets) per baseline session. The researcher provided no confirmatory feedback during the probes when the participant made his or her selection in the probe trials.

A minimum of five measures of the dependent variable were collected with each participant prior to instruction in order to establish a stable baseline (i.e., a range of 0% to 38% (one standard deviation above and anything below chance levels). In order to establish experimental control, sight word sets remained in baseline until criterion was met and were probed on a semi-alternating basis (Richards et al., 2014). The participants entered the intervention phases with Sets 2 and 3 as soon as criterion was demonstrated for Sets 1 and 2 respectively. Criterion for a treatment effect was defined as a minimum of 6 out of 8 correct trials, that is, 75% correctly read over three sessions. Additionally, the next sight word set was not introduced until a minimum of one instructional session, per sight word, was provided.

When assessing the participants’ performance in the probes, the researcher followed three steps. First, the pictures/photos were reviewed individually (i.e., the researcher pointed to each picture and labeled the picture aloud). Second, the targeted sight word, in text form, was placed above the four picture choices. Then, the participant was prompted to read the word and to give or point to the picture that went with the word. Two models were provided with sight words that were not used during intervention (e.g., marker and puzzle) to demonstrate task requirements for the participants and then the eight trials for the sight word set began.

A correct response by the learner was defined as an independent selection, of the correct picture, within 5 seconds of the researcher’s presentation of the word (Benedek-Wood, 2010) with only one or less self-correction (i.e., touching an incorrect picture first, and then the correct picture without assistance) (Crowley, McLaughin, & Kahn, 2013). If the participant missed the picture the first time it
was scored as an error unless they self-corrected without assistance or redirection. Incorrect responses included: (a) exchanging or pointing to an incorrect picture, (b) exchanging or pointing to a picture after more than one self-correction, (b) exchanging or pointing to more than one picture at one time, and (c) providing no response within 5 seconds. Self-corrections are part of learning and can potentially provide information relative to the automaticity of skills (Singh & Singh, 1984). Additionally, self-corrections were allowed in this study as self-corrections are permitted in many language and literacy assessment measures (e.g., Peabody Picture Vocabulary Test – Fourth Edition (PPVT-4), Dynamic Indicators of Basic Early Literacy Skills (DIBELS)).

**Phase II: Intervention**

Both participants began the intervention phase of the investigation with their personalized words from sight word Set 1 (see Table 3-2 to review the words used in the study). Each session primarily focused on one sight word, but sessions concluded with a brief review of previously learned sight words (a total of 5 trials). Instruction consisted of approximately three to four, 30-minute sessions per week. More specifically, the intervention phase consisted of approximately 10 minutes of assessment probes and 20 minutes of instruction. The instruction was broken down in the following manner: (a) 10 minutes of explicit instruction and practice; and (b) 10 minutes for extension activities (i.e., 5 minutes for the sight word book and 5 minutes for the sight word folder activity), for a minimum of 20 trials per the targeted sight word. The procedures of the intervention phase are discussed below in the order in which they occurred during the 30-min. session: (a) assessment probes, (b) explicit instruction, (c) sight word book, (d) sight word folder activity.

**Sight word probes**

The sight word assessment probes were always the first task of the session in order to measure what the participant learned and recalled from the previous instructional sessions. The procedures for the probes used during the intervention were identical to those provided during baseline. Each trial consisted of four exemplars (i.e., Symbolstix icons) per target sight word, presented in a random order, with two trials for each of the four targeted sight words from one of the sets. Therefore, the percentage of sight
words read correctly was a score out of eight. During the intervention phase, participants completed probes for the word set targeted in instruction (i.e., Word Set 1) and also completed probes for word sets that were held in baseline (i.e., Word Sets 2 and 3).

**Sight Word Explicit instruction**

Explicit instruction was provided for the targeted sight words, adapted from guidelines outlined by the Accessible Literacy Learning (ALL) Curriculum © developed by Light and McNaughton (2009a). Instructional activities for teaching sight words included the following steps: (a) introducing the text for the sight word and pairing the correct picture icon with the targeted sight word, (b) modeling the task, (c) providing opportunities for guided practice, and (d) engaging the participant in independent practice with corrective feedback.

As previously stated, following best practices to support explicit instruction, new sight words were introduced one at a time and previously learned sight words were reviewed (Rosenshine, 1997). More specifically, the guided and independent practice included a minimum of 10 trials and maximum of 20 trials of a single targeted sight word. A new sight word was introduced once the participant received a score of 8 out of 10 (80%) for the prior sight word in independent sight word practice. Five additional trials were provided during the explicit instruction (interspersed with the target word under instruction) to review any previously learned sight words and ensure discrimination between words. Review of previously learned materials was provided to help to continued to develop and maintain well-connected networks through rehearsal and review of information (Rosenshine, 2012).

**Instructional steps.** The four steps of explicit instruction included: (a) introducing and reviewing the target words and picture icons that corresponded with the sight words, (b) modeling the task, (c) providing guided practice, and (d) providing independent practice with corrective feedback. First, the researcher introduced the task: “We are going to read some words today. Let’s first look at these pictures and go over these words.” Every sight word in the set was reviewed by the research by pointing to the text, reading the word aloud, and pairing the corresponding correct Symbolstix icon with the text. Second, the researcher modeled the task by talking through the instructions. For example, “I want you to read the
word (the researcher pointed to the text with a left to right motion under the word), and I want you to give me the picture that goes with this word.” Then the researcher completed the instructions by pointing to the text and correct picture card and prompting the participant to give the correct picture card to the researcher. Thirdly, the researcher provided guided practice with massed trials. That is, the participant received multiple opportunities to practice selecting the icon for the newly introduced sight word. Guided practice included 5-10 trials with instructional scaffolds such as: providing a reduced field of response options, anticipating errors so that the participant is supported to perform the task successfully, and providing corrective feedback when errors are made (Browder & Xin, 1998; Rosenshine, 2012).

Corrective feedback included explicit correction, whereby the researcher clearly indicated the participant’s response was correct by stating “you got it right” or “good job” and incorrect by directing the learner’s attention to the error, modeling the correct response, and providing an opportunity for the learner to complete the trial independently before moving to the next trial (Light & McNaughton, 2009b). Instructional scaffolding continued during guided practice and included using a smaller field size (i.e., only presenting two picture cards), pointing to the correct response (if needed), and providing corrective feedback based on the participant’s response (Browder & Xin, 1998).

As the participant demonstrated consecutive correct responses independently (2-3), the researcher gradually increased the field size to four and began independent practice. Last of the instructional steps, independent practice included 10 trials for the targeted sight word and provided an additional 5 trials of review and practice for previously learned sight words (Cunningham et al., 2011). Once 80% accuracy (8 correct trials out of 10 instructional trials) for identifying the most recently introduced sight word was achieved, a new sight word was introduced.

**Sight Word Book.** The sight word book activity focused on one sight word at a time and consisted of five trials, one per page of the book. During the sight word book activity, the researcher and the participant started by looking at the book together. The images in the book were initially covered with post-its until the sight word was read. The researcher (in the following order): (a) presented four picture choices and one word; (b) had the participant read the word and choose a picture; (c) uncovered the
picture on a page and compared the picture in the book to the picture selected by the participant; and (d) pointed the text (emphasizing the word and tracking the text with finger) while prompting the participant to Velcro the picture to the page of the book. Again, corrective feedback was provided based on the participant’s response. For example, “You chose dog, but this word is drum. This is drum (points to text left to right pairs the right picture with the word). Let’s do it together (points to text left to right and says the word; then pairs the correct picture with the word). Now you read it and give me the picture that goes with the word.” These steps were repeated for each of the five pages of the book.

**Sight Word folder activity.** A manila folder containing five icons (i.e., a mixture of photographs, line drawings, and clip art representations) of one targeted sight word was presented during the sight word folder activity. The researcher had the participant select any icon from the manila folder and then stated what the picture represented (e.g., “This is a picture of a drum”). Then, the four sight words (in text form) from the targeted sight word set were presented. The participant read the four sight words and then selected the sight word text that corresponded with the target picture/photograph (e.g., select “drum” from a text array of dog, drum, cat, and ipad). After the participant chose the correct sight word, the researcher then prompted the participant to put the sight word card beside the selected picture card in the folder. Corrective feedback was provided based on the participant’s response (e.g., “Right, this is a picture of a drum, you read the word drum,” or “Let’s try again. You picked dog. This word is drum. Here is the word drum, here is the picture of drum. Now you try.”). These steps were repeated for each of the five images.

The task demands were increased in this final activity. The participant had to choose the correct word from a field of four written words; the task increased the visual discrimination demands with less contextual support from the representations provided by the pictures. This task was changed to provide a task that more closely resembled reading and would potentially provide a foundation for future sight word reading instruction when working with words that are not imageable.

**Phase III: Generalization**

Generalization data were collected prior to the start of intervention and after the intervention
ended. Photographs representing the targeted sight words were selected and used only for the generalization probes; at no other time during the intervention did the individual see these photograph representations of the sight words. Probes for generalization followed the same procedures as baseline and intervention. Each probe contained two trials for each of the four targeted sight words from one of the sets, for a total of 8 trials per probe. The presentation of the four picture cards and the order of the sight words were randomized for each trial. All word sets were probed two or three times during baseline and generalization phases using the same photographs.

**Phase IV: Maintenance**

Short-term and long-term maintenance data were collected. Short-term measures were collected approximately three to ten days following criterion being met for the sight word set targeted in intervention. It is important to note that the sight words that were previously introduced (e.g., sight words from Set 1) were also included in review as part of the explicit instruction when targeting other sight words sets. Due to this, the short-term maintenance data may have resulted in higher levels of performance, as the individual continued to receive some feedback related to these sight words; albeit minimal feedback, as only 5 review trials were completed in each instructional session (including a combination of words from Sets 1 and 2 once the learner was instruction for Set 3).

After meeting criterion (correctly reading 6 out of 8 sight words in the target word set over three sessions) for all three sets, long-term maintenance measures were collected to determine if the participants continued to demonstrate acquisition of previously learned sight words. This occurred at five and eight weeks post instruction for Chad and Nate. The probes measuring maintenance were identical to the probes used during baseline and intervention. It is important to note that long-term maintenance occurred over the break at the end of summer school so the learners did not receive any academic instruction during that time.

**Procedural reliability**

In order to calculate procedural integrity, the researcher randomly selected 20% of the video recorded sessions for: (a) probes, (b) instruction, (c) generalization, and (d) maintenance. A research
assistant assisted with procedural reliability. During a training session, together, the research assistant and researcher watched a session and completed a checklist for the required procedures (Appendix L and M). Disagreements were discussed and upon reaching 90% agreement, the research assistant independently watched the randomly selected sample of sessions and completed a procedural reliability checklist for each session. Procedural integrity was then calculated by dividing the number of steps performed correctly by the total number of steps required. Procedural reliability for baseline was 99% (range 98% to 100%), intervention was 98% (range 89% to 100%), maintenance was 99% (range 98% to 100%), and generalization was 100%.

Measures and Data Analyses

The primary dependent variable for Study 2 was the percentage of sight words accurately read; specifically the number of photos/line drawings selected correctly by the participants from a field of four when provided with the written sight word. Probes were conducted during (a) baseline, (b) intervention, (c) generalization, and (d) maintenance phases, in order to measure the participants’ performance (a) before intervention, (b) during intervention, (c) with new stimuli, and (d) after intervention respectively. As previously stated, sight word probes included two trials of each of the four targeted sight words from a set. This provided an opportunity for a maximum of 8 correct responses; since four response options were provided for each word, chance levels were 25%.

Data Analysis

Data for each participant, for each sight word set, probes were summarized separately as percentage of correct responses (out of 8 trials on each probe for each word set) (refer to Figures 4 and 5). The data were graphed and visually inspected for changes in the level, trend, and slope (Richards et al., 2014). The trend, level, and slope analyses were completed to summarize the effectiveness and efficiency of the adapted instruction on the percentage of correctly read sight words. Percentage of non-overlapping data (PND) (Scruggs et al., 1986) was selected to calculate the measure of intervention effectiveness, generalization effectiveness, and maintenance effectiveness. PND was selected due to its wide use in single-subject research (Schlosser & Dennis, 2006), simple calculation (i.e., percentage of intervention
phase data points that exceed the highest datum point in baseline) (Wendt, 2009), and easy interpretation (Wendt, 2009). For PND, interventions with scores of 90% or above are considered highly effective, between 70%-90% are fairly effective, between 50%-70% are questionable and below 50% are termed unreliable (Scruggs et al., 1986; Rakap, 2015).

Data Reliability

To establish the integrity of the data that were collected, point-by-point reliability (Kazdin, 2010) was completed by a trained second coder. This was done on a randomly selected sample of 20% of the sessions, per participant. The second coder was a Masters student majoring in speech-language pathology. He was trained to a standard on the data coding procedures using videos and a checklist (see Appendix L and M). Once reliability of 90% or better was achieved, the second coder independently completed the randomly selected sample. Then the researcher calculated the exact number of agreement across all trials, divided this number by the total number of agreements plus disagreements plus omissions, and then multiplied this number by 100 to obtain a percentage (Kazdin, 2010). Data reliability for Study 2 was: 95% (range 88% to 100% across sessions) for baseline, 98% (range 88% to 100%) for intervention, 100% for generalization, and 100% for maintenance.

Social Validity

Collecting social validity information can help to realize the functional utility of an intervention in everyday life (Schlosser, 1999). The same social validity questionnaire and procedures from Study 1 were used for Study 2. After the study was completed, the researcher distributed a social validity questionnaire to the classroom teachers, all of whom worked with the participants. The questionnaire included Likert Scale responses to five questions and three open-ended questions (see Appendix N). The questionnaire asked the professionals to indicate their level of agreement (1-strongly disagree to 5-strongly agree) regarding their perceptions of the intervention and the results. Additionally, the questionnaire asked teachers to describe any benefits, modifications, and aspects of the intervention they would want to replicate.
Results

The results are presented, per participant, according to the main research questions: (a) the effect of adapted instruction on the acquisition of sight word reading; (b) the generalization of the acquired sight words to different images; (c) the maintenance of the treatment effects long term; and (d) the social validity of the results. Each probe included eight trials for the dependent variable. A participant reached the criterion for success when he accurately identified a minimum of six out of eight (75%) sight words, for three consecutive sessions, per sight word set. The percentage of correct responses during each phase is displayed for Chad in Figure 3-1 and Figure 3-2 for Nate.

Chad

For Chad, a stable baseline was established over five probes and five sessions for Sight Word Set 1, with an average of 18% correct (range: 0% to 38%) correct. For Sight Word Set 2, a stable baseline was established after five probes and held stable for 10 probes across 14 sessions, averaging 13% correct. Chad averaged the highest baseline percentage for Sight Word Set 3, with an average of 25% correct over 10 probes across 19 sessions.

After participating instruction with Sight Word Set 1, Chad reached acquisition criterion after five sessions (approximately 1 hour and 40 minutes of instructional time), with an average of 68% correct across these 5 instructional sessions; a positive gain of +50% correct from baseline to intervention (calculated by comparing the average from baseline phase to the average of the intervention phase). For Sight Word Set 2, acquisition criterion was met after four sessions (approximately 1 hour and 20 minutes of instructional time). Chad averaged 70% correct for the intervention phase of Sight Word Set 2, demonstrating a positive gain of +57% correct from baseline to intervention. Chad needed three sessions of instructional trials (1 hour of instructional time) to demonstrate a treatment effect and reach criterion for Sight Word Set 3. He averaged 90% accuracy for the intervention phase of Sight Word Set 3 for a gain of +65% correct from baseline to intervention. Chad demonstrated 100% non-overlapping data between baseline and intervention for all three sight word sets.

For Chad, generalization probes were conducted three times during baseline and twice after
reaching criterion with the intervention for each word set (see Figure 3-1). Generalization probes included 8 trials with new images (photographs) and the same target sight words. Chad was able to generalize the sight words he learned from the intervention to these new stimulus items. Baseline for Sight Word Set 1 averaged 29% correct (range: 25% to 38%), to an average of 94% correct for the post-intervention generalization phase; demonstrating overall positive gains of +65% correct. Similar results for Sight Word Sets 2 and 3 were seen. Chad demonstrated 100% non-overlapping data between baseline and generalization for all three sight word sets.

Short-term maintenance probes were conducted between three and ten days after reaching criterion with each word set. Long-term maintenance probes were conducted six and ten weeks following the completion of sight word instruction for all three sets. Chad maintained criterion level for all short-term maintenance probes (averaging 88% correct). For long-term maintenance, Sight Word Sets 1 and 2, Chad maintained the established criterion for success (75% correct) for the six-week probe, yet fell below criterion for the ten-week probe to 63% correct (averaging 63% and 69% correct for Sets 1 and 2 respectively). For Sight Word Set 3, the six and ten week probes were both below criterion at 63% correct. Despite a drop in long-term maintenance effects, Chad demonstrated 100% non-overlapping data between baseline and maintenance for all three sight word sets.
Figure 3-1: Percentage of sight words read correctly by Chad, out of 8 trials, in probe tasks.
Nate

For Nate, a stable baseline was established over five sessions and five probes for Sight Word Set 1, with an average of 15% correct (range: 13% to 25% correct). For Sight Word Set 2, baseline phase was held stable for 8 probes across 12 sessions, averaging 14% (range: 0% to 25%) correct. Nate averaged the highest baseline percentage for Sight Word Set 3, with an average of 18% over 8 probes across 16 sessions after instruction for Set 1 began.

Nate averaged 63% correct in the 5 intervention sessions; a +60% increase from baseline (calculated by comparing the average of the baseline phase to the average of the intervention phase). PND was calculated and 100% non-overlapping data was observed for Sight Word Set 1 from baseline to intervention. Nate needed three instructional sessions to reach criterion for Sight Word Set 2 (approximately 1 hour), yet participated in additional sessions because not all sight words had been introduced during instruction. Nate averaged 85% accuracy for Sight Word Set 2; an increase of +61% correct was observed from baseline to intervention for Sight Word Set 2. PND was calculated and 100% non-overlapping data was observed for Sight Word Set 2 from baseline to intervention. Nate held a stable baseline over the course of 8 probes across 16 sessions for Sight Word Set 3. Nate needed four instructional sessions to reach criterion for Sight Word Set 3 (approximately 1 hour and 20 minutes). Nate averaged 78% correct for Sight Word Set 3, demonstrating a +57% increase from baseline. PND was calculated and Nate demonstrated 100% non-overlapping data between baseline and instruction for Set 3.

Generalization probes were conducted twice during baseline and twice after reaching criterion with the intervention (see Figure 3-2) for Nate. He generalized the sight words he learned from the intervention to these new stimulus items, with percent correct ranging from 88% to 100% after intervention compared to 13% to 38% accuracy during baseline, prior to intervention. Nate averaged: 100% correct for Sight Word Set 1, 88% correct for Sight Word Set 2, and, 88% correct for Sight Word Set 3. Nate demonstrated 100% non-overlapping data between baseline generalization probes and post intervention generalization probes, for all three sight word sets.

Short-term maintenance probes were conducted between three and ten days after reaching
criterion with each word set. Long-term maintenance probes were conducted six and ten weeks following
the completion of sight word instruction for all three sets. Nate was able to maintain criterion level for all
short-term and long-term maintenance probes. Short-term probes averaged: 96% correct for Sight Word
Set 1 (range: 88% to 100%), 94% correct for Sight Word Set 2 (range: 88% to 100%), and 88% correct
for Sight Word Set 3. Long-term probes averaged: 88% correct for Set 1 (range: 75% to 100%), 81%
correct for Set 2 (range: 75% to 88%), and 88% correct for Set 3. Nate demonstrated 100% non-
overlapping data between baseline and maintenance for all three sight word sets.
Figure 3-2: Percentage of words read correctly by Nate, out of 8 trials, in probe tasks
**Error analysis**

Data were further analyzed for patterns based on the learners’ responses during probe tasks. Per trial in probe tasks, the researcher recorded the: (a) target word, (b) stimulus presented, (c) order in which the stimulus was presented, and (d) response from the learner in relation to the target word (i.e., correct or incorrect and if incorrect the image selected). For some sessions, detailed information (e.g., order of stimulus and the image selected instead of the correct response) was not recorded by the researcher either because the participant didn’t respond or the researcher was managing challenging behaviors and attempting to keep the participant on task.

For Chad, based on the further analysis, the words that were correct the most included: cookies (69%) (Set 1), snack (53%) (Set 2), and book (52%) (Set 3). The words that were incorrect the most included: juice (64%) (Set 1), swing (75%) (Set 2), and ball (61%) (Set 3). For Set 1, cookie was the most common error (i.e., the picture most commonly selected instead of the correct picture for the presented sight word) for the sight word *juice*. *Snack* was the most common error for the sight word *swing*, in Set 2. For Set 3, *game* was the most common error for the target sight word *ball*.

The analysis of errors for Nate, revealed patterns related to location; selecting icons on the right of the array; specifically in position four (see Appendix G for a visual of position) He made selections for position four in Set 1 51% of the time, Set 2 46% of the time, and Set 3 44% of the time. For Nate, the words that were correct the most included: dog (71%) (Set 1), music (47%) (Set 2), and type (54%) (Set 3). The words that were incorrect the most included: drum (71%) (Set 1), book (67%) (Set 2), and piano (75%) (Set 3). For Set 1, *dog* was the most common error (i.e., the picture most commonly selected instead of the correct picture for the presented sight word) for the sight word *drum*. *Snack* was the most error for the sight word *book*, in Set 2. For Set 3, *piano* was the most common error for the target sight word *type*.

**Social Validity Survey Outcomes**

Two teachers completed the social validity survey for the sight word instruction. All respondents
marked strongly agree for all Likert-type questions related to intervention and improvements. Results indicated that the intervention was effective, appropriate, practical, and could potentially be generalized to other students. Chad’s teacher was interested in keeping the materials and was excited that he made progress in this study. She changed her sight word instruction to include more motivating and imageable words. Nate’s teacher also viewed positive gains in Nate’s knowledge of sight words. Nate’s teacher also modeled literacy activities (e.g., sight word instruction) and other instructional materials (e.g., telling time) after instructional practices that were used in this study, including guided practice and task adaptations (e.g., use of four pictures and a target word/concept).

**Study 2-Discussion**

This study was designed to examine the effects of adapted instruction on the acquisition of reading sight words for individuals with severe disabilities, ASD, and CCN. The study measured the changes in the participants’ accuracy reading 12 personally relevant sight words. The current study extends the previous research related to reading instruction for learners with ASD and CCN by examining the use of adapted evidence-based instructional practices for older learners (ages 10 and 19), with severe disabilities, who were identified as non-literate (i.e., could read less than 10 words) and struggled with progress in past or current literacy programs. Results for both participants supported the hypothesis that evidence-based adapted instruction would result in improved sight word learning, despite a past of limited literacy success. In addition, the intervention resulted in generalization of sight word reading to a novel representation (i.e., Symbolstix to photographs), providing evidence that both participants learned more than a paired association between pictures used in instruction and the targeted sight words (Fossett & Mirenda, 2006). The participants’ teachers also viewed the intervention as practical, appropriate, and effective. Although past literacy research on older individuals with severe disabilities, ASD, and CCN is limited (Spector, 2011), the results from this study provide evidence that implementing evidence-based adapted literacy instruction with older individuals with severe disabilities, ASD, and CCN can be an effective and efficient method of teaching personally relevant sight words.
Effectiveness of Sight Word Instruction

Intervention

The findings from the two participants in this study suggest that individuals who are at risk for developing beginning literacy skills, like older individuals with ASD and CCN, benefit from explicit and systematic instruction (e.g., Archer & Hughes, 2011). Findings from this study resulted in acquisition of a few more sight words (e.g., 12 in comparison to 5-8 in Fossett and Mirenda (2006) or 8 in Hetzroni and Shalem (2005)) with less time spent in instruction. The effectiveness of the intervention for Chad and Nate may be attributed to several aspects of the instructional program that are supported by research, including: (a) adaptations to support participation of individuals with limited speech by eliminating the need for an oral response during instruction and assessment (Fossett & Mirenda, 2006; Light & McNaughton, 2009b); (b) frequent opportunities to practice the target skill in each instructional session (Cunningham et al., 2011; Rosenshine, 2012); (c) most-to-least prompting with guided practice to minimize practicing errors that can occur during learning (Light & McNaughton, 2013, Simmons & Kameenui, 1998); (d) corrective feedback to allow learning from responses by drawing attention to errors, modeling correct responses, and providing opportunities to complete the trial correctly (Browder & Xin, 1998; Light & McNaughton, 2013); (e) introduction of one word at a time (Millar et al., 2004); (f) review of previously learned sight words (Rosenshine, 2012); and, (g) extension activities to bridge top-down and bottom-up learning in more meaningful and motivating literacy contexts (Adams, 1990; Light & McNaughton, 2013).

Generalization

The extension activities likely impacted the positive outcomes in the generalization phase of the study for the two participants. Practice with a variety of representations of the sight words was provided in order to promote generalization to untrained representations (Cooper, Heron, & Heward, 2007). The use of multiple representations (or exemplars) in the Sight Word Book and Sight Word Folder activities attempted to ensure acquisition beyond a paired associated, shifting away from a common “train and hope” research paradigm (Schlosser & Lee, 2000). Chad and Nate were both able to generalize the...
targeted sight words that they acquired during intervention to new representations, after meeting criterion in instruction, for all sight word sets. Generalization scores increased well above baseline (range of gain increases: +63% to +75% for Chad and +75% to +81% for Nate) and generalization accuracy percentages ranged from 88% to 100% for both Chad and Nate.

**Maintenance**

Chad and Nate maintained the 12 targeted sight words at and above criterion for short-term maintenance probes. Nate maintained skills for the long-term maintenance probes, yet Chad fell below criterion for the 10-week post-instruction probe (Set 1: 63%; Set 2: 69%; Set 3: 63%). Rasinski and Padak (2008) reported that, “learners of average intelligence require approximately 35 exposures to a word before it can be easily recognized; less able learners will require about 55 exposures to a word before it can be recognized automatically” (p. 169). For Chad and Nate, they both received a minimum of 25 trials with the targeted sight word during direct instruction and the sight word book and folder activities. They received additional feedback during corrective opportunities and through review activities once a new sight word was introduced.

The need for booster sessions for Chad could be due to the fact that the exposures per word potentially fell on the lower end of Rasinski and Padak’s findings for word recognition automaticity for individuals with disabilities. Sight Word Set 3 for both participants conceivably received the least amount of exposures, as words from this set were not reviewed in explicit instruction since they were acquired last. This could be a possible explanation for why Chad’s lowest maintenance scores occurred with Sight Word Set 3. Providing more review opportunities and increasing exposures per word could potentially have positive impacts on long-term maintenance outcomes for some individuals.

Additionally, it is important to note that the six and ten week maintenance probes were conducted after a break between extended school year and the start of a new school year. During that time, participants potentially engaged in minimal to no academic tasks. This break in routine and academic participation could have also impacted the outcomes of maintenance.

**Error analysis**
Although Chad and Nate both demonstrated acquisition, generalization, and short-term maintenance of the targeted sight words, error patterns did emerge during the study that warrant additional discussion and consideration. Although both participants met criterion for all sight word sets, errors were observed in the learning process. Both participants demonstrated some errors with words that began with same initial letter (e.g., *swing* and *snack*). One potential explanation for this error pattern with both participants could be the reliance on visuographic cues and non-phonetic graphic features in the printed word itself, as these errors patterns made by the participants are similar to those documented by “pre-alphabetic” (Bloodgood, 1999; Ehri, 2005; Share & Gur, 1999) and “partial-alphabetic” (Ehri, 1998) readers.

Due to previous exposure and experiences with literacy instruction, coupled with participation in Study 1, Chad and Nate are likely in a “partial-alphabetic” phase of literacy acquisition (Ehri, 1998). During this phase, learners make use of partial connections, including visual, context, and phonetic cues (Ehri, 1998). Error patterns with words that began with same initial letter (e.g., *mario* and *movie*) could also be explained by use of initial consonant for deciphering the word. Letter-sound correspondences targeted in Study 1 overlapped with the initial letter for a number of sight words. More specifically, for Chad, 5 out of 12 sight words started with initial letters that were targeted in Study 1 (m, c, i, g, l). For Nate, 6 out of 12 sight words started with initial letters that were targeted in Study 1 (d, c, i, m, p, t). Furthermore, during Study 1 extension activities included models for matching the initial sound of a word with the correct letter. This task could have implicitly highlighted application of a strategy for that assists with word recognition. Researchers have found that learners will make use of the initial consonants, often mistaking words they know (or have learned) that share similar initial letters, especially when they are relying on partial phonetic connections (Ehri, 1998; Mason, 19080). As learners transition from the partial alphabetic phase to an alphabetic phase, learners are able to form connections between all the graphemes and the phonemes and utilize these to read words (Ehri, 1998).

Another pattern that emerged was related to the words read correctly most frequently, per set, by the learner. Words that were correct the most across the probes were not only highly preferred, but were
concepts that were communicated about frequently. For Chad, the words that were correct the most included: cookies (Set 1), snack (Set 2), and book (Set 3). These items are frequently requested, using word approximations and physical communication, throughout the day. For Nate, the words that were correct the most included: dog (Set 1), music (Set 2), and type (Set 3). Nate and communication partners (e.g., teachers, aides) frequently communicated about these concepts. For example, Nate owns a dog and loves to hear stories, watch videos, and have partners read books about dogs. For leisure, Nate often chooses to listen to music and to type (with hand-over-hand assistance) on the computer. These results highlight the importance of personally relevant vocabulary for instruction, especially as a starting point for older learners who have a history of failed literacy success (Light & McNaughton, 2013). In addition, these results expand recommendations to consider words that are communicated frequently by individuals with CCN, laying the foundation for use of standard orthography as a means of communication.

**Efficiency of Sight Word Instruction**

Chad and Nate demonstrated an immediate effect upon participation in intervention, with no overlapping data and a range of three to six intervention sessions to meet criterion. They required a range of approximately 1 hour to 2 hours of instruction to acquire each set of personally relevant sight words (3 to 6 hours of instruction to acquire a total of 12 sight words). This is less instruction time than previous studies that included individuals with ASD and CCN. For example, Fossett and Mirenda (2006) found that one participant with ASD and CCN acquired five to eight words after approximately 7-hours of intervention. Both Chad and Nate demonstrated the lowest accuracy levels with words in Set 1, potentially due to increased demands as they worked through a combination of learning the demands of the task and acquiring the sight words. In a study by van der Meer and colleagues (2014), the one participant with ASD and CCN reached criteria after 22 sessions (approximately 22 hours of instruction) for word to picture matching for 12 sight words.

For Chad, the least number of instructional sessions were necessary to meet criterion for Sight Word Set 3 (after only a total of 1 hour of instruction) compared to Word Sets 1 and 2. For Nate, the fastest set to reach criterion was Sight Word Set 2, reaching criterion after only a total of 1-hour
instruction. This could potentially be due to a better understanding of the task, increased responsiveness to the corrective feedback during the intervention, and/or words in the set were more motivating. For example, it is interesting to note that, although all the words selected for Nate had personal relevance (including access to these words in his communication boards). Yet Sight Word Set 2 had the most words that Nate requested on a consistent basis from his communication boards (e.g., swing, snack, music, and book). As Light and McNaughton (2013) argued, personally relevant vocabulary is important to engage learners and provide a foundation upon which more abstract reading skills, like alphabetic principles, can be built. This is especially true of older learners with severe disabilities who have a history of failure in instruction.

For Sight Word Sets 2 and 3, Chad and Nate both met criterion prior to receiving explicit instruction on all the sight words in the set. Marzano (2011) concluded that it takes up to six repetitions to become familiar with the word. Individuals with severe disabilities may need more opportunities due to intrinsic and extrinsic factors that can impact acquisition. Chad and Nate were exposed to a minimum of 25 repetitions of one sight word during one intervention session. The increased number of repetitions with the word could be one explanation for the immediate effect and minimal instruction time required to meet criterion. Additionally, when the task was introduced each session, the picture stimuli were paired with the text to review the words that were going to be targeted. Moreover, feedback was provided when errors were made. These three factors could have contributed to reaching criterion prior to explicit instruction in all words within the set. One additional hypothesis is related to the assessment probes. The probes required the learner to select a picture to represent a sight word from a field of four with chance levels of being correct at 25%. Using fast mapping (Wilkinson & Albert, 2001), the participants may have been able to increase chance levels of being correct without receiving instruction on all the sight words in the set. For example, learners could eliminate the pictures and words that they have already learned in order to figure out the word that has not been taught yet.

**Future Directions and Limitations**

The current study’s investigation of the effects of adapted instruction on the sight word reading of
older individuals with ASD and CCN offers important data; therefore, the study does have some limitations. First, the results of this study are limited by the fact that only two participants were included in this study; thus, it is difficult to extend the results to a wider population. Chad and Nate were quite different in terms of their speech abilities, response modes, and behaviors. The fact that the two participants were different potentially suggests that the adapted sight word instruction might be successful for learners with a range of complex communication needs and abilities. Yet, replicating this study and extending this research to participants with various diagnoses and learning abilities, would strengthen the external validity of results, and is necessary to better understand the effectiveness and efficiency of the intervention.

Instructional sessions were delivered two-three times per week, often with two sessions provided per day. However, for beginning readers daily instruction is recommended (e.g., Camine et al., 1997). Results of the study may have been strengthened had instruction been delivered every day, rather than only a few times a week. The mixed results in regards to maintenance suggest that the program may require modification to enhance the long-term effectiveness of the instruction. Future research is needed to address adaptations for children like Chad, who demonstrated more difficulty retaining sight words targeted in the intervention. Additionally, the instruction was delivered in a one-to-one manner by the researcher. It would be interesting to study the response of learners with CCN in small group reading instruction, rather than one-to-one instruction, as well as the overall effectiveness of the adapted instruction by providers other than the researcher.

A second limitation relates to the assessment probes and the small target word sets (n = 12, 4 words per set). The assessment probes included an array of four choices. By providing a closed-set of responses, the task is simplified from a traditional reading task, whereby the response is open-ended (Barker et al., 2012). Additionally, the foils used in the probe task included words that were targeted within the sight word intervention and included only one other word with the same initial letter as the targeted sight word. These experimental choices potentially provided additional scaffolding support. It is possible that the responses would differ after intervention if the probes included: response options in text
only, increased array size, more foils with the same initial letter as the target word, and foils that were not included in the intervention. Furthermore, the total number of sight words targeted in the study is small and instruction only targeted the single-word level, which makes it difficult to extend the results to larger sight word vocabularies and application of the newly acquired sight words in shared reading or connected text contexts; future research investigating these areas are warranted.

For individuals with severe disabilities, educators and parents, the findings of the present study should be viewed as promising. Further research is necessary to extend these findings to explore the potential of this strategy for teaching sight words in combination with decoding skills, explore reading sight words in connected text instead of the single word level, and consider ways in which the adaptations and instructional techniques used in this intervention can support literacy programs for individuals with severe disabilities and CCN in general.

**Conclusion**

Limited research exists in relation to sight word instruction for older individuals with severe disabilities, autism spectrum disorders, and complex communication needs. Results for both participants supported the hypothesis that adapted instruction would result in improved sight word learning, despite a past of limited literacy success. In addition, the intervention resulted in generalization of sight word reading to a novel representation (i.e., Symbolstix to photographs), providing evidence that both participants learned more than a paired association between pictures used in instruction and the targeted sight words. The participants’ teachers also viewed the intervention as practical, appropriate, and effective. Use of a systematic intervention program that incorporated imageable and personally relevant sight words with repeated opportunities for practice resulted in significant positive changes in sight word reading accuracy, for the 12 targeted sight words, from baseline.
CHAPTER FOUR

DISCUSSION

These two studies contributed to the limited body of research that has investigated the effectiveness of adapted literacy instruction with older learners with severe disabilities, autism spectrum disorder (ASD), and complex communication needs (CCN). The findings of Study 1 and Study 2 suggest that older learners with severe disabilities, ASD, and CCN who have previously struggled to make progress with early literacy skills (including letter-sound correspondences and sight words) can indeed make progress. More specifically, all learners made progress from their individual baseline levels of performance on identification of 12 letter-sound correspondences and 12 sight words through participation in interventions that provided direct instruction in the context of meaningful and motivating activities, along with adaptations to accommodate the needs of individuals with CCN.

The specific results of the individual studies have already been discussed with respect to prior research. This chapter considers common features of the interventions (across studies) that likely supported why both interventions resulted in positive outcomes, as well as the similarities and differences, in terms of instructional effectiveness and efficiency, for the learners that participated in both Study 1 and 2. The chapter also considers the contributions that these two studies made in relation to Adams’ theoretical model of reading as well as gaps in the current knowledge base that should be addressed by future research.

Features of the Interventions Resulting in Positive Outcomes

While considering best practices for beginning readers, the interventions provided to the older learners attempted to bridge top-down and bottom-up approaches to beginning literacy instruction. For Study 1 and Study 2, this included 30 min. sessions whereby the learners participated in direct instruction in the context of meaningful and motivating activities, along with adaptations to accommodate the needs of individuals with CCN. These components of the adapted instruction likely contributed to the success of the learners in Study 1 and 2. A general overview of these components will be discussed subsequently.
These components will be discussed again later in this chapter in reference to outcomes and clinical implications.

**Direct instruction**

In general, the term direct instruction has been used to refer to (a) any academic instruction that is led by a teacher, and, (b) instructional procedures used by most effective teachers (Rosenshine, 2008). Direct instruction procedures commonly, and in this study, include: (1) structuring learning into manageable steps, whereby skills are introduced gradually (Carnine et al., 2010); (2) providing a consistent sequence and structure to the lesson and materials (Rosenshine, 1997); (3) providing sufficient opportunities, through models, guided practice, and independent practice (Rosenshine, 2012); (4) giving immediate feedback and corrections; and, (5) monitoring progress (Rosenshine, 2012).

**Meaningful and motivating activities**

Direct instruction procedures include instruction practices used by the most effective teachers (Rosenshine, 2012). Additionally, successful teachers provide instruction that incorporate learners interests. For older learners it is important to provide instructional activities that support success and incorporate interests from the very beginning (Light & McNaughton, 2009b), as these learners likely come to literacy instruction with a history of literacy failure (Koppenhaver et al., 1991). Use of materials and activities that incorporate personal interests can encourage active engagement, participation, and attention (Ellis et al., 1994). This can facilitate learners’ belief that literacy skills are worthwhile to learn and, therefore, increase motivation participate (Light & McNaughton, 2013).

**Adaptations to accommodate the needs of individuals with CCN**

Adaptations are required to support individuals with CCN in maximized participation in literacy instructional activities. Light and McNaughton (2009) outline three specific adaptations that are important for literacy learning, including (but not limited to) to letter-sound correspondence and sight word instruction. These three adoptions were used in both studies and require instructors to: (1) provide options for alternative respond models (e.g. pointing to words and letters) to eliminate the need for oral responses; (2) control response options and systematically analyze the errors in order to provide insight
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into areas of difficulty; and (3) provide external scaffolding to compensate for the learners lack of access to oral production and rehearsal through saying the sounds aloud for the learner and encouraging the learner to say the sounds in their head.

**Similarities and Differences in Outcomes for the Learners that Participated in Both Studies**

Adapted instruction for both studies included learners participating in direct instruction in the context of meaningful and motivating activities, along with adaptations to accommodate the needs of individuals with CCN. Results for both studies supported the hypotheses that adapted instruction would result in improved letter-sound correspondences and sight word reading skills for non-literate older learners with severe disabilities, ASD, and CCN, despite a past of limited literacy success.

**Effectiveness**

Percentage of non-overlapping data (PND) scores were calculated for both studies and compared to effectiveness guidelines from Scruggs and colleagues (1986) (e.g., PND scores of 90% or above are considered highly effective, between 70%-90% are fairly effective, between 50%-70% are questionable and below 50% are termed unreliable). For Chad in both Study 1 and 2, PND scores demonstrated 100% non-overlapping data between baseline and intervention conditions for all LSC and Sight Word sets, suggesting that both interventions were highly effective for Chad. For Nate in Study 1, PND scores ranged from 88% to 100% non-overlapping data between baseline and instruction (specifically, 88% for LSC Set 1, 88% for LSC Set 2, and 100% for LSC Set 3), suggesting that the LSC intervention was fairly effective to highly effective across letter sets, for Nate. For Study 2, PND scores for Nate were 100% non-overlapping, suggesting that Study 2 intervention was highly effective, for Nate, for all of the sight word sets.

Both studies demonstrated positive gains from baseline to intervention, across all sets (letter-sounds in Study 1 or sight words in Study 2). More specifically, in comparing the two learners that participated in Study 1 and Study 2 (Chad and Nate), Chad averaged a gain score of +54% correct across the letter-sound correspondence sets in Study 1 and +57% correct across the sight word sets in Study 2. Nate averaged a gain score of +47% correct across the letter-sound correspondence sets for Study 1 and
+60% correct across the sight word sets in Study 2. In comparison of maintenance measures, Chad was able to maintain the targeted letter-sound correspondences at and above criterion for short-term and long-term maintenance probes for Study 1, and maintained the 12 targeted sight words, for Study 2, at and above criterion for short-term maintenance probes. Chad fell below criterion for the 10-week post-instruction probe (Set 1: 62.5%; Set 2: 68.7%; Set 3: 63%) for Study 2. Nate maintained the 12 targeted sight words at and above criterion for short-term and long-term maintenance probes for Study 1 and Study 2.

Efficiency

The adapted instruction in the studies were not only effective, but were relatively efficient given the participants’ severe disabilities. Sight word learning did occur more efficiently in comparison to the letter-sound correspondence study, especially for Nate. For Study 1, Chad ranged from six to eight instructional sessions (approximately 120 to 200 mins of intervention) to meet criterion across the letter-sound sets. For Study 2, Chad needed five or six instructional sessions (approximately 100 to 120 mins of intervention) to meet criterion across the sight word sets. For Nate, Study 1 required five to 17 sessions to meet criterion across the letter-sound sets (approximately 100 to 340 mins of intervention). For Study 2, Nate required fewer sessions and less instructional time; five sessions (approximately 100 minutes), to meet criterion for each set of personally relevant sight words sets.

Hypotheses for outcome differences

In general, for Chad, both studies were similarly effective and relatively efficient. For Nate, both studies were relatively efficient, yet Study 2 was more effective than Study 1. A number of hypotheses could potentially explain these overall outcomes, including: the skill being taught, frequency of sessions, and, the components of the intervention.

Skills

The skills taught in intervention, per study, could inherently account for outcome differences, especially for Nate. It is acknowledged that acquisition of letter-sound correspondence is a challenging task (Adams, 1990). Studies have shown that even adults who have never learned to read alphabetic
orthography have difficulty identifying the correct phonemes in letter-sound correspondence tasks (Ehri, 1998). Research indicates that letter-sound knowledge is a strong predictor of beginning reading, but with the acknowledgement that it is a skill that is not easily acquired by many young children (Ehri, 1983; Adams, 1990). It is also recognized that intrinsic and extrinsic factors that individuals with CCN bring to the learning context may add substantially to the challenges associated with the task (Foley, 1993). In order to be successful at acquiring letter-sound correspondences, learners need to remember letter shapes and sounds by pairing abstract visual appearances with labels that lack any meaning (Ehri, 1998). The abstractness and attention to detail make the task challenging, as the learner has to retain each letter’s specific information in memory, based on these abstract cues. In addition, sounds are inherently short and fleeting unlike spoken word and limited attention may negatively impact learning.

Letter-sound correspondences depend largely on phonological and orthographic processing in isolation, whereas sight word reading is support by meaning and potentially context processing. More specifically, a beginning reader learns sight words through forming connections between meaning, salient visual features, and the associated label (Adams, 1990). For example, beginning readers note salient visual features accompany print (e.g., the arch behind the M in McDonalds) and then tie the meaning (e.g., experiences and pictures) and the label (e.g., parent saying “McDonalds” when the child points to the sign) to the text. The sight word instruction focused on vocabulary that was well known and both meaningful and motivating for the participants. This prior knowledge of word meaning may have facilitated learning. The use of Symbolstix and photographs during the assessment probes and intervention potentially assisted in the creation of more meaningful connections, reducing the abstraction and memory demands. Unlike previous sight word research for individuals with ASD and CCN (e.g. Fossett & Mirenda, 2006; van der Meer et al., 2014), the words that were selected for the sight word study were personally relevant and imageable. This feature of the intervention may have potentially contributed to the effectiveness of the intervention for Chad and Nate. In Study 1, the participants had to rely solely on memory of the letter shapes and sounds, using abstract visual appearances with labels that lacked any meaning. Ehri (1983) postulated that in order to speed up the course of letter-sound learning, teachers
should incorporate meaning and extensive practice into instruction. Study 1 and 2 incorporated extension activities in order to build more meaning into the instruction, however, the participants clearly had a more developed meaning base for the personally relevant and motivating vocabulary selected as sight words in Study 2.

**Frequency of sessions**

The study sequence and session occurrence could have also contributed to differences in the overall effectiveness and efficiency of learning in the studies. Letter-sound correspondence intervention (Study 1) was provided before sight word intervention (Study 2). The order in which the interventions were provided may have additionally contributed to the greater gain scores and efficiency in Study 2 for Nate. The sight words targeted in Study 2 were selected based on personal relevance, yet a number of the target words started with initial letter sounds that were targeted in Study 1. More specifically for Chad, 5 out of 12 sight words started with initial letters that were targeted in Study 1 (m, c, i, g, l). For Nate, 6 out of 12 sight words started with initial letters that were targeted in Study 1 (d, c, i, m, p, t). Research indicates that once individuals learn some letter-sound relations, they are potentially capable of forming connections between salient letters and sounds to remember how to read a word by sight (Ehri, 1998). As explained by Ehri (1998), “Spellings of words like are maps that lay out the phonological forms of words visually. Knowledge of letter-sound relations provides a powerful system that bonds the written forms of specific words to pronunciation in memory” (p. 15).

Moreover, Ehri and colleagues (1983, 1992) found that children who lacked independent phonological recoding skills could still use their alphabetic knowledge to assist in sight word reading. This is important, as the researcher completed the phonological recoding for the letter-sound task in order to adapt the intervention to accommodate the participants’ complex communication needs. In addition, during the extension activities (the folder and book) in Study 1, models for matching the initial sound of a word with the correct letter were provided. This task could have implicitly highlighted a strategy for learning how to form connections between salient letters in order to differentiate a word. Therefore, the
participants’ experience and knowledge with letter-sound correspondences may have contributed to more effective and efficient intervention outcomes in Study 2.

In addition to the letter-sound correspondence intervention occurring prior to the sight word intervention, the studies differed in regards to the frequency that sessions occurred. With Study 1, the intervention sessions occurred approximately two times per week, for 30 minutes (20 minutes for instruction and 10 minutes for probes), often with two to three days in between the sessions. With Study 2, the intervention session occurred approximately two to four times per week and often two intervention sessions occurred on the same day (with a break in-between the sessions). Study 2 more closely emulated the current best practice recommendations for literacy instruction; all students in Grades 1-3 should receive at least 90 minutes of literacy instruction per day (Vaugh, Wanzek, Woodruff, & Thompson, 2007). Study 1, per week, fell below what is recommended per day.

Learners, like individuals with ASD and CCN, who are at risk for literacy development should receive a minimum of 60 minutes more than the current best practice recommendations, for a total of 120-150 minutes of literacy instruction per day (Haager, Klingner, & Vaughn, 2007; Light & McNaughton, 2013). Yet research indicates that instructional experiences are qualitatively and quantitatively different for individuals with complex communication needs (Koppenhaver et al., 1991; Zascavage & Keefe, 2004). As a teacher in a qualitative study by Zascavage and Keefe (2004) reflected, between therapies, specials (e.g., gym, music), medical needs, and social activities, there is approximately 30 minutes a day left for literacy instruction. Often, the 30-minute time block for literacy is poorly managed, with transition time and material set-up cutting into instruction. The lack of literacy instruction as a priority could stem from continued low expectations for individuals with severe disabilities and CCN, a factor that often minimizes outcomes (Light & McNaughton, 2013). Yet, with access to adapted literacy instruction, individuals with severe disabilities, ASD, demonstrated improvements from baseline, despite limited instructional time (20 minutes per session). The overall gain, efficiency, and long-term maintenance of the skills targeted in intervention could have potentially seen even better results had the interventions occurred more than once a day and every day of the week; matching best practices for beginning readers.
**Intervention components**

The results for both studies were positive and consistent with the literature suggesting a interactive and integrated approach to instruction (Adams, 1990; Ehri, 1998). Specific examples of this include the letter-sound book and folder activities, bridging top-down and bottom-up approaches by building and activating meaning and context processing, while targeting skills at the level of orthographic and phonological processing. This integrated approach is additionally consistent with suggestions by other researchers. For example, Ehri (1998) suggested that in order to speed up the course of letter-sound learning, teachers should incorporate meaning and provide opportunities for extensive practice. Harris and Sipay (1990) also suggested that for those who need repetition, it is important to remember that drills should be presented in a meaningful way to maintain the child’s interest and encourage accurate participation. The incorporation of meaningful and multiple opportunities, for the participants in Study 1 and 2 might have been notably more important considering their history of limited literacy progress.

**Theoretical Framework**

The theoretical framework presented by Adams (1990) influenced the interventions provided to the older learners with ASD and CCN. The framework is neither top down nor bottom up, but presents reading as complex and interactive. The framework involves four types of processing: (1) orthographic processing, (2) phonological processing, (3) meaning processing, and (4) context processing (refer back to Figure 1-1). The interplay between these processors impacts the speed in which a reader recognizes a word and is influenced on the reader’s familiarity with the: (a) letter sequences (i.e., orthographic processor), (b) pronunciation of the word (i.e., phonological processor), (c) meaning of the word (i.e., meaning processor), and (d) interpretation of the text surrounding the word (i.e., context processor) (Adams, 1990; Benedek-Wood, 2010). Study 1 and 2 targeted skills at the level of orthographic and phonological processing, with attempts to activate meaning processing by adding personally relevant vocabulary, motivating activities, and use of a range of vocabulary concepts.

This study provides some evidence, that despite significant deficits in all types of processing, the compensatory nature of reading may still occur. Since the studies targeted letter-sounds and sight words
at the individual phoneme and single word level, context processing was not targeted or likely engaged. Meaning processing, although impaired, may have been used to compensate for challenges with orthographical and phonological processing; supporting the top down and bottom up approaches in intervention and use of personally relevant vocabulary.

Reading acquisition is an ongoing endeavor. Skills targeted in Study 1 and Study 2 provide some foundations, but do not suggest that the participants are finished learning how to read. Successful readers recognize letters and their sequences automatically; map sounds to letters (and vice versa); manipulate sounds; use context cues and knowledge; and integrate these skills to draw upon meaning and comprehend text (Light & McNaughton, 2013). Based on Adams’ model, the National Reading Panel recommendations (2000), and early literacy research literature for individuals with and without CCN, more skills are needed to be a successful reader. At minimum beginning literacy instruction should included instruction in: (a) phonological awareness skills (e.g., sound blending, phoneme segmentation) (Torgesen, 1999); (b) letter-sound correspondences (Bradley & Bryant, 1983); and, (c) sight words (Ehri, 1998; Gabig, 2009). Once learners acquire a few (3-5) letter-sound correspondences and sight words, beginning literacy instruction should to begin to include guided practice with decoding and incorporate comprehension during shared reading (Light & McNaughton, 2013).

**Clinical and Educational Implications**

Based on the theoretical framework presented in this paper, skillful reading includes many components that interact and develop together. Classroom literacy instruction should support this interactive process. Unfortunately, for those with moderate and severe disabilities and complex communication needs, literacy outcomes remain poor, as many do not even acquire basic literacy skills (Koppenhaver & Yoder, 1992); the majority are achieving well below grade level (Koppenhaver, Hendrix, & Williams, 2007). Yet, teaching literacy skills is one of the most empowering things we can do for individuals with CCN (Lindsay, 1989; Light & McNaughton, 2013). This includes literacy instruction for all learners, like older learners with severe disabilities, ASD, and CCN with a history of limited literacy success. Access to adapted literacy instruction can potentially break the cycle of low expectations
and limited outcomes, expand communication options, and support fuller participation in society. In order to change outcomes, it is important to consider what successful readers do, as well as the skills and supports that underlie their success. When considering starting points for formal reading instruction, researchers have consistently found that explicit instruction, in both phonics and phonemic awareness (Adams, 1990; Carnine et al., 2010; Chall, 1983) and instruction to develop automatic and robust sight word vocabularies (Gabig, 2009), play critical roles in becoming a skilled and successful reader. The current project provided some evidence towards intervention planning for clinicians and teachers including the consideration of: sequence of skills, instructional methods, and adaptations for older individuals with CCN.

**Sequence of Skills Targeted**

Early literacy instruction should include interventions in many subskills. The subskills come together, to support the ultimate goal of reading – to understand and gain insight and knowledge from the act of reading. Construction of meaning comes in part from fluent and accurate word recognition. Subskills that support acquisition of fluent and accurate word recognition are derived from beginning literacy instruction in: (a) phonological awareness skills (e.g., sound blending, phoneme segmentation); (b) letter-sound correspondences; (c) decoding; and, (d) sight words. For research purposes, all of the previously mentioned subskills were not targeted during literacy instruction. Phonological awareness skills and letter-sound correspondence skills are often taught at the same time (Erickson & Clendon, 2009), these skills are then built upon by instruction in decoding. Sight word instruction can occur simultaneously with phonics-base approaches, as both ultimately support acquisition of skills related to word recognition.

For this project, letter-sound correspondences were taught prior to instruction in sight words. Instruction should consider teaching letter-sound correspondences and sight words during the same literacy block, not addressing these skills in a sequential manner. The learners potentially used their letter-sound knowledge when engaged in the sight words instruction, proving to be a beneficial skill. Yet it is acknowledged that letter-sound acquisition can be slow, abstract, and challenging. The combination of
both skills in a literacy block would teach important foundation skills for word recognition, supporting foundational skills for word reading with and without word attack strategies.

When providing instruction in letter-sound correspondences, it is important to first assess learners’ present level of performance in order to determine which letter-sound correspondences the learner may already know. Then instructors should sequence the unknown letter-sound correspondences using guidelines recommended by Carnine and colleagues (2010) and Light and McNaughton (2009) (Benedek-Wood, 2010) (e.g., lower case letters taught first because they occur more frequently in texts, letters and sounds that are visually and auditory similar are separated in instruction). In addition, contributions from Study 1 would suggest sequencing instruction of continuous letter-sounds prior to non-continuous letter-sounds.

As with letter-sound correspondences, it is important to first assess the learners’ present level of performance with sight words in order to determine any words the learners already know. Assessment can occur from common sight word lists (Dolch, Fry), but should also extend to words that are personally relevant and commonly encountered in the individual’s life (e.g., school, home, community). For individuals with severe disabilities it is important to start with words that are highly motivating and personally relevant (Light & McNaughton, 2013). Based on results if Study 2, it is also important to initially target sight words are imageable in order to assist in activation of meaning.

**Instructional Methods**

Study 1 and 2 incorporated a combination of: (a) direct instruction (Rosenshine, 2012); (b) numerous opportunities for practice and feedback (Browder & Xin, 1998; Archer & Hughes, 2011; Rasinski & Padak 2008), (c) appropriate supports and scaffolds (Rosenshine, 2012); and (d) meaningful and motivating literacy contexts (Light & McNaughton, 2013).

The combination of these instructional features potentially contributed to the overall effectiveness and efficiency of both interventions. Educators should consider direct instruction in combination with meaningful and motivating literacy contexts. Numerous opportunities should be provided, especially for individuals with severe disabilities; a minimum of 20 trials for each target letter-sound or sight word was
provided during each instructional session. Yet, opportunity is not enough to ensure acquisition.

Instructors should ensure that minimal practice of errors occurs during the learning process. This can be fostered through models and guided practice to ensure that the learner experiences success and strong and correct neural activations occur (Adams, 1990). When errors do occur in instruction, educational professionals should provide immediate corrective feedback to allow individuals to learn from their responses (Rosenshine, 1997).

Overall, the opportunities provided in literacy instruction should include meaningful activities that occur with range of scaffolds from the professionals; from models of the skill, to guided practice, and then ultimately independent practice of the targeted skill with feedback from the instructor. Older beginning readers will come to literacy instruction with limited literacy success. Instructors should refer to and incorporate motivating and personally relevant vocabulary words (Ehri, 1983; Light & McNaughton, 2013). Results form this study demonstrated that sight words that were identified correctly the most were words that were extremely motivating to each individual. Individuals with severe disabilities are often provided with literacy interventions that focus on activities of daily living or are high frequency in connected text (e.g., Dolch words). Yet these words lack in interest and/or meaning (e.g., many Dolch words are abstract and required connected text to understand. For example: *is, the, a.*) for learners, potentially reducing attention and motivation to the task, and ultimately maximized literacy outcomes.

**Adaptations**

It is often necessary to adapt instruction in order to support full participation in literacy tasks for learners with complex communication needs (Benedek-Wood, 2010; Browder et al., 2006; Fallon et al., 2004; Light & McNaughton, 2009b). Three adaptations were used in both studies and require instructors to: (1) provide options for alternative respond models; (2) control response options to assist in systematic analysis of the errors; and (3) provide external scaffolding to compensate for the learners lack of access to oral production and rehearsal by completing the phonological recoding for the learner.

More specifically, for letter-sound correspondence tasks, educational professionals can state the
sound (phonologically recoded for the learner) and ask the learner to select the targeted letter from a field of options. For sight word tasks, the teacher can provide pictures options and ask the learner to select the picture that corresponds to the written word. These adaptations supported successful participation by learners in these studies and did not require the learners to produce an oral response in order to participate.

**Limitations**

Studies 1 and 2 investigated the effects of adapted instruction on the acquisition of letter-sound correspondence (Study 1) and sight word reading skills (Study 2) by older learners with severe disabilities, ASD, and CCN. These studies offer new and important data; however, the studies do have some limitations. The limitations per study were discussed in their previous corresponding chapters; this section highlights key limitations to these studies overall. Overall, both studies included a small number of participants, with only three learners participating in Study 1 and two learners participating in Study 2. The generalization of results must be considered carefully and replication of the studies would strengthen the external validity of the results. Both studies also included packaged interventions consisting of explicit instruction and extension activities. Due to this, it is not possible to tease out the effects of one instructional task from the other. Further research is needed in order to examine the specific effect of each instructional activity or certain instructional components (e.g., feedback, review). As previously discussed, the interventions implemented in this study can only be viewed as the foundational skills for early literacy. The interventions did not address other areas that have been found to improve word recognition (e.g., sound blending, phoneme segmentation activities), nor did the interventions address shared reading of connected text or comprehension. Despite the gains made by the participants through these studies, they have not yet acquired functional literacy skills. Acquiring literacy skills is a complex process that requires significant time and instruction overall. It is critical for instruction to continue for these participants so that they have the opportunity to further develop their literacy skills to enhance their communication and support their full participation in an increasingly text-based society.
**Directions for Future Research**

The results of the current studies suggest several potential directions for future research. In order to increase evidence that these results will generalize to other older learners with severe disabilities, ASD, and CCN, replicating this study and extending this research to participants with various diagnoses and learning abilities, would strengthen the external validity of results, and is necessary to better understand the effectiveness and efficiency of the interventions.

The current study only considered two skills (letter-sound correspondences and sight words) for beginning reading instruction. Other beginning reading instruction skills (e.g., vocabulary, phonological awareness) need to be investigated with older learners with severe disabilities, ASD, and CCN. Additionally, given the limited research on other instructional components for learners with severe disabilities, ASD, and CCN, it is important to conduct additional reading research that focuses on more advanced, yet important skills to educational and vocational outcomes (e.g., decoding, comprehension). Future studies should also expand to include connected text reading and instruction occurring in functional text-based contexts (e.g., email, text message, social media).

These studies provide evidence that the interventions were effective when delivered by a researcher. Yet in order to translate research to practice, the interventions need to be delivered by professionals who are commonly providing instruction to individuals with severe disabilities and CCN (e.g., teachers, aides, speech-language pathologists). Research should explore effective training mechanisms (one-on-one, small group, online) in order to support education professionals on successfully implementing these interventions in their classrooms.

**Conclusion**

The two studies contribute to new information for a population that commonly experiences low expectations (Ruppar et al. 2011; Zascavage & Keefe, 2004) and lack of appropriate instruction (Light & McNaughton, 2013). By providing adapted instruction that incorporated evidence-based instructional principles in phonics and sight words with appropriate adaptations for those with complex communication needs, all individuals that participated in this study were able to make positive gains in literacy skills.
Despite intrinsic and extrinsic challenges that older individuals with severe disabilities face, with very limited instructional time, the participants were able to increase foundational skills with access to the adapted instruction.

Results of the study provide evidence that older learners with severe disabilities, autism spectrum disorder, and complex communication needs can acquire letter-sound correspondences and sight words through direct instruction combined with meaningful and motivating activities. The results further provide preliminary data to guide teachers and AAC professionals in the beginning literacy instruction of individuals with severe disabilities and complex communication needs. It is essential that research continue to investigate best practices for beginning literacy instruction, especially for older learners with severe disabilities and complex communication needs who have a history of failure and exclusion from literacy instruction. All individuals have the fundamental right to become successful readers to support maximization of their educational outcomes, future occupational opportunities, and individual leisure pursuits (Machalicek et al. 2010). It is critical that literacy expectations change for individuals with severe disabilities and that these individuals are provided with quality adapted instruction to maximize their participation and communication. Research must continue in the area of literacy instruction so all individuals have the opportunity to develop functional literacy skills in order to participate in an increasingly text-based society.
References


156-173.


Houston, D., & Torgesen, J. (2004). *Teaching students with moderate disabilities to read: Insights from research*. Bureau of Instructional Support and Community Services, Florida Department of Education.


Lindsay, P. H. (1989, April). Literacy and the disabled: An unfulfilled promise or the impossible dream? Presentation at the Pacific Conference on Technology in Education and Rehabilitation, Vancouver, British Columbia.


Associate of America.


**APPENDIX A**

**Institutional Review Board Research Approval Letter**

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**EXEMPTION DETERMINATION**

**Date:** October 13, 2014  
**From:** Courtney Whetzel, IRB Analyst  
**To:** Jessica Caron

<table>
<thead>
<tr>
<th>Type of Submission:</th>
<th>Initial Study</th>
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<tbody>
<tr>
<td>Title of Study:</td>
<td>Evidence-Based Literacy Instruction for Adolescents with Complex Communication Needs</td>
</tr>
<tr>
<td>Principal Investigator:</td>
<td>Jessica Caron</td>
</tr>
<tr>
<td>Study ID:</td>
<td>STUDY00001129</td>
</tr>
<tr>
<td>Submission ID:</td>
<td>STUDY00001129</td>
</tr>
<tr>
<td>Funding:</td>
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</tr>
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- Script and Procedures for Assessing Single Word Decoding.doc (0.01), Category: Other
- Screening tool.doc (0.01), Category: Other
- Sample Book___MinionTom_LikesA_EasyDecodableWord (1).docx (0.01), Category: Other
- Script and Procedures for Teaching Target Letter-Sound Correspondence.doc (0.01), Category: Other
- Response plate for Letter Sound Correspondence.doc (0.01), Category: Other
- Data Collection Form.doc (0.01), Category: Data Collection Instrument
- Example word list for CVC words_adolescents.doc (0.01), Category: Other

The Office for Research Protections determined that the proposed activity, as described in the above-referenced submission, does not require formal IRB review because the research met the criteria for exempt research according to the policies of this institution and the provisions of applicable federal regulations.

Continuing Progress Reports are not required for exempt research. Record of this research determined to be exempt will be maintained for five years from the date of this notification. If your research will continue beyond five years, please contact the Office for Research Protections closer to the determination end date.

Changes to exempt research only need to be submitted to the Office for Research Protections in limited circumstances described in the below-referenced Investigator
Manual. If changes are being considered and there are questions about whether IRB review is needed, please contact the Office for Research Protections.

Penn State researchers are required to follow the requirements listed in the Investigator Manual (HRP-103), which can be found by navigating to the IRB Library within CATS IRB (http://irb.psu.edu).

This correspondence should be maintained with your records.
APPENDIX B

Parental Consent Form

Title of Project: Evidence-Based Literacy Instruction for Individuals with Complex Communication Needs

Investigators:

Jessica Gosnell Caron, Doctoral Candidate
Ford Building, University Park, PA 16802
703-577-7407; jcg169@psu.edu

Dr. Janice Light, Distinguished Professor
Ford Building, University Park, PA 16802
(814) 863-2010; jcl4@psu.edu

1. Purpose of the Study: The purpose of this research study is to investigate evidence-based literacy instruction for children with special needs.

2. Procedures to be followed: Your child will be asked to participate in an instructional activity that focuses on teaching literacy skills. Instructional sessions will take place in your child’s school, the Penn State clinic, or at home during a time suggested by the teacher/parent to ensure that your child will not miss other instructional activities. The instruction will include evidence-based practices that have been found to be effective with other children. Instructional sessions will include one-to-one instruction that will focus on teaching literacy skills to help your child learn how to read. The sessions will also include activities such as reading books, matching activities, and discrete trials to help your child identify letters and read words. Each session will be videotaped for the purpose of data collection. We are committed to working with your child for at least 12 weeks to help your child learn early reading skills. We will provide you with monthly updates on your child’s progress and we encourage you to ask any questions you may have throughout the course of this project.

3. Discomforts and Risks: There are no risks in participating in this research beyond those experienced in a classroom. The researcher’s goal is to make the instructional session as enjoyable as possible for your child.

4. Benefits: Your child will participate in evidence-based literacy instruction that is adapted to meet his/her individual needs. The instruction can potentially increase your child’s literacy and language skills. The study may also provide teachers with information about providing and adapting effective literacy instruction for students with special needs.
5. **Duration**: Each session will last approximately 30 minutes, and sessions will be provided 2 to 4 times per week. Because every child’s learning experiences are different, we are committed to working with your child for at least 12 weeks to help your child learn early reading skills.

6. **Statement of Confidentiality**: Your child’s participation in this research is confidential. The data and videotapes will be coded, stored, and secured in Ford Building in a locked file. Only the investigators listed above will have access to the data and videotapes. In the event of a publication or presentation resulting from the research, no personally identifiable information will be shared. The Pennsylvania State University’s Office for Research Protections, the Institutional Review Board and the Office for Human Research Protections in the Department of Health and Human Services may review records related to this research study.

7. **Right to Ask Questions**: Please contact Jessica Caron (703) 577-7407 or JGC169@PSU.EDU with questions, complaints, or concerns about this study. If you have any questions, concerns, or problems about your rights, your child’s rights as a research participant, or would like to offer input, please contact The Pennsylvania State University’s Office for Research Protections (ORP) at (814) 865-1775. The ORP cannot answer questions about research procedures. Questions about research procedures can be answered by the research team.

8. **Voluntary Participation**: Your decision to allow your child to be in this research is voluntary. You or your child can stop at any time. If you or your child choose not to participate, this decision will have no impact on the instruction the school provides for your child or your child’s relationship with the school. Your child’s participation implies your voluntary consent to participate in the research.

*Optional part(s) of the study*: In addition to the main activities of the study, there are additional considerations related to the research. The use of photographs and video is a critical part of this research. Each session will be videotaped for the purpose of data collection. Recording sessions allows us to verify that data is recorded accurately. The recordings are stored and secured in a locked file located in our research lab. Please consider how we may use this footage relative to discussions about what we have learned (for example, in publications or presentations, or for educational and training purposes). Note: You can be in the main part of the research without agreeing to these optional parts.

**Publications/Presentations**

- [ ] I give permission for my recordings to be archived for use in publications/presentations/training
- [ ] I do not give permission for my recordings to be archived for use in publications/presentations/trainings.

_________________________________  __________________________
Signature of Subject, Parent/Guardian, Date
or LAR

__________________________________
Printed Name
APPENDIX C
Communication and Language Skills Questionnaire
(Questionnaire adapted from Benedek-Wood, 2010; Autism Matters, 2007; Areas of expressive communication based on Light, 1997)

Child’s Name: _____________________________
Date: __________________
Date of Birth: _______________________

Diagnosis: ____________
Any vision concerns? ______
Any hearing concerns? ______

Expressive Communication

1. What is the primary method(s) the child uses for communicating his/her needs and wants? (Check all that apply, but please indicate if one method is used more often.)

___ looking at objects
___ speech
___ gestures
___ Mayer-Johnson/Symbols
___ High tech communication system (e.g., voice output devices) Please list:

List the most commonly used method:

2. Please list examples of commonly expressed words, phrases, and/or sentences the he/she uses:


<table>
<thead>
<tr>
<th>List any words/phrases used to express social etiquette (e.g., thank you):</th>
<th>List any words/phrases used to express social closeness (e.g., love you):</th>
</tr>
</thead>
<tbody>
<tr>
<td>List any words/phrases used to express wants/needs:</td>
<td>List any words/phrases used to share information:</td>
</tr>
</tbody>
</table>

3. Which of the following best describes the individuals’ natural speech?

| ___ easy to understand | ___ difficult for others to understand |
| ___ difficult for parents to understand | ___ almost never understood by others |

4. Which of the following statements best describes his/her reactions to his/her speech?

| ___ is easily frustrated when not understood |
| ___ does not seem aware of speech/communication problem |
| ___ tries to say sounds or words more clearly when asked |
| ___ will attempt to use an alternative form of communication if the original method fails (e.g., child reverts to using a picture to communicate when you do not understand what he/she says) |

5. What are the current goals that are being worked on related to expressive communication?

6. Which of the following do you think he/she understands (check all that apply)?

| ___ his/her own name | ___ simple directions |

*Receptive Language*
7. Please list some examples of words/phrases he/she understands:


Reading Skills

8. Knowledge about letters:
   __ can’t make the sounds   __ I have never tried any of these skills with them
   __ points to some letters   __ gets confused with certain letters (list them)
   __ gets confused with certain sounds (list them)
   __ other (Please explain)

   List Letter SOUNDS the individual knows:


9. Please list the sight words the individual can read:


10. What are current reading goals? Any concerns?


11. Please list the conditions that help the individual participate in tasks. This may include settings, people, activities, and/or materials (i.e., visual schedules, reinforcements):


APPENDIX D

Preferred Activities and Interests Questionnaire
(Please use the other side of this paper to complete responses if necessary.)

Child’s name _________________________

I am the child’s: Teacher / Parent

1. Please list names of people and places important to the learner:

2. Please list the learner’s favorite foods:

3. Please list other items the learner’s likes (e.g., animals, activities, school items):

4. Please anything that would deter from successful participation (e.g., topics the child does not like or items that would cause a distraction away from the task):

5. Please words that you would like the learner to learn to read:

6. Please list the learner’s favorite movies, TV shows, books, characters, and songs:

   Movie /TV Shows
   Books

   Characters (e.g., Sponge Bob, Spiderman, Minecraft Lego, Justin Bieber, etc.)

   Songs
APPENDIX E
Probe Data Collection Form – Letter Sound Correspondence

Student _______________    Date _______________

LSC Set:

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<tr>
<th>Target (if new letter, mark with an *)</th>
<th>Response options provided (circle student response)</th>
<th>Correct (+)</th>
<th>Incorrect (-)</th>
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8.  

LSC Set:

<table>
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<th>Incorrect (-)</th>
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LSC Set:

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17. 
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20.  
APPENDIX F
Intervention Data Collection Form – Letter Sound Correspondence

Student ____________________       Date ____________________

LSC Set:

Targeted Letter-Sound:

Activity 1: Direct Instruction

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<th>Incorrect (-)</th>
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Review (when appropriate)

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<th>Incorrect (-)</th>
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</table>
### Activity 2: Letter Sound Book

<table>
<thead>
<tr>
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<th>Point</th>
<th>Verbal</th>
<th>Reduced field</th>
<th>+/-</th>
</tr>
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### Activity 3: Folder

<table>
<thead>
<tr>
<th>Trials</th>
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<th>Verbal</th>
<th>Reduced field</th>
<th>+/-</th>
</tr>
</thead>
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</table>

Any comments about the session:
# APPENDIX G
Sight Words Data Collection Form -- Chad

Student ____________________    Date ______________ ____

**Instructional Set** (circle)

<table>
<thead>
<tr>
<th></th>
<th>SET 1</th>
<th>SET 2</th>
<th>SET 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball</td>
<td>•</td>
<td>• Mario</td>
<td>• swing</td>
</tr>
<tr>
<td>Book</td>
<td>•</td>
<td>• Movie</td>
<td>• snack</td>
</tr>
<tr>
<td>Game</td>
<td>•</td>
<td>• Juice</td>
<td>• ipad</td>
</tr>
<tr>
<td>Luigi</td>
<td>•</td>
<td>• cookie</td>
<td>• jump</td>
</tr>
</tbody>
</table>

**Target** (if new letter, mark with a (*)

<table>
<thead>
<tr>
<th></th>
<th>Response options provided (circle student response)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>5</td>
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</tr>
<tr>
<td>8</td>
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</table>

**Target** (if new letter, mark with a (*)

<table>
<thead>
<tr>
<th></th>
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<tr>
<td>15</td>
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**Target** (if new letter, mark with a (*)

<table>
<thead>
<tr>
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<td>14</td>
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<tr>
<td>15</td>
<td></td>
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<tr>
<td>Target (if new letter, mark with a (*)</td>
<td>Response options provided (circle student response)</td>
<td>Correct (+)</td>
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Comments/Other:
APPENDIX H
Sight Words Data Collection Form -- Nate

Student ____________________    Date ______________ __

Instructional Set (circle)

<table>
<thead>
<tr>
<th></th>
<th>SET 1</th>
<th>SET 2</th>
<th>SET 3</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>swing</td>
<td>dog</td>
<td>walk</td>
</tr>
<tr>
<td></td>
<td>snack</td>
<td>drum</td>
<td>water</td>
</tr>
<tr>
<td></td>
<td>music</td>
<td>cat</td>
<td>piano</td>
</tr>
<tr>
<td></td>
<td>book</td>
<td>ipad</td>
<td>type</td>
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</table>

Target (if new letter, mark with a (*)

<table>
<thead>
<tr>
<th></th>
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<tbody>
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Correct (+)  Incorrect (-)

1. 
2. 
3. 
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5. 
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9. 
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11. 
12. 
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14. 
15. 
16. 

Target (if new letter, mark with a (*)

<table>
<thead>
<tr>
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Correct (+)  Incorrect (-)
<table>
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<th>(if new letter, mark with a (*)</th>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>ct (+)</th>
<th>Incorr ect (-)</th>
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</thead>
<tbody>
<tr>
<td>17.</td>
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<td>18.</td>
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Comments/Other:
APPENDIX I
Intervention Data Collection Form – Sight Words

Student ____________________   Date _______________ ___

Sight word Set:

Target:

Activity 1: Direct Instruction

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<tr>
<th>Target (if new letter, mark with a *)</th>
<th>Response options provided (circle student response)</th>
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<th>Incorrect (-)</th>
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Review (when appropriate)

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<th>Target (if new letter, mark with a *)</th>
<th>Response options provided (circle student response)</th>
<th>Correct (+)</th>
<th>Incorrect (-)</th>
</tr>
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<tbody>
<tr>
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Comments:
### Activity 2: Book

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<th>Point</th>
<th>Verbal Reduc</th>
<th>+/-</th>
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<tr>
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### Activity 3: Folder

<table>
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<th>Point</th>
<th>Verbal Reduc</th>
<th>+/-</th>
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</thead>
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Any comments about the session:
### APPENDIX J

#### Probe Procedures for Letter-Sound Correspondences and Sight Words

*(Based on the recommendations of Light & McNaughton, 2009a)*

<table>
<thead>
<tr>
<th>LSC probes</th>
<th>Researcher:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Presents 4 letter cards on the table in a row</td>
<td></td>
</tr>
<tr>
<td>- States: “I am going to say a sound. Give me the letter that makes the sound (state one of the 4 target LSCs aloud for 2-3 seconds).”</td>
<td></td>
</tr>
<tr>
<td>Learner:</td>
<td></td>
</tr>
<tr>
<td>- Provides a response (e.g., gives a letter or points to a letter)</td>
<td></td>
</tr>
<tr>
<td>Researcher:</td>
<td></td>
</tr>
<tr>
<td>- Provides no corrective feedback, or discontinues this trial after no response after 5 seconds</td>
<td></td>
</tr>
<tr>
<td>- Changes the order in which the letters are presented to set up another trial</td>
<td></td>
</tr>
<tr>
<td>- States: “I am going to say a sound. Give me the letter that makes the sound (state one of the 4 target LSCs aloud for 2-3 seconds).”</td>
<td></td>
</tr>
<tr>
<td>These procedures are repeated, twice, for each letter, as probe trials are out of a total of 8.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sight Word Probes</th>
<th>Researcher:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Presents 4 pictures on the table in a row</td>
<td></td>
</tr>
<tr>
<td>- Previews each of the picture, pointing and labeling then</td>
<td></td>
</tr>
<tr>
<td>- Presents the sight word (text) above the 4 pictures</td>
<td></td>
</tr>
<tr>
<td>- States: “Read the word. Give me the picture that goes with this word.”</td>
<td></td>
</tr>
<tr>
<td>Learner:</td>
<td></td>
</tr>
<tr>
<td>- Provides a response (e.g., gives a picture)</td>
<td></td>
</tr>
<tr>
<td>Researcher:</td>
<td></td>
</tr>
<tr>
<td>- Provides no corrective feedback, or discontinues this trial after no response after 5 seconds</td>
<td></td>
</tr>
<tr>
<td>- Changes the order in which the pictures are presented to set up another trial</td>
<td></td>
</tr>
<tr>
<td>- States: “Read the word. Give me the picture that goes with this word.”</td>
<td></td>
</tr>
<tr>
<td>These procedures are repeated, twice, for each word, as probe trials are out of a total of 8.</td>
<td></td>
</tr>
</tbody>
</table>
### APPENDIX K
**Excerpt from Script for Teaching Target Letter-Sound Correspondences**
*(Based on the recommendations of Light & McNaughton, 2009a)*

<table>
<thead>
<tr>
<th>Model</th>
<th>Introduce a new LSC:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Point to the letter and state its sound (“mmm”). Then show the learner a picture card (with at least two pictures) of words that began with the target sound (e.g., mop, mad) while emphasizing the target sound (e.g., “mmm”). Model:</td>
</tr>
<tr>
<td></td>
<td>1. “I am going to say a sound (state sound; “mmm”). Look at the letters and give me the letter that makes that sound”.</td>
</tr>
<tr>
<td></td>
<td>2. Touch each letter (to model looking at all options), then point to the target letter and state the target sound (“mmm”)</td>
</tr>
<tr>
<td></td>
<td>3. State the sound (“mmm”) and have the participant give the correct letter to the researcher.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Guided Practice</th>
<th>Provide Guided Practice (after modeling the task)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. “Now let’s do one together. I am going to say a sound. Listen to the sound. Then look at the letters and give me the letter that makes the sound. (Say the target sound. E.g., say ‘mmmm’. Pause for 1-2 seconds to provide an opportunity for the learner to respond. If the learner responds, provide corrective feedback. If the learner does not respond, continue with script below.)</td>
</tr>
<tr>
<td></td>
<td>2. “Let’s touch the letter that says ‘mmm.’” (Point to the target letter and ask the learner to point with you. Say the sound again. E.g., say ‘mmm’ and make the learner give you the letter.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Independent Practice</th>
<th>As the learner demonstrates two to three correct responses independently, gradually increased the field size of options and provided 10 trials of independent practice.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. I am going to say a sound. Listen to the sound. Look at the letters and give me the letter that makes the sound. (Say the target sound. E.g., say ‘mmmm’. Pause for 5 seconds to provide an opportunity for the learner to respond.</td>
</tr>
<tr>
<td></td>
<td>2. Provide corrective feedback. Correct, “Good job. You picked the letter that says ‘mmm.’” When incorrect, say the sound of the letter selected, and then either prompt the learner to try again or point to the correct response (e.g., “I want the letter that says /m/. Lets do it again, this letter says /m/ (pointing to the letter). You give me this letter.”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scaffold Support</th>
<th>As the learner responds correctly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- increase field size</td>
</tr>
<tr>
<td></td>
<td>- increase the length of the pause before providing answer (up to 5 seconds)</td>
</tr>
<tr>
<td></td>
<td>- decrease prompting</td>
</tr>
</tbody>
</table>
### APPENDIX L

**Excerpt from Script for Teaching Sight Words**
*(Based on the recommendations of Light & McNaughton, 2009a)*

| Model | Introduce a new Sight Word:  
| 1. Point to the sight word and read it, then show the learner a picture card of the word while emphasizing the target word (e.g., “horse”).  
Model:  
1. “I am going to show you a new word (point to the text). Look at the word and look at the pictures. Give me the picture that goes with this word.”  
2. Touch each picture (to model looking at all options), then point to the target word and read the word aloud (“horse”)  
3. State the word (“horse”) and have the participant give the correct picture. |
| Guided Practice | Provide Guided Practice (after modeling the task)  
1. “Now let’s do one together. I am going to show you a word. Read the word. Then look at the pictures and give me the picture that goes with the word. (Point to the text. Pause for 1-2 seconds to provide an opportunity for the learner to respond. If the learner responds, provide corrective feedback. If the learner does not respond, continue with script below.)  
2. “Let’s read this word (point to word) and find the picture.”’’  
(Point to the word and ask the learner to point with you. Read the word aloud ‘horse’ and make the learner give you the picture.) |
| Independent Practice | As the learner demonstrates two to three correct responses independently, gradually increased the field size of options and provided 10 trials of independent practice.  
1. I am going to show you a word. Read the word. Then look at the pictures and give me the picture that goes with the word. Pause for 5 seconds to provide an opportunity for the learner to respond.  
2. Provide corrective feedback. Correct, “Good job. You read (state word; ‘horse’).”  
When incorrect, read the word aloud (“horse”), and then prompt the learner to point to the correct response (e.g., “This says ‘horse’. Lets do it again, this says ‘horse’ (pointing to the word and then pictures). You give me this picture.”) |
| Scaffold Support | As the learner responds correctly - increase field size - increase the length of the pause before providing answer (up to 5 seconds) - decrease prompting |
APPENDIX M
Study 1 Procedural Integrity Checklist and Data Reliability: Probes
(Adapted from Benedek-Wood, 2010 and Fallon, 2001)

Letter-Sound Set:

| Set 1: a, m, p, t | Set 2: r, c, i, g | Set 3: h, o, l, d |

1. ________ (target letter sound) □ Learner is correct  □ Learner is incorrect
   □ places four letters in front of the learner
   □ positions stimuli appropriately
   □ provides directions
   □ states target sound
   □ provides no corrective feedback

2. ________ (target letter sound) □ Learner is correct  □ Learner is incorrect
   □ places four letters in front of the learner
   □ positions stimuli appropriately
   □ provides directions
   □ states target sound
   □ provides no corrective feedback

3. ________ (target letter sound) □ Learner is correct  □ Learner is incorrect
   □ places four letters in front of the learner
   □ positions stimuli appropriately
   □ provides directions
   □ states target sound
   □ provides no corrective feedback

4. ________ (target letter sound) □ Learner is correct  □ Learner is incorrect
   □ places four letters in front of the learner
   □ positions stimuli appropriately
   □ provides directions
   □ states target sound
   □ provides no corrective feedback

5. ________ (target letter sound) □ Learner is correct  □ Learner is incorrect
   □ places four letters in front of the learner
   □ positions stimuli appropriately
   □ provides directions
   □ states target sound
   □ provides no corrective feedback

6. ________ (target letter sound) □ Learner is correct  □ Learner is incorrect
   □ places four letters in front of the learner
positions stimuli appropriately
provides directions
states target sound
provides no corrective feedback

7. _______ (target letter sound) □ Learner is correct □ Learner is incorrect

places four letters in front of the learner
positions stimuli appropriately
provides directions
states target sound
provides no corrective feedback

8. _______ (target letter sound) □ Learner is correct □ Learner is incorrect

places four letters in front of the learner
positions stimuli appropriately
provides directions
states target sound
provides no corrective feedback

Overall, per session, the researcher:
Introduced the task by providing a model and directions
Provided 4 choices per trial
Changed the order and placement of all letters
Provided 2 trials for each letter
Records data for session

Procedural Integrity: _____/45 _____%
Probe Data Reliability: _____/8 _____%
APPENDIX N
Study 1 Procedural Integrity Checklist and Data Reliability: Intervention
(Adapted from Benedek-Wood, 2010 and Fallon, 2001)

Session Date: 
Participant: 
Letter-Sound Set:

<table>
<thead>
<tr>
<th>Set 1: a, m, p, t</th>
<th>Set 2: r, c, i, g</th>
<th>Set 3: h, o, l, d</th>
</tr>
</thead>
</table>

General:
- Starts with direct instruction
- Scaffolds support as needed
- Provides 10 trials in direct instruction
- Review of previously learned letters (when appropriate)
- Provides 5 trials with extension activity 1 (book)
- Provides 5 trials with extension activity 2 (folder)

For 10 trials in direct instruction:

1. ☐ Learner is correct ☐ Learner is incorrect
   - places letters in front of the learner
   - provides directions
   - states target sound
   - provides corrective feedback

2. ☐ Learner is correct ☐ Learner is incorrect
   - places letters in front of the learner
   - provides directions
   - states target sound
   - provides corrective feedback

3. ☐ Learner is correct ☐ Learner is incorrect
   - places letters in front of the learner
   - provides directions
   - states target sound
   - provides corrective feedback

4. ☐ Learner is correct ☐ Learner is incorrect
   - places letters in front of the learner
   - provides directions
   - states target sound
   - provides corrective feedback

5. ☐ Learner is correct ☐ Learner is incorrect
   - places letters in front of the learner
   - provides directions
   - states target sound
   - provides corrective feedback
<table>
<thead>
<tr>
<th></th>
<th>Learner is correct</th>
<th>Learner is incorrect</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td></td>
<td>places letters in front of the learner</td>
<td></td>
</tr>
<tr>
<td></td>
<td>provides directions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>states target sound</td>
<td></td>
</tr>
<tr>
<td></td>
<td>provides corrective feedback</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td></td>
<td>places letters in front of the learner</td>
<td></td>
</tr>
<tr>
<td></td>
<td>provides directions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>states target sound</td>
<td></td>
</tr>
<tr>
<td></td>
<td>provides corrective feedback</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td></td>
<td>places letters in front of the learner</td>
<td></td>
</tr>
<tr>
<td></td>
<td>provides directions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>states target sound</td>
<td></td>
</tr>
<tr>
<td></td>
<td>provides corrective feedback</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td></td>
<td>places letters in front of the learner</td>
<td></td>
</tr>
<tr>
<td></td>
<td>provides directions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>states target sound</td>
<td></td>
</tr>
<tr>
<td></td>
<td>provides corrective feedback</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td></td>
<td>places letters in front of the learner</td>
<td></td>
</tr>
<tr>
<td></td>
<td>provides directions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>states target sound</td>
<td></td>
</tr>
<tr>
<td></td>
<td>provides corrective feedback</td>
<td></td>
</tr>
</tbody>
</table>

Procedural Integrity: _____/46 _____%
Intervention Data Reliability: _____/10 _____%
APPENDIX O
Study 2 Procedural Integrity Checklist and Data Reliability: Probes
(Adapted from Benedek-Wood, 2010 and Fallon, 2001)

Sight Word Set:

<table>
<thead>
<tr>
<th>Set 1: mario, movie, juice, cookie</th>
<th>Set 2: swing, snack, ipad, jump</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set 3: ball, book, game, luigi</td>
<td>Set 3: walk, water, piano, type</td>
</tr>
</tbody>
</table>

1. ________ (target sight word) [ ] Learner is correct [ ] Learner is incorrect

   [ ] places four pictures in front of the learner
   [ ] places a target word in front of the learner
   [ ] provides directions
   [ ] changes order and location of stimulus
   [ ] provides no corrective feedback

2. ________ (target sight word) [ ] Learner is correct [ ] Learner is incorrect

   [ ] places four pictures in front of the learner
   [ ] places a target word in front of the learner
   [ ] provides directions
   [ ] changes order and location of stimulus
   [ ] provides no corrective feedback

3. ________ (target sight word) [ ] Learner is correct [ ] Learner is incorrect

   [ ] places four pictures in front of the learner
   [ ] places a target word in front of the learner
   [ ] provides directions
   [ ] changes order and location of stimulus
   [ ] provides no corrective feedback

4. ________ (target sight word) [ ] Learner is correct [ ] Learner is incorrect

   [ ] places four pictures in front of the learner
   [ ] places a target word in front of the learner
   [ ] provides directions
   [ ] changes order and location of stimulus
   [ ] provides no corrective feedback

5. ________ (target sight word) [ ] Learner is correct [ ] Learner is incorrect

   [ ] places four pictures in front of the learner
   [ ] places a target word in front of the learner
   [ ] provides directions
   [ ] changes order and location of stimulus
   [ ] provides no corrective feedback

6. ________ (target sight word) [ ] Learner is correct [ ] Learner is incorrect
___ places four pictures in front of the learner
___ places a target word in front of the learner
___ provides directions
___ changes order and location of stimulus
___ provides no corrective feedback

7. _______ (target sight word)  □ Learner is correct  □ Learner is incorrect

___ places four pictures in front of the learner
___ places a target word in front of the learner
___ provides directions
___ changes order and location of stimulus
___ provides no corrective feedback

8. _______ (target sight word)  □ Learner is correct  □ Learner is incorrect

___ places four pictures in front of the learner
___ places a target word in front of the learner
___ provides directions
___ changes order and location of stimulus
___ provides no corrective feedback

**Overall, per session, the researcher:**

- Introduced the task by providing a model and directions
- Provided 4 choices per trial
- Changed the order and placement of pictures
- Provided 2 trials for each sight word
- Records data for session

Procedural Integrity: _____/45   _____%

Probe Data Reliability: _____/8   _____%
APPENDIX P

Study 2 Procedural Integrity Checklist and Data Reliability: Intervention
(Adapted from Benedek-Wood, 2010 and Fallon, 2001)

Session Date:  
Participant:  
Sight Word Set:  
<table>
<thead>
<tr>
<th>Set 1</th>
<th>Set 2</th>
<th>Set 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word targeted in session:</td>
<td>Word targeted in session:</td>
<td>Word targeted in session:</td>
</tr>
</tbody>
</table>

General:
☐ Starts with direct instruction
☐ Scaffolds support as needed
☐ Provides 10 trials in direct instruction
☐ Review of previously learned words (when appropriate)
☐ Provides 5 trials with extension activity 1 (book)
☐ Provides 5 trials with extension activity 2 (folder)

For 10 trials in direct instruction:
1. ☐ Learner is correct  ☐ Learner is incorrect
   ☐ places pictures in front of the learner
   ☐ provides directions
   ☐ provides target word
   ☐ provides corrective feedback

2. ☐ Learner is correct  ☐ Learner is incorrect
   ☐ places pictures in front of the learner
   ☐ provides directions
   ☐ provides target word
   ☐ provides corrective feedback

3. ☐ Learner is correct  ☐ Learner is incorrect
   ☐ places pictures in front of the learner
   ☐ provides directions
   ☐ provides target word
   ☐ provides corrective feedback

4. ☐ Learner is correct  ☐ Learner is incorrect
   ☐ places pictures in front of the learner
   ☐ provides directions
   ☐ provides target word
   ☐ provides corrective feedback

5. ☐ Learner is correct  ☐ Learner is incorrect
6. ☐ Learner is correct  ☐ Learner is incorrect

☐ places pictures in front of the learner
☐ provides directions
☐ provides target word
☐ provides corrective feedback

7. ☐ Learner is correct  ☐ Learner is incorrect

☐ places pictures in front of the learner
☐ provides directions
☐ provides target word
☐ provides corrective feedback

8. ☐ Learner is correct  ☐ Learner is incorrect

☐ places pictures in front of the learner
☐ provides directions
☐ provides target word
☐ provides corrective feedback

9. ☐ Learner is correct  ☐ Learner is incorrect

☐ places pictures in front of the learner
☐ provides directions
☐ provides target word
☐ provides corrective feedback

10. ☐ Learner is correct  ☐ Learner is incorrect

☐ places pictures in front of the learner
☐ provides directions
☐ provides target word
☐ provides corrective feedback

Procedural Integrity: _____/46  _____% 
Intervention Data Reliability: _____/10  _____%
APPENDIX Q
Social Validity Questionnaire

Use the following scale for questions 1-5:

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>Agree</td>
<td>Neither</td>
<td>Disagree</td>
<td>Strongly Disagree</td>
</tr>
</tbody>
</table>

1) The student’s reading skills improved as a result of the intervention.

| 1 | 2 | 3 | 4 | 5 |

2) The reading intervention could be implemented in a classroom.

| 1 | 2 | 3 | 4 | 5 |

3) The reading intervention would be beneficial for other children with autism.

| 1 | 2 | 3 | 4 | 5 |

4) The student seemed to enjoy participation in the literacy tasks.

| 1 | 2 | 3 | 4 | 5 |

5) The reading intervention is something I would like more training with.

| 1 | 2 | 3 | 4 | 5 |

6) What (if anything) would you change about the intervention?

7) What (if anything) would you replicate for other academic tasks?

8) What (if anything) do you feel was the major benefit of the intervention?
Vita
Jessica Gosnell Caron

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2016 Doctor of Philosophy, Communication Sciences and Disorders
The Pennsylvania State University; University Park, Pennsylvania
2007 Master of Science, Communication Sciences and Disorders
Mass General Institute of Health Professions; Charlestown, Massachusetts
2005 Bachelor of Science, Communication Sciences and Disorders
James Madison University; Harrisonburg, Virginia

Research Funding & Scholarships
• Emerging Researcher Travel Award (2014) International Society for Augmentative and Alternative Communication (ISAAC)
• Sertoma Scholarship (2014) Sertoma Foundation

Selected Publications


Selected Presentations at Scientific and Professional Meetings
