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EFFECTS OF AN IPAD-BASED EARLY READING INTERVENTION WITH STUDENTS WITH COMPLEX NEEDS

by

Kristin Goodwin Lucas

A thesis submitted in partial fulfillment
of the requirements for the Doctor of Philosophy
degree in Teaching and Learning in the
Graduate College of
The University of Iowa

December 2015

Thesis Supervisors: Associate Professor Suzanne Woods-Groves
Assistant Professor Allison L. Bruhn

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Graduate College
The University of Iowa
Iowa City, Iowa

CERTIFICATE OF APPROVAL

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PH.D. THESIS

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This is to certify that the Ph.D. thesis of

Kristin Goodwin Lucas

has been approved by the Examining Committee for
the thesis requirement for the Doctor of Philosophy degree
in Teaching and Learning at the December 2015 graduation.

Thesis Committee: _____
Suzanne Woods-Groves, Thesis Supervisor

_____
Allison L. Bruhn, Thesis Supervisor

_____
John L. Hosp

_____
Patricia Bahr

_____
Shawn M. Datchuk

To Richard Hamilton Goodwin, an inspirational Dad and Doctor of Education.

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Through my adult life I have worked with people of all ages with disabilities, as a direct care worker, recreation therapist, swim therapist, and as a special education teacher for nearly two decades. These are the people that inspire me to dig deeper to be a better teacher and advocate. Each of these people, along with their families, help define my purpose in life. Through the years we moved from non-inclusive "my students" to more inclusive "our students". There is so much more work to be done. You are the reason more research and more professionals that strive for inclusion in this field are necessary.

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ABSTRACT

Early reading literacy is foundational to all other academic learning. It is imperative that elementary students with and without disabilities be provided with evidence-based reading instruction. Elementary students with developmental disabilities (DD) and complex communication needs (CCN) benefit from evidence-based reading instruction that incorporates individualized, explicit instruction and appropriate assistive technology. Research to identify evidence-based practices for students with DD and CCN is necessary to assist teachers to close the gap in overall achievement for this group of learners. The purpose of this study was to determine the efficacy of the early reading program Go Talk Phonics (Ahlgrim-Delzell, Browder, & Wood, 2014) that incorporated evidence-based systematic instruction delivered through assistive technology to teach reading to elementary students ($n = 2$) with DD and CCN.

The two participants in this single-case designed study did not make adequate progress toward the objectives of Lesson One of the intervention in order to continue on to Lessons Two and Three. Although the participants in this study were less successful in the objectives of the lesson than participants in the Ahlgrim-Delzell et al., (2014) study, there were differences in the participants, assistive technology, and design of the experiment. Important considerations were revealed when selecting academic interventions for students with CCN and DD. Assessment of broader aspects of the students' skills and literacy experience, as well as differential reinforcement procedures specific to instructional demands may be necessary to see gains from instruction.

PUBLIC ABSTRACT

The purpose of this study was to determine the efficacy of an early reading program *GoTalk Phonics* (Ahlgrim-Delzell, Browder, & Wood, 2014) that uses an iPad as an instructional delivery tool along with systematic instruction, on the acquisition of early phonics skills of two students with complex communication needs and developmental disabilities.

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CHAPTER ONE
INTRODUCTION

All children, including those with complex communication needs (CCN) and developmental disabilities (DD) should be afforded effective evidence-based instruction in early reading. This investigation served to determine the efficacy of an early reading literacy program that was designed to incorporate evidence-based practices for students with CCN and DD. Kratochwill and colleagues (2010) asserted that evidence-based practices require replication across cases, students, and at least three research groups. The current study is designed to replicate a previous study conducted by Ahlgrim-Delzell and colleagues in 2014 that investigated the efficacy of the Go Talk Phonics curriculum (Ahlgrim-Delzell, Browder, & Wood, 2014) with students with DD and CCN.

Students with Disabilities' Access to General Curriculum

All children have the right to access the general curriculum in K-12 schools according to No Child Left Behind (NCLB, 2002) and the Individuals with Disabilities Education Improvement Act (IDEIA, 2004). Within the United States the general curriculum varies slightly from state to state, but broadly consists of core subject areas and a variety of elective courses. One such core subject, language arts is addressed in the Common Core State Standards (CCSS, 2010). CCSS (2010) delineated that foundational reading skills should be developed in every student through the employment of evidence-based materials and practices (Liben & Liben, 2014).

Early reading skills are foundational to content learning (Duke & Block, 2012; Liben & Liben, 2014). The National Reading Panel (NRP, 2000) recommended five areas for comprehensive reading instruction, which include, (1) phonemic awareness, (2) phonics, (3)

fluency, (4) vocabulary, and (5) text comprehension. Previous research studies have supported the fact that students with DD and low incidence disabilities (e.g., CCN) can benefit from the same scientifically-based reading instruction as typically-developing children (Connors, Alberto, Compton, & O'Conner, 2014).

Through legislative acts (e.g., NCLB, 2002; IDEIA, 2004), Congress sought to align educational opportunities for students with disabilities to those available to students without disabilities. Students with disabilities encompass students with complex communication needs (CCN) and developmental disabilities (DD). Students with CCN and DD are a heterogeneous group of learners who cannot rely on oral communication and have difficulties in other areas of development (Beukelman & Mirenda, 2014; Light & McNaughton, 2012). Lack of oral communication coupled with adaptive and academic support needs pose challenges to strict adherence to traditional methods of reading instruction.

How Students with CCN Learn to Read Text

Reading is a complicated process for children with CCN who often have difficulties with cognition, sensory regulation, motor skills, and language skills (Light & McNaughton, 2012). Students with CCN require a comprehensive approach to instruction and direct intervention (Clendon & Erickson, 2010; Light & McNaughton, 2012). Machalicek, Sanford, Lang, Rispoli, Molfenter, and Mbeseha (2010) reviewed literature on literacy interventions for students with DD and CCN who used assistive technology (e.g., aided augmentative and alternative communication systems). Machalicek et al., (2010) found systematic instruction that included scaffolding of skills, direct instruction, and least-to-most prompting with time delay as the most effective strategies for instruction for this group of learners.

Systematic Instruction

Direct instruction. Direct systematic phonics instruction is more effective than non-systematic reading instruction at increasing reading skills of learners (Machalicek et al., 2010; NRP, 2000). Direct instruction incorporates systematic scripted instructional sequences that keep students' attention and are delivered at a quick pace. The scripted procedures include prompting supports that help the students respond correctly, while pacing procedures reduce the amount of supports required to elicit independent correct responses (Ahlgrim-Delzell, Browder, & Wood, 2014; Cooper, Heron, & Heward, 2007)

Prompting procedures. Constant time delay (CTD) is a near errorless strategy for instruction that begins with a zero second time delay prior to prompting the correct response (Cooper et al., 2007; Wolery et al., 1992). This means the prompt is supplied simultaneously to the presentation of the stimulus. After several trials of zero delay, the procedure for CTD calls for increases in fixed time delay (e.g., 2 seconds, 4 seconds) to allow the learner the time to respond independently (Cooper et al., 2007; Wolery et al., 1992). The CTD procedure has been used successfully with children with and without disabilities (Browder, Ahlgrim-Delzell, Spooner, Mims, & Baker, 2009).

Least-to-most prompting is a consequential prompting procedure, which occurs after the opportunity for response is provided (Cooper et al., 2007). System of least prompts, otherwise known as least to most prompts, is a systematic prompting procedure that provides the least amount of assistance necessary to allow a student the opportunity for correct responding. This procedure allows the student a set time before a hierarchy of instructor prompts (e.g., model, verbal, physical) are delivered.

Assistive technology. Last "any item, product, or product system, whether acquired commercially off-the-shelf, modified, or customized that is used to increase, maintain, or improve the functional capabilities of individuals with disabilities" is the definition of assistive technology in IDEA (1997, p. 8). Assistive technology (AT) is an important consideration for all persons with disabilities when developing the Individual Education Program (IEP). However when evaluating AT for children with CCN and DD, experts in Augmentative and Alternative Communication (AAC) need to be involved in evaluating the individual needs for each student (Light & Clendon, 2004). IEP teams have used the SETT (students-environment-tasks-tools) framework as a collaborative decision-making tool to determine what assistive technology might be useful for students with disabilities through evaluation of tools (Zabala, 1995).

Recent developments in mobile technologies, such as the iPad™ (2010) have created innovations through apps appealing to parents and teachers propelled by the needs of children with disabilities. Innovations of particular interest are ease of access through touch screens and accessibility features, as well as voice output for more effective communication (Light & McNaughton, 2012). However, there is a paucity of research on academic interventions that incorporate AT specific to students with CCN and DD, and little assurance that AAC apps are evidence-based to meet the needs of children with CCN and DD (Edyburn, 2013; Kagohara et al., 2012; Light & McNaughton, 2012). When decisions are made to purchase an intervention that is delivered via AT, the determination of the AT being a match for the studen needs to be completed by the team (Zabala, 1995).

Behavioral Supports. Academic and behavioral supports must be integrated to help children benefit from early literacy instruction (Special Education Report, 2010). Teachers work with other members of the IEP team to gather direct (e.g., observations) and indirect (e.g.,

interviews) sources of data through a Functional Behavior Assessment (FBA) , which is done in order to determine what is prompting and maintaining a behavior (Cooper, Heron, & Heward, 2007). Then, a highly individualized Behavior Intervention Plan (BIP) can be developed in order to address the function of the behavior with the ultimate goal of improving behavior so that a student may experience academic, behavioral, and social success. As behavior improves literacy skills increase (Special Education Report, 2010).

Assessment Framework. Assessments that address academic prerequisites, behavioral needs, and assistive technology matching can aid individuals in preplanning supports and interventions (Special Education Report, 2010; Sugai et al., 2001; Zabala, 1995). It is imperative that interventions are tailored to build upon students' prerequisite skills and that the skills addressed in the intervention are skills next to be scaffolded onto the participants' current skills (Horner et al., 2010). Successful acquisition of skills can be further bolstered by tailoring individualized behavioral and assistive technology supports.

Purpose of the Study

The purpose of the current study evaluated the effectiveness of using systematic instruction with an iPad-based phonics program to teach students with CCN and DD early reading skills. Ahlgrim-Delzell, Browder, and Wood (2014) developed the Go Talk Phonics curriculum for students with CCN that included AT for articulatory feedback; systematic direct instruction; CTD; and a system of least prompts. This curriculum was delivered via the Go talk 32 AAC device. The intervention for this study consists of the Go Talk Phonics curriculum (Ahlgrim-Delzell et al., 2014) delivered through the format of the Go Talk Now™ app on the iPad™. Limitations of the Ahlgrim-Delzell and colleagues (2014) study included (1) use of the bulky AAC device that required multiple overlays and suggested use of the iPad™ and (b)

maintaining motivation of the students throughout the study due to the fatiguing nature of the non-instructional probes included in their multiple baseline design. The aim of this study is to replicate the Ahlgrim-Delzell et al., (2014) study, with variations that include a multiple probe single subject design and the use of an iPad as AT.

Significance of the Study

There is a dearth of empirical studies that support the use of early reading instruction and academic interventions using AT for students with CCN and DD. Thus, there is a need to further investigate the efficacy of early reading instruction and specific interventions that address the individual needs of learners with CCN and DD (Browder, Wakeman, Spooner, Ahlgrim-Delzell, & Algozzine, 2006; Clendon & Erickson, 201; Light & McNaughton, 2012). In this study, a multiple probe across measures single subject design will be employed to investigate the efficacy of an iPad-based phonics intervention to improve the reading skills of two (N = 2) students with CCN. The intervention uses systematic phonics instruction with AT for articulatory feedback. The dependent measures include (a) phoneme identification, (b) blending sounds to form words, (c) blending sounds to form words to identify the corresponding picture, and (d) sight word identification.

There were five research questions. First, what is the overall effect of iPad-based, systematic phonics instruction on early phonics skills? Second, what is the effect of the intervention on letter-sound relationships? Third, what is the effect of intervention on blending sounds to identify words? Fourth, what is the effect of intervention on sight word reading? Fifth, what is the effect of intervention on word reading in order to identify a picture?

CHAPTER TWO
LITERATURE REVIEW

All students, including children with developmental disabilities (DD), should be afforded the right to receive evidence-based instruction in early reading literacy. This literature review will provide an overview of the characteristics of elementary students with DD who have complex communication needs (CCN) across the domains of communication skills, cognition, socialization, motor skills, and adaptive behavior. In addition, an examination of the need for and the components of early literacy instruction for elementary students with CCN and DD will be provided. Finally, components of early literacy instruction that have garnered empirical support for these learners will be discussed.

Characteristics of Elementary Students with CCN and DD

Students with DD who do not develop speech and language skills fall into the heterogeneous group of children with CCN (Beukelman & Mirenda, 2013; Light & Drager, 2007). Approximately 1.3% of the population cannot rely on natural speech to meet their daily communication needs (Beukelman & Mirenda, 2013). Students with CCN often do not develop critical communication, language, and early reading literacy skills due to speech, language, motor, and or sensory perceptual impairments (Beukelman & Mirenda, 2013; Light & McNaughton, 2012; Light, McNaughton, Weyer, & Karg, 2008; Mirenda, 2003). The Individuals with Disabilities Education Act (IDEA, 1997) identifies children ages 3-9 years of age with developmental delay through one or more domains of development. Students with CCN, a heterogeneous group, commonly exhibit a range of difficulties within the domains of receptive and expressive communication skills, cognition, socialization, motor skills, and adaptive skills.

Communication domain. Communication is the sharing of information with a sender and receiver of message and these messages compose language (Hallahan, Kauffman, & Pullen, 2012). *Receptive communication* involves understanding messages or decoding information (Beukelman & Mirenda, 2013; Hallahan et al., 2012). *Expressive communication* is sending messages or encoding information. Messages encompass many communication functions (e.g., social interaction, requests, sharing ideas, rejecting) and are important to child development (Beukelman & Mirenda, 2005; Hallahan et al., 2012). Speech and language impairments are communication disorders (e.g., articulation, language, voice difficulties) that can be detrimental to educational performance (IDEA, 2007). Students with CCN and DD have speech and language impairments that affect their participation and can limit their activities across environments. This restricted access to learning and lack of academic and social communication opportunities with peers and teachers can negatively affect educational outcomes for this population (Beukelman & Mirenda, 2013; Light & Drager, 2007).

Students with DD and CCN, 1.3 % of the population, use Augmentative and Alternative Communication (AAC) tools (Beukelman & Mirenda, 2013). AAC technology is part of the habilitation services designated in the Health Care Reform Act of 2010 (Beukelman & Mirenda, 2013). Habilitation services include intervention strategies that address (a) initial speech-language production and comprehension (receptive and expressive language), and (b) participation in various activities (American Speech-Language-Hearing Association, ASHA, 2013; Beukelman & Mirenda, 2013; Hasselbring & Glaser, 2001). Although unaided communication systems (e.g., sign language, gestures) are recommended for some persons with CCN and DD, a variety of communication partners have to be conversant in the system as well.

Therefore, research has shown that individuals with CCN and DD are more able to convey their meaning with aided systems, such as AAC devices (Treviranus & Roberts, 2003).

Lack of effective communication skills can interfere with development in all domains (Beukelman & Mirenda, 2005, 2013; Light & Drager, 2007). Effective communication skills include the ability to comment in discussions, reject or protest actions or comments (e.g., true-false activities), and relate understanding (Beukelman & Mirenda, 2013). Elementary learners with CCN and DD require frequent opportunities to practice communication skills in naturalistic settings, so school environments should be engineered for opportunities to be available throughout the day (Beukelman & Mirenda, 2013; Copeland et al., 2014; Koppenhaver & Erickson, 2003; Light & McNaughton, 2012).

Language skills may develop atypically for children with CCN and DD. In order to assess the capabilities of children with CCN to use AAC, six aspects of communication development are addressed: awareness, communicative intent, world knowledge, memory, symbolic representation, and metacognition (Beukelman & Mirenda, 2013; Rowland & Schweigert, 2003). Each of these areas of communication development become increasingly sophisticated. For example, awareness includes the understanding that your actions result in consequences (e.g., if you vocalize, someone will vocalize in return) and knowledge about the world comes from experience (Beukelman & Mirenda, 2013; Sturm & Clendon, 2004). Communicative intent is purposeful communication directed toward another person. Symbolic representation is the knowledge that symbols represent meaning (Beukelman & Mirenda, 2013; Rowland & Schweigert, 2003, Sturm & Clendon, 2004). Memory and metacognition are complex skills necessary for learning and the use of low- or high-technology AAC (Beukelman & Mirenda, 2013; Rowland & Schweigert, 2003).

Elementary learners with CCN and DD can experience difficulties in acquiring language skills that promote understanding of concepts, symbol understanding, and early reading skills (Light & McNaughton, 2012; Rowland & Schweigert, 2003). Adequate practice is required in use of the communication system (e.g., response mode) in addition to academic skills (Rowland & Schweigert, 2003). Therefore, careful consideration of AAC is necessary when teaching academic skills to learners with CCN and DD. The task difficulty with an inefficient response mode through a communication system can interfere with the amount of cognitive effort required for academic learning (Beukelman & Mirenda, 2013; Light & Drager, 2007).

Cognition. Cognition is the "ability to solve problems and use strategies" (Hallahan et al., 2012, p. 457). Individuals with CCN and DD may experience difficulty in the areas of working memory, attention, and language skills (Hallahan et al., 2012; Mercer, Mercer, & Pullen, 2011). Working memory is a component of cognitive executive function, along with inner-speech, and control of arousal levels to regulate behavior, which can be delayed (Hallahan et al., 2012). Individuals with CCN and DD who experience difficulties in working memory or attention may encounter difficulties with the acquisition of academic skills such as reading. With regard to early reading literacy, Adams (1990) described the reading process as having four processors working together; the orthographic processor for print, the phonological processor for speech, the meaning processor attaches meaning to the print and speech, and the context processor confirms the work of the other processors and applies knowledge of language to comprehend what is read. These processors have to work together to read. Acquisition of early reading literacy may be related to difficulties in understanding that words have parts or phonemes (Mercer et al., 2011). Phoneme segmentation and blending of sounds to form words are necessary steps to the acquisition of basic decoding skills (Mercer et al., 2011). Basic

decoding skills require extended practice to become automatic (i.e., rapid and accurate), so that students can attend to comprehension of what is read (Mercer et al., 2011). For students with DD and CCN, cognitive and communication development not only interfere with success in academic areas, but can become an added barrier to socialization (Raghavendra, Olsson, Sampson, McInerney, and Connell, 2012).

Socialization. The socialization domain refers to play skills, interpersonal relationships, and various coping mechanisms (Sparrow, Cicchetti, & Balla, 1989). Severe communication difficulties for students with DD and CCN impact participation in social networks in school. Social networks might include the classroom community, grade level cohort, before and after school groups, or the school community at large. Theories on childhood development, such as Piaget's stages of development, or Bronfenbrenner's ecological systems theory, posit the importance of the context and influences of people in a child's social networks on overall development (Bronfenbrenner & Ceci, 1994; Derry, 2013). During Piaget's preoperational phase of development, children learn to extend their linguistic capabilities with others during play. Play groups and class situations where children learn are essential to the theory of development in which social networks are key (Derry, 2013). The microsystem of institutions and group (e.g., family, school, peer group) have the largest impact on a child's development (Bronfenbrenner, 1979; Bronfenbrenner & Ceci, 1994). Hence, positive social relationships and social peer acceptance are high-priority educational outcomes (McDonnell & Hunt, 2013).

Raghavendra and colleagues (2012) noted that students with CCN required more adult support to participate in the same activities than their typical peers. In addition, significant barriers can exist between the amount of access and participation of students with CCN in areas of self-improvement, social activities, and interaction with peers (Raghavendra et al., 2012). In a

follow-up study that compared out-of-school activities, students with CCN were reported to be more restricted in their social participation than their typical peers and persons with physical disabilities without CCN (Raghavendra, Virgo, Olsson, Connell, & Lane, 2011).

Motor skills. In addition to struggling with socialization, children with CCN and DD have difficulty in the motor skills domain. Interaction with one's environment can be dependent upon one's motor system and movement. *Gross motor* skills utilize the large muscle groups required for walking, crawling, and balancing. These usually develop throughout early childhood (Stallings, 1973). *Fine motor* skills utilize small muscle groups (Stalling, 1973). Manipulating books and other objects, accessing technology, and playing with toys all require the more precise movements of fine motor skills. Motor learning has three phases; the cognitive phase, associative phase, and autonomous phase. During the cognitive phase a lot of cognitive effort is required to learn the new physical task. With practice, efficient strategies are strengthened while ineffective strategies are discarded (Stallings, 1973). In the associative phase, movements become more consistent and fluid. During the autonomous phase the motor skills are performed automatically (Stallings, 1973). Therefore, as new skills are being learned, physical tasks within a new skill require added cognitive effort. Many children with CCN and DD have difficulty with motor skills, ranging from mild to severe that complicate their ability to access communication and academic skills (Light & McNaughton, 2013). It is important that all service providers (e.g., occupational therapist, physical therapists, speech-language pathologists) are included on AAC assessment and intervention teams to address the needs of children with CCN who have motor skill difficulties (Beukelman & Mirenda, 2013).

Adaptive behavior. A fifth domain of development is adaptive behavior. Adaptive behavior is social and practical intelligence used daily, which is necessary to function

independently in society (Hallahan et al., 2012). Adaptive skills include communication, self-care, home living, social skills, community use, self-direction, health and safety, functional academics, leisure, and work (Hallahan et al., 2012). Elementary students with DD who have CCN rely on caregivers and assistance to develop these skills, which can also be called functional skills (Browder & Spooner, 2011; Hallahan et al., 2012). Adaptive skills are affected by the same difficulties noted in communication (e.g., language comprehension and production), socialization (e.g., developing friendships), and cognition (e.g., working memory) in children with CCN and DD (Hallahan et al., 2012). Children who have limited adaptive skills require explicit instruction in all skills. Due to these students' limited abilities to generalize what is learned, instruction should take place across contexts with real materials and systematic instruction (Hallahan et al., 2012).

Summary. The domains of communication, cognition, socialization, motor skills, and adaptive skills, include many possibilities for a diverse narrative to describe a child with CCN and DD. Each child's level of communication, cognition, socialization, motor skills, and adaptive skills may be different, but their need for literacy instruction and strategies that make learning efficient and effective are the same as children without disabilities (Browder, Wakeman, Spooner, Ahlgrim-Delzell, & Algozzine, 2006; Liben & Liben, 2014). The need for adequate conventional literacy in today's society is more necessary than ever. For students with CCN and DD, the ability to read can have a large impact in all areas of their life (Downing, 2005; Erickson, Hatch, & Clendon, 2010; Sturm & Clendon, 2004). Literacy provides increased opportunity for students to communication about the world around them, and eventually take part in the society at large as a literate member of society (Downing, 2005; Koppenhaver & Erickson, 2003). Persons with adequate literacy skills are more employable, develop more social

relationships, and are more likely to further their education (Copeland, Keefe, & deValenzuela, 2014). However, because students with CCN struggle with the developmental domains described above, it can be difficult to develop conventional literacy skills necessary to participate fully in society.

Legislative acts, such as No Children Left Behind (NCLB, 2002) and the Individuals with Disabilities Education Improvement Act (IDEIA, 2004), as well as the United Nation's Convention on the Right of Persons with Disabilities (2006) have mandated that students with disabilities receive instruction in the general education content standards and curricula that their peers without disabilities receive. This includes providing the students access to early reading literacy instruction along with their peers. As a result, there is a need for students with DD who have CCN to be afforded with evidence-based strategic reading instruction.

Literacy Skills

Emergent literacy is the descriptive term for reading experiences children have before they learn to read (Koppenhaver & Erickson, 2003). These experiences include exploring books, scribbling, and sharing information about a story. *Conventional literacy* instruction is learning to read and write (Koppenhaver & Erickson, 2003). The National Early Literacy Panel (NELP, 2008) examined literature to determine variables that were strong predictors of positive outcomes in conventional literacy. The strongest variables were (a) alphabet knowledge (i.e., names and sounds of printed letters); (b) phonological awareness (i.e., the broad term that includes phonemic awareness, the ability to hear and manipulate sounds in syllables, onsets, rimes, & phonemes); and (c) the rapid automatic naming of letters, digits, objects, or colors, writing one's own name, and phonological memory. The NELP (2008) called these code-focused variables. These findings were consistent with the earlier reports from the NRP (2000) and Armbruster,

Lehr, and Osborn (2001), who delineated the five broad skills of reading instruction as phonemic awareness, phonics, fluency, vocabulary, and comprehension.

Phonemic awareness. Phonemic awareness is defined as knowledge that spoken words can be broken down into phonemes or smaller sound segments (Ehri, Nunes, Stahl, & Willows, 2001; NRP, 2000). Phoneme isolation, identity, categorization, blending and segmentation are used to instruct. It is most effective when focused on only one or two skills at a time (Adams, 1990; Saunders & DeFulio, 2007). Research found that phonemic awareness and letter knowledge are the best predictors of learning how to read (Browder et al., 2006; NRP, 2000). Two studies evaluated the efficacy of phonemic awareness as a component of early reading instruction for students with CCN (Bailey, Angell, & Stoner, 2011; Truxler & O'Keefe, 2007). Although the research groups approached phonemic awareness from different perspectives (e.g., whole-to-part, part-to-whole), both studies showed a functional relation between phonemic awareness activities and early reading skills (Bailey et al., 2011; Truxler & O'Keefe, 2007).

Phonics. In 2000 the NRP recommended systematic and explicit phonics instruction, and defined these terms as "increasing the understanding that letters represent phonemes and that these sounds are blended together to form written words" (p. 93). Phonics instruction allows students to sound out words with which they are unfamiliar, instead of depending on memorization of all words (Ehri et al., 2001; Foorman & Torgesen, 2001; NRP, 2000). Systematic phonics instruction has been recommended since the 1960s when Chall (1967) recommended it as the most effective strategy to teach reading. In a synthetic approach, phonics are taught by helping students first, to recognize a letter (grapheme), sounds (phoneme), and then, teaching them to decode a word by blending the letter sounds (Browder et al., 2006; Chall, 1967; Ehri et al., 2001).

Analytic approaches begin with whole words and segment them into chunks, blend the chunks back into words, and then, create analogies between rimes (Chall, 1967; Ehri et al., 2001). Chall's 1983 edition of Learning to Read "suggested that synthetic phonics had a slight edge over analytic phonics instruction" (Ehri et al., 2001, p. 396). Phonics instruction should not be the entire reading program, but should be included as part of a balanced literacy approach, along with engaging in phonemic awareness activities, listening to stories and informational text, reading text, and writing (Ehri et al., 2001; NRP, 2000). The NRP described use of a balanced approach to reading instruction that also includes fluency instruction (NRP, 2000).

Fluency. Fluency is the ability to read text quickly, accurately, and with expression, and enables students to understand what they read (Keefe, 2007; Therrien, 2004). With enough reading practice, no matter what the vehicle to learn words (e.g., phonics, sight word instruction), all words evolve to be read by sight (Ehri, 2005). The transfer of decoding to sight words is the most efficient way to read fluently (Ehri, 2005; Fuchs et al., 2000). Instruction in fluency includes modeling fluent reading and having students engage in repeated oral reading. Fuchs, Fuchs, Hosp, and Jenkins (2001) reported there is a high correlation between fluency and comprehension. More cognitive effort can be utilized to resolve comprehension questions, if there is fluency in oral reading (Fuchs et al., 2001; Light & McNaughton, 2013). Fluency instruction should include repeated reading, shared reading, choral reading, read aloud, repeated reading through performance, and independent reading (Keefe, 2007; Therrien, 2004).

Vocabulary. Reading vocabulary or word knowledge (e.g., unfamiliar words in print) are translated to oral vocabulary for understanding (NRP, 2000). Over time vocabulary or word knowledge extends from receptive to generative use (Stahl & Stahl, 2012) and represents concepts, which expand conceptual knowledge (Castek, Dalton, & Grisham, 2012). Beginning

readers use their vocabulary to understand what they are reading. Vocabulary is developed directly with explicit word learning instruction, and indirectly by listening and reading extensively (NRP, 2000). Effective vocabulary instruction features include multiple exposures of words being taught, definitional and contextual information, and engagement with words through deep processing (McKeown, Beck, & Sandora, 2012; Stahl & Stahl, 2012). Word learning and use of vocabulary with students with CCN or DD (n = 8) was the focus of two studies (Fallon et al., 2004: Hanser & Erickson, 2007). By focusing on phonemes to graphemes instruction, all participants were able to read targeted words and generalized skills to novel words (Fallon et al., 2004; Hanser & Erickson, 2007).

Text comprehension. Text comprehension is defined as the intentional thinking processes that happen during reading and is important for understanding what is read (Armbruster et al., 2001; NRP, 2000; Therrien & Hughes, 2008). Underlying language difficulties and lack of experiential prior knowledge interfere with comprehension (Copeland, 2007; Erickson, 2003). In order to activate prior knowledge, teachers might utilize question words (e.g., who, where) and preview the text, pictures, and title to make predictions about what the students will be reading (Copeland, 2007). Strategies that improve text comprehension instruction include, use of graphic organizers, answering and generating questions, recognizing story structure, and summarizing text (Armbruster et al., 2001). There is a high correlation between text comprehension and fluency (Fuchs et al, 2001). Reading comprehension is a cognitive process that encompasses vocabulary and text comprehension. The NRP paired vocabulary and text comprehension, along with comprehension strategy instruction as essential to the development of reading comprehension (2000).

Instruction in phonemic awareness, systematic phonics instruction, fluency, vocabulary, and text comprehension strategies are recommended by the NRP (2000) as the best approach to reading instruction. This five-faceted approach has been found to be effective for students with and without disabilities (Connors et al., 2014). In a synthesis of the Institute of Education Sciences (IES) supported reading research, students with DD benefitted from the same reading development theories and scientifically based reading instruction as typically developing students (Connors et al., 2014).

Several recommendations for effective reading instruction emerged, including, (1) incorporating a comprehensive reading curriculum that teaches phonics skills in addition to sight word identification, (2) providing an extended period of time (ie., 2-3 years) for most students with intellectual disabilities to acquire basic levels of literacy, (3) building a foundation of phonemic awareness and print knowledge, vocabulary development, and comprehension skills using oral language and storybooks, and (4) applying explicit behaviorally based instructional strategies. Stronger reading outcomes are associated with these strategies (Connors et al., 2014).

These recommendations are reflected in the following synopsis of early reading instruction literature for students with CCN and DD that have each incorporated adaptations necessary for students' responses in place of oral language. Four studies examined single components of reading skills. Whereas, three studies examined comprehensive approaches to early reading instruction for students with CCN and DD.

Reading Instruction Literature for Students with CCN and DD

Using a multiple probe across subjects design, Fallon, Light, McNaughton, Drager, and Hammer (2004) examined the effects of direct instruction on the single-word reading of five students with CCN and DD or who used AAC. The instructional program used 14 target letters

and their corresponding sounds to generate 75 VC (vowel-consonant) or CVC (consonant-vowel-consonant) words. The words were divided into target and novel word lists. Pictures for each word were created to use in an array of four items (3 foils, 1 target) for students to respond.

The five students, ages nine to fourteen, improved their single-word reading skills, learning 35-45 words over a range of 10-34 sessions. According to graphed data, four of the five students had 100% non-overlapping data. Procedural reliability was measured at 97% and inter-observer agreement (IOA) was 99% accuracy. Best instructional practices (e.g., active engagement of students, scaffolding tasks to promote errorless learning, direct instruction) were incorporated in this program. The use of the novel word reading task helped researchers to discern what reading strategies were used by the participants (i.e., decoding or sight word reading). Three of the five participants were able to decode the novel words at 60-80% accuracy.

Some limitations noted by Fallon and colleagues (2004) included the small number of participants, instruction not delivered daily, and difficulty assessing whether the words had become sight words or were being sounded out. Fallon and colleagues (2004) stressed the importance of the need for more research to develop reading instruction programs that combine decoding and sight words instruction for students with CCN. The authors found that direct instruction supported the development of early reading skills in students with CCN (Fallon et al., 2004).

Procedurally similar to Fallon et al. (2004) study, Truxler and O'Keefe (2007) taught four children with CCN and DD, ages eight and nine, a set of phonemes and measured the accuracy of the identification of initial sounds. However, instead of generalization to another set of words (Fallon et al., 2004), authors examined the students' ability to generalize the phonemic awareness skills from the initial sound to the middle and ending sound placement in words.

Truxler and O'Keefe (2007) added another experiment within the same article that examined the phonemic skills on the spelling ability of the participants.

One participant of the four was successful in phonemic awareness, letter-sound knowledge, word recognition, and spelling. However, there was no evidence of generalization of decoding skills to non-word items. The other three participants were unable to meet criterion in the first experiment of the article, and after three consecutive sessions and two hours of instruction in applying the phonemic awareness skills to spelling tasks in the second experiment, the participants did not understand translation of the letter-sound correspondence to the spelling task, so instruction was terminated (Truxler & O'Keefe, 2007). According to the authors, the intervention activities may not have been effective due to the experimental measures including too many items. The authors pointed out that participation inclusion criteria of Fallon et al., (2004) study depended on the acquisition of 100% of target letter names and letter-sound correspondence (pre-taught) prior to their decoding study, which was not a requirement for participation in this study (Truxler & O'Keefe, 2007). An implication this study illuminated is that letter-sound correspondence paired with limited phonemic awareness, may not be enough for students to acquire decoding and spelling skills (Truxler & O'Keefe, 2007). More practice of phonological skills (e.g., partial word awareness, phoneme counting) may have provided some foundation to the more analytical skills of decoding (Truxler & O'Keefe, 2007).

In a third study of reading instruction for three students with CCN and DD, ages 7 & 13, Hanser and Erickson (2007) investigated the effectiveness of the Literacy Through Unity: Word Study program that combined word identification and communication. Through a non-concurrent multiple baseline across participants design, the three participants with CCN and DD completed 75 lessons across four to six weeks of instruction. The program used spelling lessons through a

scripted direct instruction approach that taught systematic phoneme, phonic skills, and word skills. All participants increased their skills in word identification, developmental spelling, and expressive communication tasks. Procedural reliability ranged from 90-96% across 4-5 sessions. There was no inter-observer agreement reported. Hanser and Erickson (2007) suggested that future research might integrate explicit communication instruction with word identification programs.

The scope of the Hanser and Erickson (2007) was comprehensive while the following intervention was more focused on the single skills of phoneme identification. Bailey, Angell, and Stoner (2011) utilized a structured intervention package with direct instruction and picture books to teach phonological and phonemic awareness. The participants were students (n = 4) ages twelve to fifteen, with CCN and DD who used AAC (Bailey et al., 2011). The intervention included two distinct components: (1) all participants had interactive small group reading lessons using a book that emphasized targeted phonemes, and (2) individual scaffolding of phoneme lessons. Direct instruction with scaffolding of skills and an error correction strategy consisting of a prompt hierarchy was utilized to deliver the instruction. A functional relation between the intervention and letter sound matching ability was found at variable levels for the participants. Procedural fidelity was 96% and IOA was calculated at 94% for the intervention. All students improved in sound-to-letter matching in at least two of the three sets targeted across the nine-week intervention (Bailey et al., 2011).

In contrast to the relatively short nine-week study by Bailey et al. (2011), Light, McNaughton, Weyer, and Karg (2008), detailed a sixteen-month intervention with fifty-five hours of instruction (30 minutes twice weekly) that incorporated evidence-based practices for early reading instruction for an eight-year old girl (n = 1) with multiple disabilities who required

AAC. Light and colleagues (2008) investigated components of evidence-based literacy instruction which included, phonemic awareness (e.g., blending/segmenting phonemes), phonics skills of decoding, sight word identification, vocabulary instruction, text comprehension, and writing one sentence messages with AT.

Direct instruction (i.e., modeling, guided practice, and independent practice), with most-to-least prompting for near errorless learning were implemented throughout the intervention. AT included an AAC device, a communication board, and a speech-generating device (SGD). The intervention resulted in student gains for twenty letter-sound correspondences, and location of 26 letters, punctuation and functions on a keyboard. In addition, during reading activities the student read more than sixty words and demonstrated more than 90% accuracy on known words (Light et al., 2008). The author recommended future researchers examine the efficacy of employing evidence-based practices such as those incorporated within this study to applied investigations within the classroom (Light et al., 2008).

Similar to Light and colleagues (2008), direct instruction, prompting systems, and assistive technology were utilized in the following study. The Early Literacy Skills Builder curriculum (ELSB; Browder, Gibbs, Ahlgrim-Delzell, Courtade, & Lee, 2007), developed to address early literacy skills was evaluated through a quasi-experimental design (Browder, Ahlgrim-Delzell, Courtade, Gibbs, & Flowers, 2008). The ELSB curriculum, included components of concepts of print, phonemic awareness (e.g., first sound identification, phoneme segmentation), vocabulary with picture referents, phonics (e.g., decoding), and reading comprehension that included listening comprehension (Browder et al., 2008).

Twenty-three elementary-aged participants with significant disabilities (n = 23), half of whom were non-verbal or who had CCN (n = 12) were randomly assigned to the treatment group

who received the ELSB curriculum, or the control group who received story-based lessons and a sight word reading program. Systematic instruction included direct instruction with scaffolded skills. Prompting and fading procedures included CTD and least to most prompts as a correction procedure.

The treatment group (n = 11) exhibited large effect sizes of 1.15 to 1.57, while the control group showed small (.39) to medium (.65) effects when comparing the results from the Nonverbal Literacy Assessment (NVLA; Baker, Spooner, Ahlgrim-Delzell, Flowers, & Browder, 2010), the phonics and phonemic awareness skills, and the Early Literacy Skills Assessment, a direct measure of the ELSB curriculum (Browder et al., 2008). Both groups received the shared reading instruction and improved on the conventions of reading part of the assessment (Browder et al., 2008). The skills that were measured include phonemic awareness and phonics skills, conventions of reading (e.g., text pointing, prediction, listening comprehension), and all the areas of the ELSB curriculum through the ELSA (Browder et al., 2008). The procedural fidelity of story implementation in the control group was eighty-five percent. The ELSB treatment had a procedural fidelity of 93%, with inter-observer agreement of 94.9%. All eleven students in the ELSB group progressed through at least one of the five levels of the curriculum. One student completed all five levels. A limitation of the study was that the measures utilized (e.g., NVLA, ELSA) were creations of the same group of researchers. However, other measures included the Peabody Picture Vocabulary Test 3 (PPVT-3; Dunn & Dunn, 1997) and the Woodcock Language Proficiency Battery (Woodcock, 1991), which reflected the difference in effects between the treatment and control groups.

This study demonstrated that students with significant disabilities, verbal or nonverbal, were able to gain early literacy skills with intensive instruction. These students were able to

acquire some phonemic awareness and phonics skills, in addition to early literacy shared reading skills (Browder et al., 2008). Browder and colleagues (2008) noted there has been limited research measuring the impact of a full curriculum instead of single components of literacy with students demonstrating these specific disabilities. The authors further noted that there was a need to employ assessments that are unbiased toward learners who are nonverbal or have physical or sensory impairments (Browder et al., 2008).

The impact of a full curriculum suggested by Browder and colleagues (2008), was the impetus for the development of a full curriculum that extended the 2008 research to early reading skills. Ahlgrim-Delzell, Browder, and Wood (2014) developed GoTalk Phonics (GTP), a phonics based program that utilized the GoTalk 32 Express AAC device. Through a multiple baseline design, the three participants with moderate intellectual disabilities and Autism (n = 3) and CCN, were taught early reading skills with the AAC device providing a conduit for vocal responses. The program used systematic instruction including CTD and system of least prompts delivered via scripted lessons. Procedural fidelity ranged from 89-97%, and the IOA was calculated at 97%.

Results showed improvement in the three target phonics skills of phoneme identification (average gain of 30.45), blending phonemes to form words (average gain of 27.7), and blending phonemes to identify pictures that match words (average gain of 23.95 in independent correct responses). Ahlgrim-Delzell et al., (2014) cited the following limitations: (1) the timing of the intervention in the school year, (2) the AAC device was large and required multiple overlays for the phonics lessons, and (3) the probe was extensive which interfered with student motivation to complete the probes throughout the study. Suggestions to address these limitations included introducing the intervention earlier in the school year, using the iPad in lieu of the AAC device,

and creating the probe on a tablet with a touch screen (Ahlgrim-Delzell et al., 2014). The six studies reviewed are included in Table 1.

Table 1. Early Reading Literature Studies with Students with CCN and DD.

Citation	Participants	Study Design	Literacy Skills	Systematic Instruction	Results	Quality indicators
Ahlgrim-Delzell, Browder, & Wood, 2014	N=3 Ss with CCN & DD, able to access AAC device	Multiple baseline across participants	GTP curriculum: PHM (ID, 1st sound in words, PHM segment) PH (blend-words, blend-pictures V), sight-V, TC ; comp curr	Sc, DI, CTD, LtM AT, scaffolding	All Ss impr- across skills, average mean (30.45, 27.7, 23.95) I correct response scores by phase/skill	SV (+/+), PF (89-97%) IOA (97%) FR: AT-iPad platform, less arduous measure
Bailey, Angell, & Stoner, 2011	N=4 students with CCN, AAC users, middle school age (2 boys, 2 girls)	Multiple baseline across participants (9 wk IV)	Interactive reading-PHM loaded picture book,1:1 PHM lessons (18 sounds, words) 1comp curr	DI, Scaffolded, error correction strategy (prompt hierarchy)	2 functional rel, 2 not, Letter sounds-overall improvement, words-2 improved, 2 did not	PF-96%(93% IV, 77% assessment); IOA-94% FR: more research needed

Note. CCN-Complex Communication Needs, Sc-scripted, DI-Direct instruction, LtM-least to most prompting, AT-assistive technology, PHM-phonemes, PH-phonics, F-Fluency,V-vocabulary, TC-Text comprehension SV-social validity Tx-treatment group, C-Control group, FR-future research, Single component curriculum-1 comp curr, Comprehensive curriculum-Comp Curr.

Table 1. Early Reading Literature Studies with Students with CCN and DD Continued.

Citation	Participants	Study Design	Literacy Skills	Systematic Instruction	Results	Quality indicators
Browder, Ahlgrim-Delzell, Courtade, Gibbs, & Flowers, 2008	N=23 Ss, K-4 @ 1/s verbal/CCN (n=11/12) CCN-5(Tx) 7 (C)	Tx/Control group, random assignment C-Story-based lessons, Edmark	Tx-ELSB (based on research)-PHM (1st sound,segment,blend) PH(blend), V(picture referents), TC (listening TC, sequence reading TC); Comp Curr	DI, CTD, LtM (if incorrect) scaffolding Large effect sizes Tx (1.15-1.57) C-small-mod: (.39-.65)	All 11 progressed through at least 1/5 levels. 6 to L 2, 3 to L 3, 1 to L 4, 1 completed all 5 L	PF-85% (story implementation) ELSBPF-93% IOA-94.9% FR: build on reading curricula. not single aspect
Fallon, Light, McNaughton, Drager, & Hammer, 2004	N=5 Ss with CCN, ages 9-14, 4 boys/1 girl, used finger pt-direct select	Multiple probe across subjects	14 target letters to generate 75 VC/CVC words, (50 target, 25 novel), generalization to novel words in books; 1comp curr	DI, (model, guided,	4/5-100% non-overlapping data, learned 35-45 over 10-35 instructional sessions	PR-97% IOA-99%;FR: dev reading –decoding, class-based, articulatory feedback.

Note. CCN-Complex Communication Needs, Sc-scripted, DI-Direct instruction, LtM-least to most prompting, AT-assistive technology, PHM-phonemes, PH-phonics, F-Fluency,V-vocabulary, TC-Text comprehension SV-social validity Tx-treatment group, C-Control group, FR-future research, Single component curriculum-1 comp curr, Comprehensive curriculum-Comp Curr, L = Levels.

Table 1. Early Reading Literature Studies with Students with CCN and DD. Continued.

Citation	Participants	Study Design	Literacy Skills	Systematic Instruction	Results	Quality Indicators
Hanser & Erickson, 2007	N=3 children with CCN, ages 13(fem), 13 (male), 7 (male)	Non-concurrent, Multiple baseline design	75 Sc lessons over 4-6 weeks *Literacy through Unity: Word Study*-PH, PHM, icon sequencing 1 comp curr	Sc, DI, systematic PH, spelling lessons	All 3 made gains across word ID, spelling, and communication tasks	PR(90-96% across 4-5 sessions), No IOA-FR-new resources & methods to up level of literacy
Light, McNaughton, Weyer, & Karg, 2008	N=1 girl, 8 y.o. with multiple disabilities with CCN	Case study, 16 month intervention, 55 hours of instruction (30 m/twice/week	PHM (blend/, segment), PH, decoding, sight word, V, language; TC, writing/keyboarding AT to type1sentence Comp Curr	DI, opportunities for application, MtL (model, Guided, Ind P), AT-(AAC, comm board,SGD)	20 letter-sound, locate 26 letter, punc, Fx on keyboard, read >60 word,reading activites >90% known words,	Know what and inst proc/ adaptations Ss with AAC, need to transfer to daily practice in schools

Note: CCN-Complex Communication Needs, Sc-scripted, DI-Direct instruction, LtM-least to most prompting, AT-assistive technology, PHM-phonemes, PH-phonics, F-Fluency,V-vocabulary, TC-Text comprehension SV-social validity Tx-treatment group, C-Control group, FR-future research, Single component curriculum-1 comp curr, Comprehensive curriculum-Comp Curr.

Table 1. Early Reading Literature Studies with Students with CCN and DD. Continued.

Citation	Participants	Study Design	Literacy Skills	Systematic Instruction	Results	Quality Indicators
Truxler & O'Keefe, 2007	N=4 children with CCN, ages 8-9	2 studies multiple baseline across subjects; 30 min/daily	PHM (blending and segmentation) Booster instruction if DVsounds < 80% accuracy 1comp curr	DI Booster instruction of sound without story reading context	Participant 2 improved phoneme skills, word recog and spelling, no generalize to nonwords, Particpants 1, 3, 4- the IV was not enough in Ex 1 to translate to spelling in Ex 2	PR-100% (20% randomly selected sessions IOA-96-100%

Note: CCN-Complex Communication Needs, Sc-scripted, DI-Direct instruction, LtM-least to most prompting, AT-assistive technology, PHM-phonemes, PH-phonics, F-Fluency,V-vocabulary, TC-Text comprehension SV-social validity Tx-treatment group, C-Control group, FR-future research, Single component curriculum-1 comp curr, Comprehensive curriculum-Comp Curr

Summary of Early Reading Instruction for Students with CCN and DD

The six experimental studies that were reviewed included one group study and five multiple baseline studies. In addition, a sixteen-month case study that entailed early reading components and direct instruction was detailed (Light et al., 2008). The total number of participants with CCN and DD (n = 32) in these seven experiments was limited and represented a low-incidence population with diverse needs. The low numbers of participants was deemed a limitation across the studies. Across studies, several effective strategies emerged. Strategies included, direct instruction, constant time delay, systematic prompting, and the use of assistive technology. This is consistent with previous literature, including a review of literacy interventions for students using aided AAC devices in which Machalicek and colleagues (2009) noted a link between improvements in literacy skills to systematic instructional procedures (e.g., direct instruction, prompting hierarchies, language scaffolding). Several of these strategies were consistently utilized in the studies reviewed. The following paragraphs include more detailed discussion of these strategies.

Direct instruction. The National Reading Panel (NRP, 2000) revealed that research shows that direct systematic phonics instruction was more effective than non-systematic phonics instruction, and is more effective than other forms of reading instruction. Systematic, direct instruction is considered an effective method for teaching fundamental reading skills (Allor, Champlin, Gifford, & Mathes, 2010; Bradford, Shippen, Alberto, Houchins, & Flores, 2006; Browder et al., 2006).

Systematic, direct instruction provides a carefully selected sequence of skills for instruction and is linked across the five major areas recommended by NRP (2000). Skills build upon previously mastered skills, are driven by ongoing assessment, and students are provided

plenty of practice opportunities on each skill (Allor et al., 2010; Hallahan et al., 2012). Direct instruction is a teaching strategy that incorporates explicit and structured teaching routines (Allor et al., 2010; Hallahan et al., 2012). Fast paced lessons keep students engaged and can be extended to skill mastery (Hallahan et al., 2012). Strategies such as modeling, scaffolding, guided practice, independent practice, and assessment are all included in systematic direct instruction (Allor et al., 2010; Cooper, Heron, & Heward, 2007; Hallahan et al., 2012).

The group study (Browder et al., 2008), in which half the participants had CCN and DD, subjects were randomly assigned into treatment or control groups. Intensive instruction with a direct instruction curriculum provided the means for students with significant DD and CCN to acquire some phonemic awareness and phonics skills. The five single-case designed studies and the case study reported that intensive direct instruction and the interactive nature of their interventions as key to the skill acquisition of the participants (Ahlgrim-Delzell et al., 2014; Bailey et al., 2011; Fallon et al., 2004; Hanser & Erickson, 2007; Light et al., 2008; Truxler & O'Keefe, 2007).

Direct instruction curriculum usually incorporates scripted instruction. Scripted instruction has been found to be effective for students with DD (Jimenez, Lo, & Saunders, 2012) or at risk for reading failure (Cooke, Galloway, Kretlow, & Helf, 2011). McIntyre, Rightmyer, and Petrosko (2008) compared scripted and non-scripted reading instruction for struggling first grade students (n=52) and found no significant differences in the phonics scores after one year. Instructional patterns were more consistent in the scripted model of instruction, but patterns emerged in the more eclectic, non-scripted model (McIntyre et al., 2008). However, the Cooke et al., (2011) study on scripted instruction resulted in increased rates of on-task instructional time for students and the rate of off-task opportunities decreased. Ahlgrim-Delzell and colleagues

(2014) utilized a fully scripted curriculum, which included an AAC device and systematic instruction to teach early reading skills (e.g., phonics) to participants (n=3) with DD and CCN.

Constant Time Delay. CTD was the main instructional strategy incorporated in two comprehensive early reading programs for students with CCN and DD (Ahlgrim-Delzell et al., 2014; Browder et al., 2008). CTD is an antecedent response prompt. CTD begins with presentation of a zero delay (0-second delay) (Cooper et al., 2007). This means the presentation of the natural stimulus and the response prompt occur simultaneously. After several zero-delay trials, the procedure calls for a fixed time delay (e.g., 2 seconds, 4 seconds). This time delay allows the learner a space to respond independently and fluently (Cooper et al., 2007; Wolery et al., 1992). An example of CTD, with the identification of a picture within a four-picture array, might be a zero-delay of the model of a finger point to the correct picture simultaneously to the request for response. After several trials at zero-delay, the teacher would systematically increase the delay to a 2-second delay prior to providing the point model, followed by a 4-second delay prior to the model. Each of the time delays allow the student the opportunity to respond independently.

In a review of literature using CTD as an instructional procedure, Browder, Ahlgrim-Delzell, Spooner, Mims, and Baker (2009), 30 experiments were analyzed. CTD was found to be an evidence-based practice for teaching picture and sight word recognition. Twenty-two of the thirty studies met the quality indicators necessary to be considered an evidence-based practice. CTD is meant to assure that learning takes place with few errors. One limitation the research found in these studies is that only half reported error rates, which was one of the quality indicators the research team selected. Thirteen of the fifteen studies that reported error rates, reported rates below 5% (Browder et al., 2009). CTD was utilized in studies that taught single

word identification as well as programs that focused on phonetic analysis (Ahlgrim-Delzell et al., 2014; Caffrey & Fuchs, 2007; Campbell & Meschling, 2009; Cohen, Heller, Alberto, & Fredrick, 2008; Knight, Ross, taylor, & Ramasamy, 2003). A consequential prompting procedure, least to most prompts, is an opposite procedure from CTD, an antecedent time delay.

Systematic prompting. Several of the early reading studies reviewed included the use of prompt hierarches as correction strategies. Two studies utilized least to most prompting as an instructional strategy (Ahlgrim-Delzell et al., 2014; Browder et al., 2008). Least-to-most prompts, also called system of least prompts, is a systematic prompting procedure that allows the student an "opportunity to provide the correct response with the least amount of assistance on each trial" (Cooper et al., 2007, p. 404). The procedure requires set time limits with the natural stimuli, before another presentation of the stimuli and a response prompt along a hierarchy of supports (Browder et al., 2011; Cooper et al., 2007). The student receives successive amounts of assistance on a prompting hierarchy until the response occurs after the stimulus is provided (Browder et al., 2011; Cooper et al., 2007). For example, Ahlgrim-Delzell and colleagues (2014) used least-to-most prompts if the student waited beyond the CTD cue. The CTD procedure is depicted in Table 2.

Table 2. One Step of a Scripted Lesson Incorporating 2-sec Delay and Least-to-most Prompting.

Teacher says	Student's response	If student needs help
/t/. Your turn. What letter makes the /t/ sound?	Activates the button to make /t/ sound.	If correct praise. If the student waits after the 2 second delay, model finding the "t" and say "This is /t/. You press it". Provide physical guidance if necessary for the student to press the button.

First, the procedure calls for a model (least intrusive prompt), then a verbal cue, followed by physical guidance (most intrusive prompt) (Ahlgrim-Delzell et al., 2014).

Assistive technology. Several studies utilized high-technology AAC devices within the interventions to provide students' opportunities for response (Ahlgrim-Delzell et al., 2014; Fallon et al., 2007; Hanser & Erickson, 2007). Low-technology AAC was utilized in the other studies for student response opportunities (Bailey et al., 2011; Browder et al., 2008; Truxler & O'Keefe, 2007). Light and colleagues (2008) reported the use of both high- and low-tech assistive technology.

Assistive technology is defined as "any item, piece of equipment, or product system, whether acquired commercially off-the-shelf, modified, or customized that is used to increase, maintain, or improve the functional capabilities of a child with a disability" (IDEA, 1997, p. 8). When Individual Education Program (IEP) teams are assessing preferences for AT they look at system portability, durability, and intelligibility of the voice output (Beukeleman & Mirenda, 2013; Edyburn, 2013).

In a recommendation for future research, Ahlgrim-Delzell and colleagues (2014) recommended use of an iPad as a format to extend their early reading instruction. Kagahara and colleagues (2013) reviewed studies that used iPods or iPads to teacher individuals with DD. iPads were utilized in two of the fifteen studies. One delivered an instructional video on spelling, and the other, as a voice output device. Both provided positive results. Implications for students with DD supported this "off-the-shelf" piece of AT (Kagahara et al., 2013, p. 154). Introduced in April, 2010, iPads and apps are low cost compared to AAC devices (Edyburn, 2013; Light & McNaughton, 2012). This new technology is also useful to persons with disabilities and their families due to the portability of the technology and the easy access of the touch screen, in addition to the social aspect of using the same device as peers in schools (Edyburn, 2013; Kagahara et al., 2013).

One adaptation to address articulatory concerns to teach students with CCN is voice output for articulatory feedback (Beukelman & Mirenda, 2013; Card & Dodd, 2006; Erickson, Koppenhaver, Yoder, & Nance, 1997). AT in education (Edyburn, 2006) and the use of voice output devices is necessary in the special education field for students with CCN at the early literacy stage of development (Erickson, Hatch, & Clendon, 2010). Recent developments in AT/AAC devices include the proliferation of mobile technologies with touch screens, voice output, and applications geared to the needs of students with disabilities (Hasselbring & Glaser, 2001; Light & McNaughton, 2012). Technology has allowed individuals with CCN to "increase their communicative competence, attain higher education, secure employment, and participate more fully in society" (Light & McNaughton, 2013, p. 3). Light and McNaughton (2013) cautioned about the necessity to put the individual with CCN first, and not focus on the technology, but the needs of the individual.

Research has shown that AT supports word reading and reading with comprehension (Erickson, Hatch, & Clendon, 2010; Howell, Erickson, Stanger, & Wheaton, 2000; Koppenhaver & Erickson, 1995). Voice output devices play a vital role in support of emergent literacy (Erickson et al., 2010; Fallon et al., 2004; Sturm & Clendon, 2004; Weymeyer, Smith, Palmer, & Davies, 2004). Researchers suggest that synthetic articulatory feedback similar to voice output devices may provide more concrete feedback for acquiring phonics skills for students with DD and CCN (Ahlgrim-Delzell et al., 2014; Fallon et al., 2004).

Summary

Children with CCN and DD may experience difficulties in the acquisition of academic skills such as learning to read. However, through evidence-based practices, including systematic instruction in phonics skills, these students can gain the skills necessary for life-long literacy (Bradford et al., 2006; Browder et al., 2008). AT can aid in the endeavor to provide effective instruction to students with DD and CCN. A combination of AT and systematic instruction with well-defined scripted lessons, which incorporates scaffolded skills as foundational, is an effective way to teach students with CCN and DD to read (Allor et al., 2010; Browder et al., 2009). Systematic instruction is considered an evidence-based practice for early reading instruction (Allor et al., 2010; Browder et al., 2009; Browder, Lee, & Mims, 2011). Due to a limited number of studies that incorporate systematic instruction and AT within early reading literacy for students with CCN and DD, further investigation is warranted (Ahlgrim-Delzell et al., 2014; Bailey et al., 2011; Browder et al., 2008, Fallon et al., 2004; Hanser & Erickson, 2007; Light et al., 2008; Truxler & O'Keefe, 2007).

Ahlgrim-Delzell and colleagues (2014) extended the early literacy research of Browder et al. (2008) into a phonics curriculum that incorporated the evidence-based practices this literature

supports for students with CCN and DD. An AAC device was programmed with the curriculum for student response and articulatory feedback. Ahlgrim-Delzell et al., (2014) noted the limitations of the AAC device as being bulky and requiring multiple overlays to address the multiple skills with the lessons. Ahlgrim-Delzell and colleagues (2014) suggested the smaller, more flexible platform of an iPad. A second limitation was the difficulty maintaining motivation due to the arduous nature of the non-instructional probes utilized in the multiple baseline design (Ahlgrim-Delzell et al., 2014). This investigation extended Ahlgrim-Delzell et al. (2014) study by examining the effectiveness of the Go Talk Phonics curriculum across four dependent variables, utilizing an iPad as the instructional technology tool. The dependent variable probe was delivered via the iPad outside of the instructional days through a multiple probe single-subject design.

Components of the Current Study

This study employed a multiple probe across measures single subject design to investigate the efficacy of an iPad-based phonics intervention to improve the reading skills of two elementary students (*n*=2) with CCN and DD. The intervention utilized systematic phonics instruction with AT for articulatory feedback. The dependent measures included (a) phoneme identification, (b) blending sounds to form words, (c) sight word identification, and (d) blending sounds to forms words to identify the corresponding picture. The research questions were:

1. What is the overall effect of iPad-based, systematic phonics instruction, measured through phonics skills probes, on students' ability to acquire early phonics skills?
2. What is the effect of the iPad-based, systematic phonics instruction, measured through phonics skills probes, on students' ability to associate sounds with letters?

3. What is the effect of the iPad-based, systematic phonics instruction, measured through phonics skills probes, on students' ability to blend sounds in order to identify words in print?
4. What is the effect of the iPad-based, systematic phonics instruction, measured through phonics skills probes, on students' ability to identify sight words?
5. What is the effect of the iPad-based, systematic phonics instruction, measured through phonics skills probes, on students' ability to read words in order to identify a picture?

CHAPTER THREE
METHOD

Chapter Overview

This study was designed to investigate the effect of an early reading intervention delivered via an iPad on the early reading skills of elementary students who are nonverbal or have complex communication needs (CCN). This study specifically investigated the efficacy of an iPad-based early reading intervention to improve the students' following skills: (a) to associate letters with sounds, (b) to blend sound to identify words, (c) to identify sight words, and (d) to read words to identify a matching picture. A multiple probe across measures single-subject design was employed with a sample of two elementary students with CCN and DD. Data were collect using a formative curriculum-based probe during baseline and intervention phases. Students' pre- and post-study literacy skills were measure with a standardized early literacy assessment for learners with CCN. Fidelity of implementation data were collected throughout the baseline, intervention and maintenance phases.

Participants

In Iowa, students are served non-categorically, and if eligible for special education services, are considered Eligible Individuals (EI). The EI label designates "an individual with a disability who is eligible for special education or related services" (Area Education Agency Special Education Procedures manual, 2014, p. 56). The students with CCN often are served in Level 3 classrooms with access to general education curricula. The Individual Education Programs (IEP) of each student receiving district-provided special education services are measured using a Weighted Enrollment Form (WEF), which assigns a score based on the amount of special education services and supports required to serve each student. The Level 3

designation refers to the extra costs of services required based on the students' more extensive needs which includes specialized instruction in a highly structured environment (i.e., self-contained classroom or extended time in a resource room).

Upon Institutional Review Board (IRB) approval and the district research review board, I conferred with two special education teachers at one local elementary school. Following parental consent, I used a set of inclusion criteria to determine which students would participate in this study. The following inclusion criteria were employed: (a) the student is an EI under the age of 10, (b) the students had CCN as determined by a speech language pathologist, (c) the student cannot identify at least 5 letter sounds using vocalizations, (d) the student is able to physically access the iPad touch screen, (e) the student demonstrates fewer than 5 sounds matched to letter knowledge based on researcher-created iPad alphabet pages. In order to assess (c), (d), and (e). I used a comprehensive sound assessment delivered via three iPad alphabet pages that consisted of nine lower-case letters each. I asked the students to "touch the letter that made the sound ___". This task was used to determine the number of letter sounds the student could identify, that the student could physically access the iPad touch screen, and knew fewer than five sounds. The first two students assessed did not meet the requirement of less than five letter-sound associations. The teachers from this school suggested another school/teachers who served students with similar skills and had CCN. From that suggestion after parent permission, two students were eligible to participate in the study based on the inclusion criteria

Pseudonyms were used for the participant names. The participants were Liam and Anson. Liam is an eight-year-old, white male in second grade. Liam's disability category is EI and he has been diagnosed with Autism Spectrum Disorder (ASD) with significant delays in receptive and expressive communication. Liam's speech language pathologist reported that he signs

"more" to request preferred items, he uses the Picture Exchange Communication System (PECS) to request wants and needs and is making adequate progress through the phases. He had previously been exposed to the Pragmatically Organized Dynamic Display AAC System (PODD) and was using a high tech communication system at the time of the study. He currently has no clear words in his communication repertoire. Liam's special education teacher reported that he matches pictures on his schedule to transition, uses PECS, and currently completes independent work of sorting and matching letters. They use Unique Learning system for core literacy instruction. Liam is working on 1:1 correspondence, pointing to words in a book, receptive letter identification and pointing to the main idea on a page. During the assessment for entry into this study, Liam was able to access the iPad through direct selection, identified 3 of 26 letters, and scored <50 on the Phonological and Print Awareness (PPA) Scale which was below 70, described as in the deficient range of scores (Williams, PPA, 2014).

Anson is an eight year-old white male in second grade. Anson's disability category is EI and he has been diagnosed with ASD with receptive and expressive language delays. Anson's speech language pathologist reported that he is capable of making some sounds, but does not use verbal language for functional communication. He uses pictures, gestures, PECS, and has not used an AAC device. His receptive skills are stronger than his expressive skills. He has fewer than fifty intelligible words that he is able to mimic. Anson's special education teacher reported that his current literacy program includes Unique Learning System's core reading instruction and he practices 1:1 correspondence, pointing to words, letter-sound imitation, receptive letter identification, making words and simple sentences, attending to a story, and matching letters and sight words. He has exposure to 30 minutes of large group reading in general education. Anson matches pictures on his schedule for transitions and uses PECS to communicate wants and needs.

Setting

The study took place in a public elementary school in a small Midwest town. Screening sessions occurred at a rectangular table within the special education classroom. All phases of the study were conducted in the special education classroom (baseline, instruction, probe conditions). There was no quiet separate space available in the school. Two spaces available in the classroom were used depending on multiple schedules. When other students were in one-on-one situations, a rectangular table facing the center of the room was our designated space. When outside instructors (e.g., speech-language, guidance) were teaching a small group, a one-on-one instructional table out of view of the group was used.

Four students with similar instructional needs were served in this large, light-filled classroom, which contained one group learning area, four independent work-stations, and two rectangular tables used for 1:1 instruction. Students were instructed by a special education teacher of 3 years and 2 paraprofessionals. There were two computer stations, a smart board with a dedicated laptop, a projection system, movable cloth dividers, a sink, and both carpeted and linoleum areas. All students had schedules specific to their needs along one wall. All students had a locker area in the hall and bins for materials and preferred items used for individual instruction.

Dependent Variable

The dependent variable was data collected through individual administration of the researcher-created probe based on the intervention designed by Ahlgrim-Delzell, Browder, and Wood (2014). The GoTalk Phonics (GTP) probe consisted of all lesson items specific to (a) phoneme identification, (b) blending sounds to form words, (c) sight words identification, and (d) blending sounds to form words which the student matches to a picture. The researcher-

developed intervention probe consisted of all skill items addressed in the intervention. I reviewed and listed all items across three lessons. The probe includes 60 items (i.e., 9 sounds, 18 blends for words, 13 sight words, and 20 blends to identify a picture). Data were recorded as a plus (+) for a correct response or a minus (-) for an incorrect response on the GTP probe data collection form, which can be found in Appendix A. Data was disaggregated by lessons and recorded as percent correct.

Administration of Probes. The GTP probe was administered individually, with the researcher sitting side-by-side with the student. It took approximately 20 minutes to administer. The average length of Liam's probe sessions were 17.7 minutes, and Anson's average length of the probe sessions were 20-minutes. Prior to the assessment the researcher assured that the iPad was on silent and showed the student an iPad page of letters (not included on the probe), and said "Touch (a letter) on this page". If necessary, this was repeated to assure the student understood that upon the request, the student should respond. Following this introduction, the researcher said, "Let's get started!" The researcher used the same words to elicit a response from the students. A script for administration of the probe is depicted in Table 3.

Table 3. Directions for Administration of the GTP Probe.

Probe Assessment	Administrator says	Student response
Practice items (prior to assessment) • Alphabet Page on iPad	"Touch (a letter) on this page."	If student touches a letter without hesitation proceed to the probe, saying "Let's begin!" If the student hesitates or does not respond, repeat direction to elicit a response, model, and encourage student response.
(a) Letter-sound association • Sounds 3 page • Assure sound is turned off	" Touch the sound ____." Allow 5-s wait time.	If student responds, go to next item. If student does not respond, repeat direction one time with wait time. Record response and go to next item.
(b) Blending Sounds to form words • Blend 2, 1-2 page (10 items) • Blends 3, 1-2 (3 items) • Blends 3, 3-4 (5 items) • Sounds produced at 1-s intervals	"I will say the sounds, and you touch the word." "__-__-__. Touch the word __-__-__." Allow 5-s wait time.	If student responds, go to next item. If student does not respond, repeat direction one time with wait time. Record response and go to next item.
(c) Blending sounds to identify picture • Decode 2 (7 items) • Decode 3 (13 items)	"You read the word and touch the picture that matches." "Touch the picture of this word" (point to word) Allow 5-s wait time.	If student responds, go to next item. If student does not respond, repeat direction one time with wait time. Record response and go to next item.
(d) Sight Words • SW1 (7 items) • SW2 (7 items)	"I will say a word, and you touch the word." "___. Touch the word. Allow 5-s wait time.	If student responds, go to next item. If student does not respond, repeat direction one time with wait time. Record response and go to next item.

This probe was administered for three times at (a) baseline and (b) following each set of five intervention days. It was to be administered (c) three weeks following completion of the full intervention to determine if the skills were maintained. Accuracy was determined by delivering the dependent variable GTP probe without intervention. The researcher delivered the probe as described in Table 3. The probe contains 60 items. Of these, 11 items are specific to lesson 1, 22 items are specific to lesson 2, and 27 items are specific to lesson 3. Following Lesson 1, the percent correct of eleven items specific to lesson 1 were placed in the top tier of the graphic display, while items from Lesson 2 and 3, considered generalization items.

Interobserver Agreement. All sessions of GTP probe administration for the dependent variables were videotaped. I met individually with two graduate students to review how to watch the videotapes and record student responses on an identical probe sheet. Identification of picture to word matches and recordings of phoneme –grapheme matches were made available to the observers to ensure accuracy in observation. We met a second time to clarify any questions after watching several videotapes. A total of an hour was spent in the initial meeting to review the procedures, with an additional half hour to answer questions that emerged from some initial reviews.

Inter-observer agreement (IOA) was determined using item-by-item agreement by dividing the number of items scored the same by the total number of items scored and multiplying by 100 (Kennedy, 2005). Agreement is easily calculated and sensitive to overall levels of responding (Kennedy, 2005). IOA data were collected for both participants for their responses on the 60-item probe used to measure baseline and probes following instruction. IOA data were collected for all lesson one items and generalization items (lesson 2 & 3 items). IOA data were collected for 67% of sessions with 97.6 % agreement (range of 94%-100%) for Liam.

IOA data were collected for 58% of sessions with 98% agreement (range 96-100%) for Anson. IOA data was not collected for sessions in which the participants blocked the view of the camera for parts of the session or there was a camera mal-function.

Descriptive Measures

The following descriptive measures, unlike the dependent variables, which are directly affected by the manipulation of the intervention, were added to the experiment to evaluate different aspects of the study. The Phonological and Print Awareness scale was used as a distal measure of early literacy. Momentary Time sampling of off-task behavior was done post hoc to determine the actual levels of off-task behaviors demonstrated by the students. The social validity scale was developed to determine the participants' perspective on this specific intervention.

Phonological and Print Awareness Scale (PPA). The distal measure of phonological skills was administered pre-and post-study to determine each students' skills prior to intervention of following completion of the study. The intention was that the participants would proceed through Lesson 3, but the students only completed three weeks of instruction on Lesson 1. The Phonological and Print Awareness Scale (PPA Scale; Williams, 2014) is a standardized, norm-referenced individually administered instrument that examines the early literacy skills of phonological and print awareness. It is normed with a nationally representative same (n = 1,104), and was designed to be used with children, ages 3.5 to 8 years 11 months, who are nonverbal or have CCN. The PPA has 69 items representing six domains that can be administered in 10-15 minutes. The domains addressed are recognizing rhymes, print knowledge, initial sound matching, final sound matching, sound-symbol (matching the phoneme to it's

grapheme), and phonemic awareness. The standard score allows comparison of a child's performance to typically developing peers and growth can be measured over time.

Evidence of reliability was computed, with internal consistency reliability coefficients for the PPA Scale across age groups and forms A, B, and C (> 0.91). The test-retest reliability was (> 0.91) across ages and forms. Alternative form reliability across all forms was (> 0.90) (Williams, 2014).. Evidence of convergent validity was examined through a comparison with Woodcock Reading Mastery Test (WRMT; Woodcock, 2011), Oral and Written Language Scales, second edition, Reading and Comprehension (OWL-IIRC; Carrow-Woolfolk & Williams, 2011), and the Terra-Nova Complete Battery, third edition (CBT; McGraw-Hill, 2008), all of which measure similar constructs. Convergent validity data correlations were significant a $p < .001$ with OWL-II at $r = 0.66$, WRMT letter identification at $r = 0.51$, WRMT phonological awareness at $r = 0.59$, WRMT Rapid Automatic Naming at $r = 0.52$, and Terra Nova, third edition, Reading at $r = 0.53$, across a subset of standardization and clinical samples (Williams, 2014).

Off-task behavior. Off-task behavior was defined as any behavior exhibited by the student that was inattentive to the assigned task. Examples included, rocking, vocalizing (echolalic, mimicking sounds/words), flicking a bracelet or ear lobes, chewing or twirling shoestrings or cotton band, standing up and coming face-to-face with me, rubbing my arms/sleeves, or hands in pants. Momentary time sampling was used to record off-task behavior from video recordings of all instructional sessions and probes. Momentary time sampling (MTS) was chosen due to its usefulness in measuring continuous activities such as task engagement (Cooper et al., 2007). Ten-second MTS was used due to the short bursts of inattentiveness demonstrated by the participants. Specifically, for the duration of the lesson or probe, every 10

seconds, I looked at the student to determine if he was off-task at that moment. I counted the number of off-task moments divided by total number of intervals in the session multiplied by 100 to determine with percentage of off-task behavior in each session.

Social validity. Social validity is an estimation of satisfaction experienced by the people involved with an intervention. Subjective evaluations help the research determine how participants perceive the goals, procedures, and outcomes associated with the intervention (Kazdin, 2011). For instance, will the intervention be continued after the researcher completes the study? And, does the intervention increase the student's ability to learn the lessons and increase the student's motivation to persist in learning?

Participating students evaluated the social validity of the phonics intervention through a researcher-developed survey. The researcher-made student survey used statements to ask the student to determine if the liked or did not like parts of the lesson. The student survey consisted of a 3-point scale, with smiley/frown face picture referents, ranging from *I liked this* to *I didn't like this*. The social validity measure for the students included example of likes and dislike with a point to the matching picture (see Figure 1). Rather than having the student merely point to their choice on the survey, I printed 2-inch square pictures matching the *Yes* smiley and *No* frown face to place in front of the students, which was more consistent with the use of picture referents in the classroom. Students were given separate two-inch square pictures of the *Yes* smiley and *No* frowny to answer that could be mixed up to assure they looked at their choices. To measure the five-item student survey, a frown face is worth zero points, a neutral choice was worth 1 point, and a smiley face score two points. To obtain a total score, the scores on each item were summed. Higher scores indicate greater social validity.

Figure 1. Social Validity Survey-Student Participant

1. I matched sounds to letters.

I like this.	Did not respond.	I did not like this.
		

2. I found the first sound in words.

I like this.	Did not respond.	I did not like this.
		

3. I blended sounds to read a word.

I like this.	Did not respond.	I did not like this.
		

4. I read words to find a picture.

I like this.	Did not respond.	I did not like this.
		

5. I can learn to read.

I like this.	Did not respond.	I did not like this.
		

Experimental Procedures

Baseline. Baseline is used to determine the initial pattern of behavior or existing level of skills prior to intervening (Kazdin, 2011). One PECS book was available for students to make requests. I saw Anson use the PECS book 3-4 times over the course of the study. Each time one of the study participant was not working with a teacher in a one-on-one situation, they were sitting at the group table using an iPad with headphones on. They were often on a letter app and would touch different pictures repeatedly and show excitement by head weaving, flapping, or vocalizing, after several touches. These were used for leisure time. Literacy activities other students were doing included reading books, talking about a book's pictures, and using a computer. The student participants used their picture schedule and location match to smoothly transition throughout their days.

The probes administered during the baseline condition took place in the classroom at a rectangular table, with the researcher sitting side-by-side with the participant. I set up the video camera while they transitioned from their last activity. The materials at the table included the iPad, the GTP Probe data sheet, and a pen. Both students showed interest in the activity of administration of the probe (see Table 3).

Intervention. The GoTalk Phonics (GTP) curriculum (Ahlgrim-Delzell, Browder, & Wood, 2014) had eight lessons that contain three different targeted phonemes on which consonant-vowel-consonant (CVC) words are segmented and blended. In this study, participants were to complete the first three lessons of the curriculum. Each lesson addresses seven skills: (1) phoneme identification, (2) identification of the first sound in words, (3) phoneme segmentation of CVC words, (4) blending sounds to form words, (5) blending sounds to form words to find the matching picture, (6) sight words to enable reading connected text in the stories, (7) reading

connected text with comprehension. The participants began at lesson one which entailed five days of instruction.

Each lesson of the GTP curriculum included a one-page overview of the objectives of the lessons and skills the students learn. The overview also delineated the materials needed and the systematic instruction description, amount of time delay, and correction procedure for errors. Teachers' actions and words were scripted for all lessons. The teacher script was printed in red. Days 1-4 had a consistent frame with an anticipatory set, which consisted of (a) showing the book that coincides with the lesson, and (b) introducing the action of pressing a letter on the iPad™ and listening to the voice output. A teacher model for each skills occurred on the first trial of each skill. Day five of each lesson introduced the e-book on the iPad. The e-book is a story developed to practice the sounds and words, both blended and sight words. Each lesson had a story specific to the lesson. On day five the focus was on reading and comprehension of the connected text.

Throughout the lessons a constant time delay (CTD) procedure was used. CTD involves zero-delay prompting (e.g., pointing to the correct target item immediately following stimulus) at the introduction of the lesson. This is followed by designated increases of time delay (e.g., 2-s or 4-s) that give the students the opportunity to independently respond to a request. Table 4 depicts an example of the content included in Lesson 1.

Table 4. An example of the sequence of 5 days of Lesson 1. **denotes items included in probe.

Lesson 1	Day 1	Day 2, 3, 4	Day 5
Anticipatory Set	Explore paper copy of e-book Sam & iPad	Explore E-book & iPad	E-book, read story using the iPad
Systematic Instruction	Constant Time Delay (CTD): 0 delay	CTD: Day 2=2 sec; Day 3 & 4=4 seconds	Least Intrusive Prompting
Identify letter given the sound**	Activates iPad for sounds /m/, /s/, /a/	Activates iPad for sounds /s/, /a/, /m/	--
First sound in words	Activates iPad for sounds: /sit/, /man/, /ant/ (6 words)	Activates iPad for sounds: /sit/, /man/, /ant/ (6 words)	--
Segmenting words	Presses all sounds in sam, am. Uses auditory cuing to hear the sounds & words	Presses all sounds in sam, am. Uses auditory cuing to hear the sounds & words	--

Day one of each lesson begins with a constant time delay (CTD) of zero, meaning the teacher points to the correct answer immediately upon asking for a response. Directions describing what the teacher says, the student's response, the correction procedure, if the student needs help, and praise specific to the skill, are provided. Days two, three, and four of each lesson are taught in the same order, but the amount of time delay is expanded. For example, in Day 2 of Lesson 1, the teacher allows 2 seconds before the teacher cues the student response. On Days 3 and 4 of Lessons 1, the teacher allows 4 seconds before cueing the correct response. On Day Five of each lesson the student gets to read the rest of the story, with cues to read the story silently and answer comprehension questions. As part of the correct procedure for the comprehension questions, the student is directed to use the iPad to read each word.

The skills were taught in a consistent order beginning with (1) identification of a letter given its sound (see Figure 2, top screen shot). This leads to teaching (2) the first sound in words, and (3) word segmentation, where each letter is pressed in sequential order, and another press of the word in the express mode bar. Following the placement of all letters in the bar, the student

can press anywhere in the express bar to hear the word. Next, (4) blending sounds to for words, and (5) blending sounds to find a picture are taught (see Figure 2, screen shots 2 and 3 respectively).

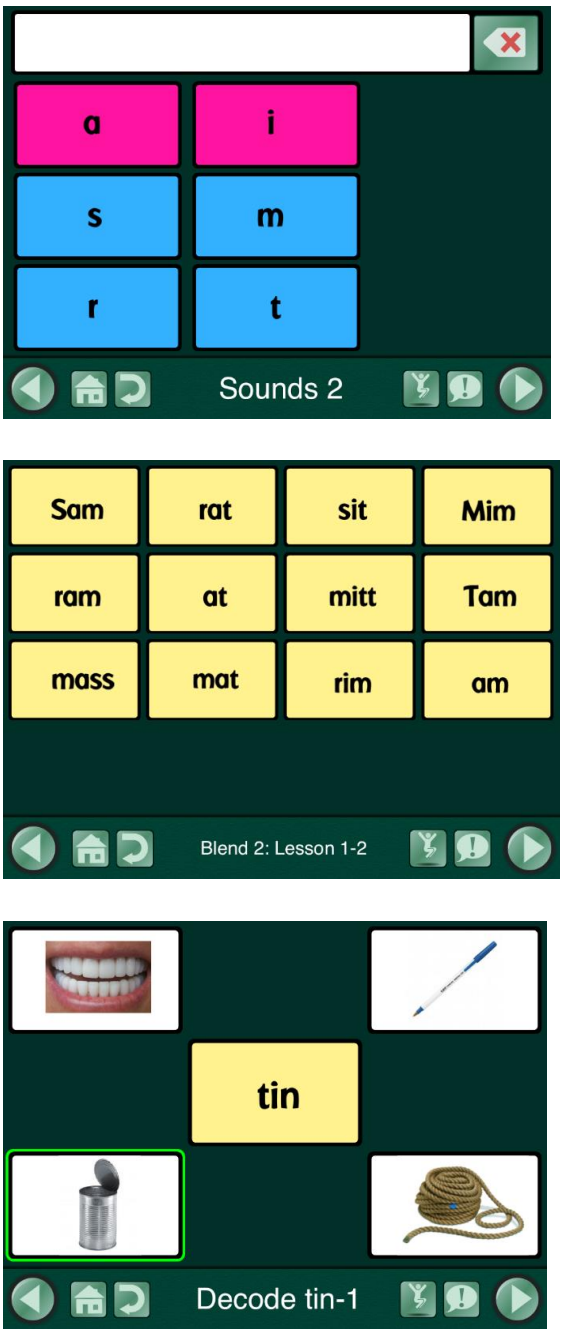

Figure 2. iPad Screen Shots. The first screen shot is the Sounds from lesson 2. The second screen shot is Blends in lesson 2. The third screen shot is what is used to decode to identify a picture.

The blending objectives use auditory cueing and a quiz mode, which randomizes picture placement on the iPad. The actions of the teacher assure that the students hear the auditory output of the iPad. The quiz mode is what was used on the GoTalk Now™ application, so

pictures do not always appear in the same location on the screen. (6) Sight words, taught through CTD, are introduced as a few "tricky words" (GTP curriculum, 2014, p. 7). This is followed by (7) introduction of the e-book for the lesson, for the students to read connected text through word access, which provides voice output for the words. A comprehension question, the only skill which does not use CTD of zero, is presented about the page of connected text. If the student needs help, the teacher rereads the question. Then, the teacher has the student reread the sentence from which the answer is found.

Fidelity of Implementation. I delivered the intervention to individual students. The intervention was videotaped and scored by three observers to insure fidelity of implementation. The treatment integrity checklist was used to determine that the intervention was delivered as it was designed. Two graduate students in special education were trained to view the videotapes and check fidelity of each step of a ten-step checklist. The observers completed the researcher-developed fidelity measure depicted in Appendix C by checking the blank space, which is followed by a description of what is included in each step of the lesson. Treatment integrity was determined by calculating the number of steps completed correctly divided by the total number of steps required in the curriculum and multiplying by 100 to convert it to a percentage. Treatment integrity data were scored across 92 % of instructional sessions and was 100% for Liam. Treatment integrity was collected across 67 % of instructional sessions for Anson and was 100%. The mean treatment integrity for the research interventionist was 100%.

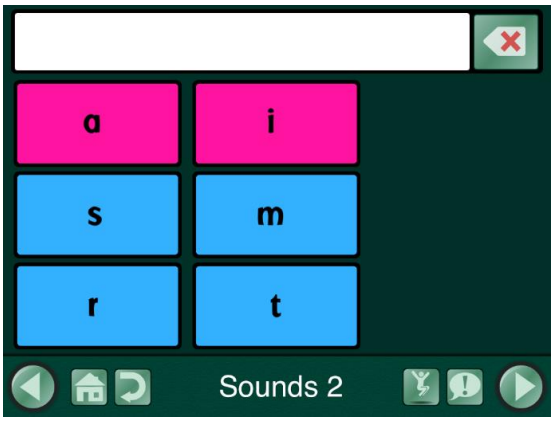

Figure 3. **Screen Shot with Detail**. The bottom line in the Go Talk Now app is used for navigation within the program. This was the location of the added behavioral support.

Behavioral Supports. After the intervention began, I observed off-task behavior that included touching the arrows at the bottom of each iPad page to navigate the app to different pages (see Figure 3). Thus, I added a behavioral support to decrease the likelihood of off-task behavior. Specifically, this included a paint stick adhered to the iPad with Velcro™ to remove access to flipping pages on the GoTalk Now app (see Figure 4). This behavioral support, in addition to guided access found in accessibility features of the iPad and removal of swipe navigation found in the settings of the GoTalk Now app, was used to decrease the likelihood of the students playing with the features of the iPad in lieu of learning the material. This phase modification 1, as depicted on the graph, began on day six on the study with Liam, and day 4 with Anson.

Figure 4. IPad with paint stick with added 5-penny token system.

Despite the Phase 1 modification, off-task behavior was still evident. Thus, an additional modification was made. I implemented a 5-penny token system that mirrored the procedures used in the classroom during instruction (Cooper et al., 2007). I brought a bag of novel tangible items from which the students chose preferred items prior to each session. Pennies were added to the paint stick every 2-3 student responses for remaining on task. After 5 pennies were earned, the student traded the 5 pennies for the preferred tangible item they chose. I tried to give the penny to the student to place on the Velcro. However, the students would try to remove the paint stick to flip pages within the application. This modification began on day twelve of the study for both participants.

Experimental Design and Analysis

A multiple probes across measures design, a variation of the multiple baseline design (Tawney & Gast, 1984), was used to evaluate the effects of the GoTalk Phonics (GTP) curriculum on the phonics skill acquisition of students with CCN. Unlike multiple baseline, data are collected intermittently instead of continuously, and the independent variable is sequentially introduced (Tawney & Gast, 1984). In this study, each lesson of the three-lesson intervention was to be introduced sequentially. Introduction of each lesson was dependent upon student performance on the lesson-specific intervention probe items.

Four studies that used the multiple probe design across tasks or components of lessons were reviewed to ensure accurate implementation of the design (Campbell & Mechling, 2009; Jimenez, Lo, & Saunders, 2014; Yaw, Skinner, Parkhurst, Taylor, Booher, & Chambers, 2011; Wertz, Campbell, & Wolery, 2003). Each study used a three day baseline probe that included all items from the lessons or tasks. Two of these studies (Campbell & Mechling, 2009; Yaw, et al., 2011) incorporated three sessions of intervention probes after teaching each instructional set. The staggered introduction of the lessons served as maintenance probes for the first two lessons. Tawney and Gast (1984) suggested that three consecutive probe trials were the minimum prior to introduction of the independent variables. During the baseline condition, the graph was visually inspected to determine if the data are low and stable. If the data were variable or not stable upon visual inspection, baseline for that student continued until stability is achieved.

The probe was administered for three sessions at (a) baseline, (b) following each set of intervention days, and (c) three weeks following completion of the intervention to determine if the skills were maintained. Generalized items were all untaught items on the probe. These were graphed as percent correct during each probe session. Lesson-specific items (those taught during

the lesson) were disaggregated and graphed as percent correct as well. See Figure 2 that follows. Scores on lesson-specific items determined introduction of the subsequent lesson. The decision rule was based upon 80% mastery of the lesson objectives.

Experimental control is demonstrated by the participant responding at near-baseline level across the probe sessions and improves on after the targeted skills are introduced (Tawney & Gast, 1984). In this study, I evaluated the effects of the GTP curriculum by determining if a functional relation or demonstration of experimental control over the dependent variable by the independent variable (Kennedy, 2005) existed, with replication across two more of the same lesson of intervention across two participants. The level, trend, and rapidity of change during the probe sessions were visually inspected to determine if the dependent variable changed in response to manipulation of the independent variable (Kennedy, 2005).

This multiple probe design can be an efficient tool used to (a) measure the acquisition of a target behavior, and (b) determine the extent to which behaviors generalized (Kennedy, 2005). Kennedy noted that a drawback of this design is the intermittent data collection as the design is less sensitive to abrupt changes in the target behavior. However, by collecting data on the targets during instruction, I could determine how the students were progressing on the targeted skills. The overall timeline of this study was proposed as depicted in the following table.

Table 5. Overall Timeline of this Study

Baseline	Instruction	Probe 1	Instruction	Probe 2	Instruction	Probe 3
3-5 days	5 days of Lesson 1	3 days	5 days of Lesson 1 repeated	3 days	5 days of Lesson 1 repeated	3 days

The overall timeline could have been expanded for two reasons, either (1) the baseline sessions may extend beyond three sessions, or (2) if mastery is not met, the five days of the prior lesson should be repeated, and the three-session probe would be repeated before the decision

should be made to go onto the next lesson. Mastery was considered to be 80% accuracy on the lesson-specific items on two of three probe sessions. An issue that might arise when establishing a rule about '80% accuracy on 2 of 3 sessions', is that one of the sessions may barely miss the mark. If the accuracy is within 5 percentage points of mastery on one of the sessions, the researcher would make a decision as to whether the lesson should be repeated by examining all the data.

CHAPTER 4

RESULTS

Participant Data

Information from the GTP probe was instrumental in answering the four research questions. The probe was intentionally divided into the categories matching the four questions. The breakdown for each participant follows.

Liam

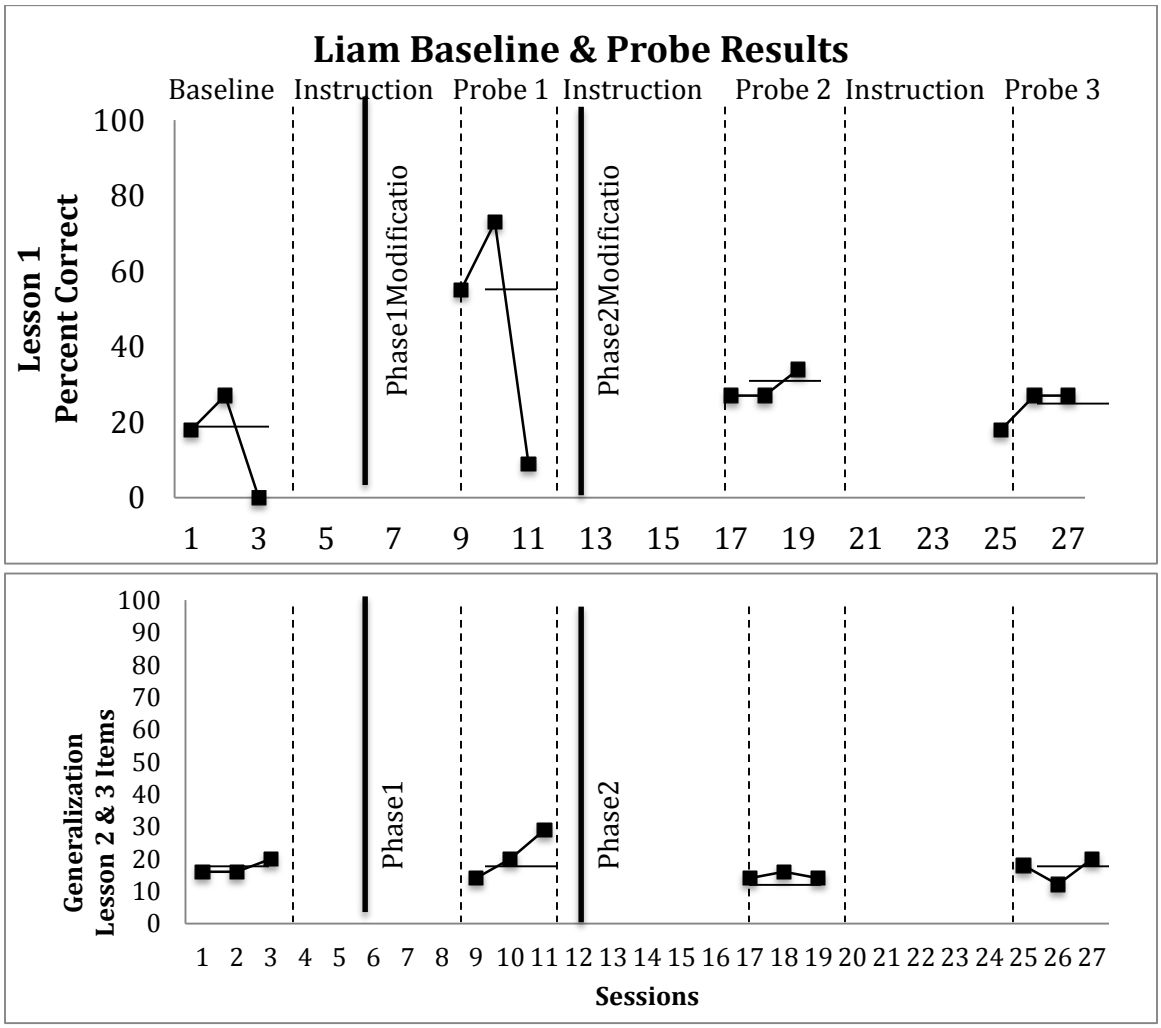

Figure 5. Liam Baseline & Probe Results. Graph depicting GTP probe data across baseline, 5 days of instruction that occurs between each set of 3 probe sessions.

Following baseline showing a countertherapeutic trend on Lesson 1 items and low and stable data on the generalization items from Lessons 2 & 3, intervention began with five days of instruction on Lesson 1. After another five days of instruction of Lesson 1, the accuracy of the probe data decreased by more than half (Mdn = 27). After another five days of instruction of Lesson 1, Liam maintained the level of (Mdn = 27) accuracy on Lesson 1 items. The accuracy demonstrated on the generalization items continued to occur at low, relatively stable levels throughout the three series of probes. All instruction was discontinued due to lack of progress.

Visual inspection of the lesson specific probe data showed that Liam had potential to progress in small steps, to which I would have continued his intervention had he increased his accuracy on the third set of probes. However, after Liam's third set of probes, I determined that to continue the instruction as it was currently designed was not likely to result in significant progress. See Figure 5.

The disaggregated data from the baseline and probe conditions, as well as behavioral data are displayed in Table 6. The Lesson 1 specific data at the top of the table consist of the items taught. The overall Lesson 1 results show median percent correct. At baseline, Liam had a median score of 18%. Following the intervention of Lesson 1, Liam had a median percent correct of (Mdn = 55%). After another 5 days of instruction, Liam scored a median percent correct of 27%. Following a third round of instruction of Lesson 1, Liam had a median score of 27% correct.

The components of identification of three phonemes, identifying a word by blending segmented sounds, identifying sight words, and reading a word to identify a picture were taught in each lesson, and items specific to each component were assessed on each probe. The Lesson 1 specific items on the probe include three phonemes, two blends, five sight words, and one picture

from a word. The table includes the number of correct items out of the total number of items across the three baseline and probe sessions. At baseline, Liam did not correctly identify the phonemes on any session. He identified one blend out of six opportunities, two sight words of fifteen opportunities, and one picture by reading a word of three opportunities. Across the three probe sessions, Liam correctly identified 4, 2, and 1 phonemes of the nine opportunities respectively. He identified 3 blends of the six opportunities presented through the probe on all three probe series. On the five sight words presented on each probe he correctly identified 6 of 15 opportunities during the first probe series, 4 of 15 on the second set of probe sessions, followed by 2 of 15 opportunities on the final set of probes. When identifying a picture matching a word, Liam correctly identified the picture on 2 of 3 probe series across the three probe sessions.

The generalization items included all items specific to what would have been taught in Lessons 2 & 3. Therefore, the items listed on the following section of Table 6 are untaught. The overall results of the generalization items. At baseline, Liam had a median percent correct of 17%. On the three probe sessions following each set of five instructional days of Lesson 1, Liam showed median percent correct scores of 20, 14, and 18 respectively.

The generalization items or untaught items broken down into the four components on the probe (i.e., phonemes, blends, sight words, and identifying a picture matching the word) are displayed in the table with the number of items correct over the number of opportunities across the three sessions of the probe. At baseline Liam correctly identified 1 phoneme item of eighteen opportunities. He correctly identified 7 blends of forty-eight opportunities and 2 sight words of twenty-four opportunities. Liam also correctly identified 16 pictures matching a word he read of fifty-seven opportunities.

In response to untaught phonemes, Liam correctly identified 1 of eighteen opportunities on the first round of probes, 3 of eighteen on the second round of probes, and 4 of eighteen on the final series of probes. When responding to blend items on the probes with 48 opportunities each, Liam correctly identified 9, 5, and 4 respectively. When identifying the eight untaught sight words, Liam correctly identified 5 of twenty-four opportunities on the first series of the probe. He correctly identified 3 sight words of 24 opportunities across the second and final probe series. When reading words to identify a picture, Liam correctly identified 17, 11, and 12 pictures of the fifty-seven opportunities within the three-probe series.

Behavioral information displayed on Table 6 includes the mean percentage of off-task 10-s momentary time sampling data gathered through post-hoc video review. Liam showed a mean percentage of off-task behavior at 49% of the 10-s moments during the baseline condition. During intervention sessions, Liam demonstrated a mean of 57%, 31%, and 16% of off-task behavior respectively. During the three probe conditions, Liam showed a mean of 40, 46, and 41 percent of the total 10-s momentary time samples across the videotaped sessions.

Phonological and Print Awareness Scale. Liam completed the first 2 sections of the six-section scale, with no correct responses on the initial assessment. Post study results showed he completed all six sections with limited growth. Liam's standard score increased from < 50 to 54, with pre- and post-study results in the deficient range (below 70) for the early literacy skills measured.

Social validity. Two-inch square pictures matching the *Yes* smiley and *No* frown face was placed in front of Liam to answer the social validity statements (see Figure 1). Liam handed his choice to me. He chose the positive reply to each statement. His 2-point positive response to

all five statements totaled a score of 10 of 10 possible points on the social validity from the student perspective.

Table 6. Liam's Probe Results

	Baseline	Intervention1	Probe 1	Intervention2	Probe 2	Intervention3	Probe 3
Lesson 1 Mdn %Correct	18	•	55	•	27	•	27
Phoneme	0/9	•	4/9	•	2/9	•	1/9
Blends	1/6	•	3/6	•	3/6	•	3/6
Sight Words	2/15	•	6/15	•	4/15	•	2/15
WordsPictures	1/3	•	2/3	•	2/3	•	2/3
Generalization Mdn % Correct	17	•	20	•	14	•	18
Phonemes	1/18	•	1/18	•	3/18	•	4/18
Blends	7/48	•	9/48	•	5/48	•	4/48
Sight Words	2/24	•	5/24	•	3/24	•	3/24
Words & Pictures	16/57	•	17/57	•	11/57	•	12/57
Mean % Off-Task Behavior	49	57	40	31	46	16	41

Note. Lesson 1 and Generalization items (items specific to untaught lesson 2 and 3) median percentage correct. Components (phoneme, blends, sight words, and reading words to identify a picture) denote the number correct over the total number of opportunities. Off-task behavior consists of the mean percentage during each phase of the study.

Anson

Following a baseline showing a countertherapeutic trend for lesson 1 and generalization items on the probe, intervention began. Intervention consisted of five days of Lesson 1 instruction. Following five days of instruction in lesson 1, the 60-item probe was administered for three days.

Following a repeated five days of instruction on Lesson 1, Anson demonstrated decreased accuracy in the Lesson 1 items (Mdn = 18 %) and an increased accuracy specific to the generalization items (Mdn = 20 %). Instruction of Lesson 1 was implemented for a third time. Anson's performance on Probe 3 revealed decreased accuracy for skills specific to Lesson 1 (Mdn = 9 %), as well as skills specific to the generalization items from lessons 2 and 3 (Mdn = 10 %). At this point I made the decision to stop the intervention due to decreased performance on the targets. See Figure 6.

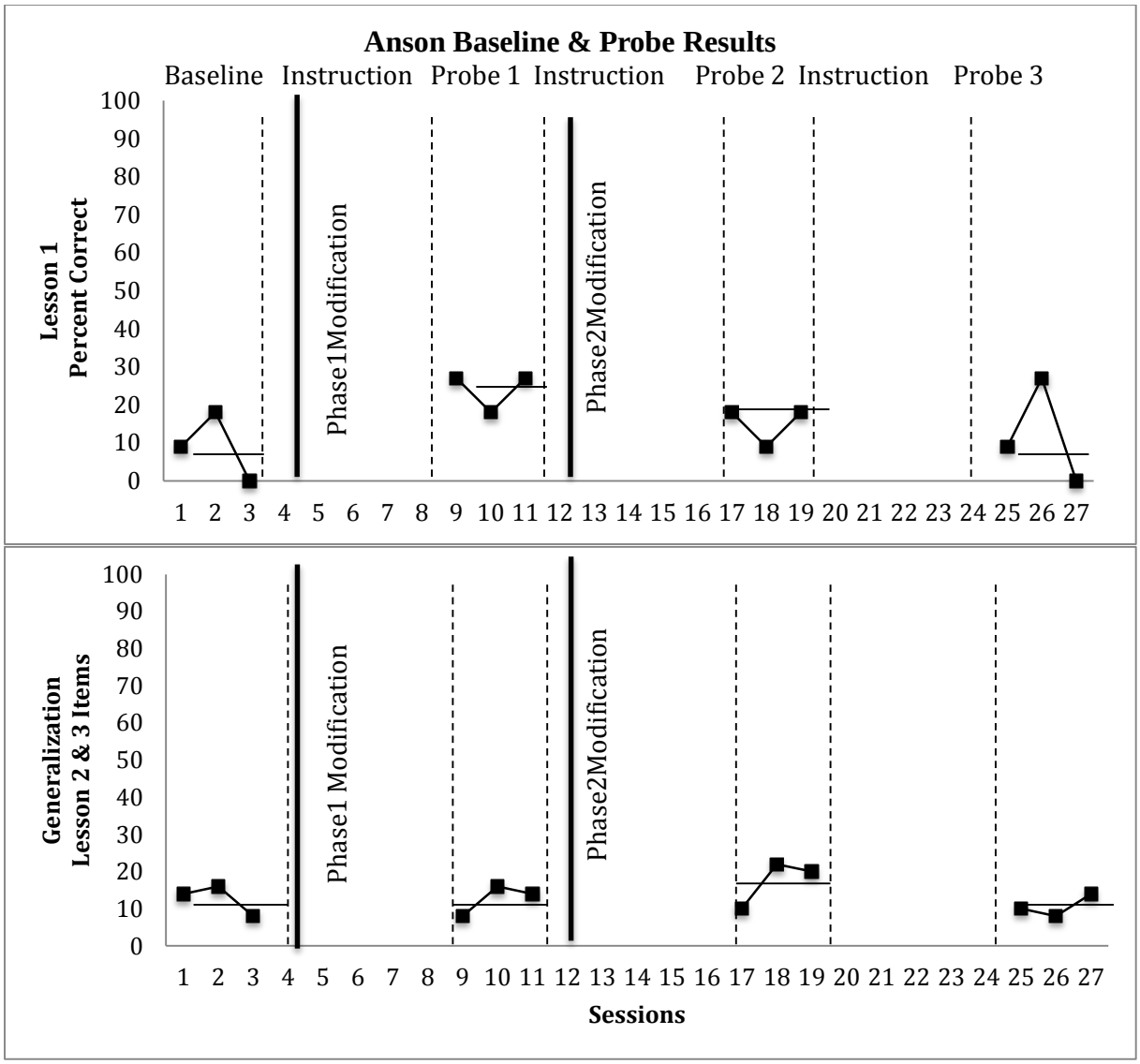

Figure 6. Anson Baseline & Probe Results. Graph depicting GTP probe data across baseline and 5 days of instruction occur between each set of 3 probe sessions. Phase + denotes addition of a 5-penny token system implemented.

Following baseline showing a countertherapeutic trend on Lesson 1 items and low and stable data on the generalization items from Lessons 2 & 3, intervention began with five days of instruction on Lesson 1. The first probe series showed a median score of 27 percent correct.

After another five days of instruction of Lesson 1, the accuracy of the probe data decreased (Mdn = 18 %). After another five days of instruction of Lesson 1, Anson decreased his accuracy (Mdn = 9 %) on Lesson 1 items to baseline levels. The accuracy demonstrated on the

generalization items continued to occur at low, relatively stable levels throughout the three series of probes. I made the decision to stop the intervention of Lesson 1 instruction due to lack of progress. Visual inspection of the lesson specific probe data showed that Anson decreased his accuracy of the Lesson 1 skills. After Anson's third set of probes, I determined that to continue the instruction as it was currently designed did not seem responsible. See Figure 6.

The disaggregated data from the baseline and probe conditions, as well as behavioral data are displayed in Table 7. The Lesson 1 specific data at the top of the table consist of the items taught. The overall Lesson 1 results show median percent correct. At baseline, Anson had a median score of 9%. Following the intervention of Lesson 1, Anson had a median percent correct of Mdn = 27. After another 5 days of instruction, Anson scored a median percent correct of 18%, a decrease in accurate responding. Following a third round of instruction of Lesson 1, Anson had a median score of 9% correct.

The components of identification of three phonemes, identifying a word by blending segmented sounds, identifying sight words, and reading a word to identify a picture were taught in each lesson, and items specific to each component were assessed on each probe. The Lesson 1 specific items on the probe include three phonemes, two blends, five sight words, and one picture from a word. The table includes the number of correct items out of the total number of items across the three baseline and probe sessions. At baseline, Anson did not correctly identify the phonemes on any session. He identified one blend out of six opportunities, three sight words of fifteen opportunities, and was unable to read a word to identify a picture during three opportunities. Across the three probe sessions, Anson correctly identified 0, 1, and 1 phonemes of the nine opportunities respectively. He identified 3 blends of the six opportunities during the first series of probes, no blends on the second series, and one blend on the final probe. On the

five sight words presented on each probe he correctly identified 3 of 15 opportunities during the first probe series, 2 of 15 on the second set of probe sessions, followed by 1 of 15 opportunities on the final set of probes. When identifying a picture matching a word, Anson correctly identified the picture on 2 of 3 opportunities across the first and second probe sessions, and once on the final probe series.

The generalization items included all items specific to what would have been taught in Lessons 2 & 3. Therefore, the items listed on the following section of Table 6 are untaught. The overall results of the generalization items were similar to the results of the taught items. At baseline, Anson had a median percent correct of 14%. On the three probe sessions following each set of five instructional days of Lesson 1, Anson showed median percent correct scores of 16, 20, and 10 respectively.

The generalization items or untaught items broken down into the four components on the probe (i.e., phonemes, blends, sight words, and identifying a picture matching the word) are displayed in the table with the number of items correct over the number of opportunities across the three sessions of the probe. At baseline Anson correctly identified 3 phoneme items of eighteen opportunities. He correctly identified 4 blends of forty-eight opportunities and 2 sight words of twenty-four opportunities. Anson also correctly identified 9 pictures matching a word he read out of fifty-seven opportunities.

In response to untaught phonemes, Anson correctly identified 3 of eighteen opportunities on the first round of probes, 3 of eighteen on the second round of probes, and 1 of eighteen on the final series of probes. When responding to blend items on the probes with 48 opportunities each, Anson correctly identified 4, 5, and 4 respectively. When identifying the eight untaught sight words, Anson correctly identified 2 of twenty-four opportunities on the first series of the

probe. He correctly identified 3 sight words of 24 opportunities across the second and final probe series. When reading words to identify a picture, Anson correctly identified 20, 15, and 9 pictures of the fifty-seven opportunities within the three-probe series.

Behavioral information displayed on Table 7 includes the mean percentage of off-task 10-s momentary time sampling data gathered through post-hoc video review. Anson showed a mean percentage of off-task behavior at 31% of the 10-s moments during the baseline condition. During intervention sessions, Anson demonstrated a mean of 20%, 28%, and 52% of off-task behavior respectively. During the three probe conditions, Anson showed off-task behavior at a mean of 45, 38, and 53 percent.

Phonological and Print Awareness Scale. Anson completed all six sections of the PPA Scale pre- and post-study. His standard score decreased by one point from 56 to 55 from the initial assessment to the final assessment. Both scores were in the deficient range (below 70) for the early literacy skills measured.

Social validity. In order to answer the social validity statements (see Figure 1), two-inch square pictures with the *Yes* smiley and *No* frown face were placed in front of Anson. He touched his choices, which were the positive reply worth 2 points for each statement. From the student's perspective, the social validity was strong with a total score of 10 of the 10 possible.

Table 7. Anson's Probe Results.

	Baseline	Intervention-1	Probe 1	Intervention-2	Probe 2	Intervention-3	Probe 3
Lesson 1 Mdn % Correct	9	•	27	•	18	•	9
Phoneme	0/9	•	0/9	•	1/9	•	1/9
Blends	1/6	•	3/6	•	0/6	•	1/6
Sight Words	3/15	•	3/15	•	2/15	•	1/15
Words-Pictures	0/3	•	2/3	•	2/3	•	1/3
Generalization Mdn % Correct	14	•	16	•	20	•	10
Phonemes	3/18	•	3/18	•	3/18	•	1/18
Blends	4/48	•	4/48	•	5/48	•	4/48
Sight Words	2/24	•	2/24	•	3/24	•	3/24
Words-Pictures	9/57	•	20/57	•	15/57	•	9/57
Mean Off-Task Behavior	31	20	45	28	38	52	53

Note. Lesson 1 and Generalization items (items specific to untaught lesson 2 and 3) median percentage correct. Components (phoneme, blends, sight words, and reading words to identify a picture) denote the number correct over the total number of opportunities across 3 probes. Off-task behavior consists of the mean percentage during each phase of the study.

CHAPTER FIVE

DISCUSSION

The primary purpose of this study was to determine the effectiveness of the GoTalk Phonics program (Ahlgrim-Delzell et al., 2014) with added behavioral supports for early phonics skill acquisition for two elementary students with DD and CCN. The GTP program is composed of seven skills including, (1) phoneme identification, (2) identification of the first sound in words, (3) phoneme segmentation of CVC words, (4) blending sounds to form words, (5) blending sounds to form words to find the matching picture, (6) sight words to enable reading connected text in the stories, (7) reading connected text with comprehension. Four of the seven skills were chosen as determinants of mastery to move onto the next lesson: (1) phoneme identification, (2) blending sounds to form words, (3) sight word identification, and (4) finding the word to match the picture. The study was conducted in a school setting with participants taught in an authentic teaching and testing environment.

Ahlgrim-Delzell et al., (2014) was one of only three studies (Ahlgrim-Delzell et al., 2014; Browder et al., 2008; Light, McNaughton, Weyer, & Karg, 2008) that examined comprehensive curricula designed to teach early literacy skills for students with complex needs, instead of single components of literacy instruction. Whether the studies examined single components of literacy instruction or a comprehensive curriculum, all the studies used direct instruction, and systematic instruction such as constant time delay, as well as error correction procedures, which are all evidence-based practices for students with CCN and DD.

The current study's intervention was nearly identical to that of Ahlgrim-Delzell et al. (2014) with a few exceptions. First, an iPad was used as the delivery tool for instruction instead of the AAC device used in the prior study. Second, a multiple-baseline multiple-probe design

was used rather than a multiple-baseline across participants design as in the Ahlgrim-Delzell et al. (2014) study. Third, behavioral supports were added to assist in task attention. Despite the research-based components meticulously included in the GTP curriculum such as scripted, direct instruction, prompting procedures, and assistive technology with voice output capabilities, a functional relation was not established for either participant between the independent variable and dependent variable.

Research Questions Addressed

Phoneme-Grapheme Association. First, although both students completed the lesson one items three times, neither student learned the phonemes *m, a, s,* across the three weeks of instruction. Liam chose none correctly during baseline trials across three sessions. By the final probe he correctly identified one phoneme across three sessions. Liam chose more items correctly on the second and third series of probes. Anson correctly identified no phonemes across three sessions at baseline, and by the third probe identified 1 item across three sessions. Second, visual analysis of data for both students showed little consistency of phoneme accuracy. The participants had similar accuracy with the taught phonemes (i.e., m, a, s) as the untaught phonemes from probe items specific to Lessons 2 and 3.

During Lesson One, the initial portion of the lesson focused on the phonemes of *m, a, s*. Students were taught the sounds, and then listened to these sounds at the beginning of 1-2 words per sound, as well as segmented *Sam* and *am*, and blended the sounds in the word Sam. The phonemes were practiced in several ways common in phonics instruction, but given the lack of progress made by the students, perhaps there was not enough repetition or practice of these skills. The same instruction with a different order of items was presented for three more days,

although each round of instruction may have required more guided and independent practice for acquisition of the skills for the participants in this study.

Blending to identify word. When blending sounds to identify words, both students were more accurate with lesson 1 items (i.e., *sam, am*) than the probe items from lessons two and three. Liam correctly identified one word correctly during baseline and increased to three items across the three session of the probe. Across the 12 sessions of the probe he was accurate 42% of the opportunities. Anson correctly identified none at baseline and increased to 1 item by the final probe. Across the twelve sessions of the probe, Anson was accurate 17% of the opportunities for the Lesson one items. Visual analysis of the data showed that both students were more accurate on the Lesson One items than the untaught items from Lessons Two and Three.

Sight Word Identification. There were five sight words in Lesson One. Liam correctly identified 2 items correctly during the three sessions of baseline, as well as during the final set of probes. Liam correctly identified 23% of sight words from Lesson One probe opportunities, which was more accurate than the untaught items. Anson correctly identified three Lesson One sight words during baseline sessions, and decreased his accuracy by the final probe to one item. Anson was more accurate with the untaught Lesson Three sight words than the taught items from Lesson One.

In Lesson One, there were five sight words for the students to learn. On day one of Lesson One the sight words were introduced with a zero-delay, and on each day of the lesson the same procedures with 2-sec or 4-sec delay were taught. If the student incorrectly responded, a correction procedure of showing the correct response and providing the stimulus of "now you find ____", with physical guidance if necessary, an errorless strategy, was incorporated across instructional days. More repetition of guided and independent practice may have been necessary

in the acquisition phase of instruction evidenced by the lack of student progress in the lesson objectives.

Reading a word to identify a picture. Lesson One only defined one word to read to identify a picture, while Lesson Two had eight items and Lesson Three had eleven items. Both students were more accurate finding the picture matching the word from Lesson One. Liam read the word and correctly identified the picture 58% of the opportunities across the sessions. At baseline, Liam correctly identified the picture once across three sessions, and increased to twice across three sessions for each of the other probes. Anson read the word and correctly identified the picture matching the word on 42% of opportunities across the sessions. At baseline, Anson did not correctly identify the picture across the three sessions. On the first and second probe sessions, he was accurate on 2 trials, and correctly identified the word once during the final probe sessions. Both students showed greater accuracy on the taught items versus the untaught items when reading words to identify pictures.

During the daily lessons, both students engaged in the lesson and by the end of each week were more accurate in choosing the correct response to the stimuli. Even if the students seemed to be learning the skills during the lessons, their results on the GTP Probe were limited.

Summary

When compared to prior literature on teaching early reading skills for students with CCN and DD, and particularly the Ahlgrim-Delzell et al., (2014) study which most closely resembles this work, Liam and Anson were not as successful as the participants in the prior study. The students were delivered the same instruction scripted in the Go Talk Phonics curriculum for three rounds of Lesson One. Instead of an AAC device that was used in the prior study, the curriculum was downloaded into an iPad, which was used as an instructional delivery tool. The multiple

probe design included intermittent data following each sequence of instruction instead of the multiple baseline design with its continuous data used by Ahlgrim-Delzell et al., (2014).

Early reading skills identified by the NRP (2000) were addressed in the literature focused on this population of students with CCN and DD. Four of the studies examined single components of literacy such as phoneme manipulation including blending and segmenting phonemes (Bailey et al., 2011; Fallon et al., 2004; Hanser & Erickson, 2007; Truxler & O'Keefe, 2007). If you look at the overall study results on phoneme progress, two of the studies show few gains in phoneme use (Bailey et al., 2011; Truxler & O'Keefe, 2007) and the other two showed better results. Truxler & O'Keefe (2007) noted their intervention may not have been effective due to too may items in the experimental measures. In the limitations of the studies, common themes included the need for more comprehensive curricula that combine decoding and sight word instruction and the importance of addressing the differing communication needs of students with CCN (Fallon et al., 2004; Hanser & Erickson, 2007).

The current study is one of only a few that examined more comprehensive curricula (Ahlgrim-Delzell et al., 2014; Browder et al., 2008; Light et al., 2008). Light et al., (2008) was a case study (n =1) that followed the student's lead (i.e., as skills were learned, the instructors always determined what skills to teach next). The student had multiple disabilities and utilized AT and the researcher provided adaptations to meet her individual needs. The other studies of comprehensive curricula denoted inclusion criteria of being able to "direct select" to respond to teacher stimuli. Browder et al. (2008) studied the effectiveness of the Early Literacy Skill Builder curriculum (ELSB; Browder et al., 2007). This group study showed that students with significant disabilities were able to gain phonemic awareness and some phonics skills. The development of Go Talk Phonics came directly from the prior work of Browder et al. (2007).

Each of these curricula utilized scripted direct instruction with systematic instructional procedures including CTD and the system of least prompts for error correction.

Each of these studies, whether they examined single-components of literacy or comprehensive curricula, included direct instruction and systematic error correction procedures. The skills were scaffolded for participants to build on previously learned items. The research-based strategies specific to the needs of this population of students lead to my pre-study hypothesis that this program would be an effective curriculum for my participants. The Go Talk Phonics curriculum included instructional strategies and early reading skills necessary to develop early readers. Despite the evidence base inherent in this curriculum, the participants were not as successful as I had expected.

Although the participants did not meet mastery their individual results showed quite different trends. Liam showed more accuracy in the taught skills of Lesson 1 than in the untaught skills of Lessons 2 and 3. However, Anson showed no growth and decreased skills in the taught items of Lesson 1 and increased skills of Lessons 2 and 3, which were untaught in this study. Both participants demonstrated slightly higher percentage of accuracy with the skill that required the student to read a word to match the picture across the taught and untaught lessons. Perhaps for students without functional communication skills, it is difficult to ascertain what is known and unknown prior to instruction. Another trend found in the data was that off-task behavior for both students was higher during the probe conditions than during the intervention.

Limitations and Recommendations for Future Research

Despite the research-based components of the Go Talk Phonics program and the results of the prior study (Ahlgrim-Delzell et al., 2014), the current study provides some cautions to heed when considering implementation of this or similar programs. The skill levels between the

participants in the two studies during baseline were starkly different. The baseline levels of phoneme identification in the Ahlgrim-Delzell et al., (2014) study were 40% higher than the current participants' level of phoneme identification at baseline. The mean percent correct at baseline of the participants in the Ahlgrim-Delzell et al., (2014) study was 48%, whereas the current study's participants averaged 8% correct at baseline. All three participants in the Ahlgrim-Delzell et al., (2014) study had completed at least 6 levels (from 7 total) in the Early Literacy Skill Builder program ((ELSB; Browder, Gibbs, Ahlgrim-Delzell, Courtade, & Lee, 2007), whereas, the participants in the current study had not completed a similar program. They were currently using Unique Learning System for literacy, but specific skills were unknown at the onset of the study. Perhaps the students in the previous study who had more phoneme identification knowledge were more receptive to the phonics skills taught in this program than students in the current study. Thus, assessing for a specific level of prerequisite skills may be important prior to implementing this intervention. It is also possible that students' previous literacy instruction played a role (e.g., ELSB versus Unique Learning System for Literacy). For instance, the ELSB was written by the same group who wrote the Go Talk program, and thus instructional strategies and skills taught may have been very similar.

A second consideration related to the lack improved reading skills is student behavior. In the Ahlgrim-Delzell et al. (2014) study, two of the participants were taught within a classroom much like the participants in the current study. However, one of the participants was taught in a separate quiet location due to his distractibility. In the current study, off-task behavior was not assessed a priori, but post-hoc. Off-task behavior for both participants was both self-stimulatory (e.g., playing with shoe strings, flipping identification bracelet) and directed toward others (e.g., stood up and lunged toward me, touched my sleeves) and was measured through 10-s MTS with

a range from 16-57% of sessions. Unfortunately, it was not clear prior to the study that behavior would be a major problem during one-on-one instruction. Knowledge of the participants' level of task attention during instruction, as well as any antecedents that prompt the behavior or consequences that maintain the behavior may have been useful information for development of appropriate behavioral supports.

The behavior supports were not robust or differentiated enough to decrease the off-task behavior demonstrated by the participants in the current study. Behavior supports should be designed individually for the students based on an FBA (Horner, Sugai, & Anderson, 2010; Sugai, Horner et al., 2001). A Behavior Intervention Plan (BIP), based on an FBA, can help determine a replacement behavior that serves the same function as the problem behavior (Spooner, Browder, & Knight, 2011). BIPs can take time to collect observation information, develop and test hypotheses on the function of the off-task behavior, as well as develop teaching strategies compatible with the plan (Sugai et al., 2001).

The BIP may include differential reinforcement procedures that take in account the motivation for the behavior. These procedures are implemented and evaluated for effectiveness (Cooper et al., 2007). Successful intervention plans make the behavior inefficient for serving the function it once served. Thus, BIPs can assist teachers and researchers to more effectively teach academics, including early phonics, to students with behavioral needs (Horner et al., 2010; Spooner et al., 2011).

A third limitation of this study is associated with the technology. Specifically, AT fit, was not determined at the start of this study. The only determination was that the participants were able to directly select their choices on the iPad. The students were able to select items on

the iPad, but an AT fit assessment may have helped us to determine if the iPad was the best AT tool to deliver instruction for these particular students.

AT fit is an important aspect in selecting appropriate technology for learners with complex needs (Light & McNaughton, 2012). The SETT (Student Environment Task Tool; Zabala, 1995) framework implementation, it asks the IEP teams consider equipment based on whether it can be used by the student, its availability, and if there are any existing barriers to its use (http://www.joyzabala.com/). The students in this study were able to access the iPad pages and are widely available in the attended school district. However, off-task behavior interfered with successful use of the AT.

One recommendation is to develop an assessment framework prior to a study that would assist teachers in determining what other supports may be necessary for implementation of an intervention such as Go Talk Phonics. The current study examined the skills the students were unable to perform (e.g., complex communication needs, limited phonological awareness) as well as the ability to access the iPad through direct selection, but the building blocks for subsequent skills were absent from the inclusion criteria. The descriptive measure of the PPA (2014) Scale used prior to the study might have been useful as a measure for entry into the study if a determination of what skills or a minimal score would show readiness for the GTP curriculum. An assessment framework that addressed skills directly aligned with the curriculum, necessary behavioral supports, and assistive technology matching would have helped determine the level of support the participants in this study might require to profit from the intervention.

Fourth, several factors associated with novelty should be considered. For instance, unplanned activities or schedule changes can cause children with autism to demonstrate disruptive behaviors (Koegel & LaZebnik, 2004). In the course of this study there may have been

too much simultaneous novelty for participants for whom routines are important. The students routinely used iPads during their downtime (i.e., non-instructional time). However, the iPads were usually used for play, not instruction. This was novel in that not only did instruction replace play, but the adult was in control of its use instead of the student controlling iPad use. Both students made attempts to play with the features of the iPad throughout the study. Transition from apps used for play to instruction might include some stimulus-response practice with similar play characters placed into the Go Talk Now app, which was the vehicle for the curriculum. Short periods for acclimating to the platform and actions required during the lessons and probe conditions may have decreased some of the novelty by the time the lessons began. Further, perhaps instruction should have occurred during students' usual literacy instructional time rather than during play time. Another novel factor may have been that the lesson content was unlike the students' other instruction. Specifically, the instructor, instructional cues, tangible items, video camera were unlike that which the students were accustomed. The use of the token system for correct answers was similar to their current use. However, use of tokens for attending to the task without being tied to correct or incorrect responses was not.

In sum, the study may have better fit into the school day had the research taken place during one of the participants' regular instruction times. Teacher interaction during the student use of iPads might have included some stimulus-response opportunities, such as "touch the bear" to which the student touches the bear. This teacher interaction might have given some insight into a students' receptivity to responding to adult stimulus while using an iPad for instruction rather than play. Another recommendation is to include observation time prior to the study, so that students can become acclimated to the researcher-instructor within the setting.

Summary

The purpose of this study was to evaluate the effectiveness of using systematic instruction with an iPad-based phonics program to teach students with CCN and DD early reading skills. To determine the effects of the GoTalk Phonics curriculum, I conducted a multiple-baseline multiple-probe design with two participants, Liam and Anson, who had CCN and DD. Results indicated that the intervention was not effective for either one of them as neither participant improved their early phonics skills including phoneme-grapheme correspondence, blending, sight word recognition, and identifying a picture to match a word. Given these findings, further research is needed to better understand how (a) mobile technologies such as the iPad, with its voice output capabilities, can be used effectively as instructional delivery tools to teach students with CCN and DD, (b) function-based behavioral strategies can prepare students to receive instruction through alternate means such as programs delivered through an iPad, and (c) an assessment framework associated with academic, communication, behavioral, and AT supports can aid in pre-planning intervention and determining the efficacy of an intervention for students with CCN and DD.

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APPENDIX A

GTP Probe (short probe-through lesson 3)

Phoneme ID		**BL**	**BL**	**BL**	**1**	**1**	**1**	**2**	**2**	**2**	**3**	**3**	**3**		
/s/															
/a/															
/m/															
/r/															
/t/															
Short /i/															
/f/															
/n/															
Short /o/															
															/9
Blend sounds to ID words															
/sam/															
/am/															
/Tam/															
/rim/															
/sit/															
/ram/															
/mat/															
/at/															
/mit/															
/rat/															
/fan/															
/Ron/															
/on/															
/fit/															
/fin/															
/not/															
/mom/															
/toss/															
															/18
Blend sounds to ID pics															
Sam															
ram															
mitt															
rim															
Tam															
mat															
rat															
fan															
mom															
Ron															
fin															
tin															
toss															
fit															
tan															

tot															
rot															
on															
not															
fat															
															/20
Sight Words															
boy															
i															
a															
is															
see															
girl															
my															
friend															
on															
the															
me															
no															
yes															**/13**
															/60

APPENDIX B

Fidelity Checklist

Teacher: _____Date: _____ Observer: _____ Lesson 1, Day 5

_____Lead In: *You have worked very hard, so now we get to read our e-book. Today you will get to read the rest of the story Sam. I want to read the story using the iPad. We will take turns reading. First I will read a sentence. Then, you will have a turn to read that sentence to me.*

_____iPad Page:e-book1.5A, After reading each sentence, point to each word in the sentence as the student reads it on the iPad.

- If the student presses the buttons to read each word one sentence at a time, praise.
- If the student presses the incorrect word, point to correct answer and say, *Here is "(correct word)".* If no response, say *Read the story.* Model pressing each word, state words, and say, *You press the words.*

_____iPad Page e-book Comp 1.5A , *Let's talk about our e-book. Use your iPad to answer a question.*

- *What is the boy's name? (Sam)*
-

_____iPad Page:e-book1.5B, After reading each sentence, point to each word in the sentence as the student reads it on the iPad.

- If the student presses the buttons to read each word one sentence at a time, praise.
- If the student presses the incorrect word, point to correct answer and say, *Here is "(correct word)".* If no response, say *Read the story.* Model pressing each word, state words, and say, *You press the words.*

_____iPad Page e-book Comp 1.5B , *Let's talk about our e-book. Use your iPad to answer a question.*

- *Who do you see? (Sam or boy)*

Fidelity Checklist

Teacher: _____Date: _____ Observer: _____Lesson 2, Day 1-0s 2-2s 3-4s 4-4s

_____ **Anticipatory Set:** Explore book, explore iPad.

_____**Letter Given it's Sound:** iPad page: Sounds1: Sounds game*: You press the letter /m/, /s/, /a/ like this. /__/. Your turn.* (If correct, praise. If incorrect, *This is* ___. Teacher presses it.)

_____**First Sound in Words:** iPad page: Sounds 1: A new sounds game: *Tell me the first sound you hear when I say the word.* After practice set: *Now I'm going to see if you can do it by yourself.* 5 words. . (If correct, praise. If incorrect,*This is* ___. Teacher presses it.)

_____**Segment Words:** iPad Page: Segment 1. *Now lets use those letters to sound out some real words.* Example item. *"xxx". Press the sounds in "xxx".* (1 word each day). . (If correct, praise. If incorrect, *This is* ___. Teacher presses it.)

_____**Blend Sounds to Form Words:** iPad page: Blend 1: *Let's see if you can find that word a new way if I say the sounds. (/aaamm/, /sssaamm/)* . (If correct, praise. If incorrect, *This is* ___. Teacher presses it.)

_____**Blend Sounds to Form Words (pictures):** iPad page: Decode 1. *Let's find the picture of a word we read. Read this word using your letter sounds. Point to the picture of the word. .* (If correct, praise. If incorrect, *This is* ___. Teacher presses it. *Now you read Sam and find the word*. Physical guidance if necessary.)

_____**Sight Words:** iPad page: Sight Words 1. *To put our sentence together we need a few tricky words. I will say the word, then you quickly find the word on the iPad.* One example, followed by 4 words . (If correct, praise. If incorrect, *This is* ___. *You press it.)*

_____**Read Text and Comprehension:** iPad page: ebook: *Now we get to read our e-book. This book is about a boy named Sam. Today we will read more about Sam.* Point to each word in the sentence as the student reads it on the iPad. . (If correct, praise. If incorrect, *Use the iPad to read the story.* Teacher model. If wrong word, *Here is "___".* Physical guidance if necessary.)

_____**Comprehension and Application:** iPad page: Comp 1.__: *Let's talk about the ebook page. Use your iPad to answer a question. Who do you see?(If student needs help: No zero delay here. Reread sentence and answer question. Provide physical guidance if necessary.)*

_____**Close lesson:** *We will read more tomorrow.*

Fidelity Checklist

Teacher: _____Date: _____ Observer: _____ Lesson 2, Day 5

_____Lead In: *You have worked very hard, so now we get to read our e-book. Today you will get to read the rest of the story My Friend Tam. I want to read the story using the iPad. We will take turns reading. First I will read a sentence. Then, you will have a turn to read that sentence to me.*

_____iPad Page*:* e-book2.5A, After reading each sentence, point to each word in the sentence as the student reads it on the iPad.

- If the student presses the buttons to read each word one sentence at a time, praise.
- If the student presses the incorrect word, point to correct answer and say, *Here is "(correct word)".* If no response, say *Read the story.* Model pressing each word, state words, and say, *You press the words.*

_____iPad Page e-book Comp 2.5A , *Let's talk about our e-book. Use your iPad to answer a question.*

- *Who is the girl?* (Tam)
- Who is a friend? (Tam)

_____*If correct, praise. If incorrect or no response, say Let's read the story on the iPad to find the answer. Here is the sentence with the answer. Use your iPad to read this sentence aloud.* If necessary, model*. Now you do it*. If still incorrect, use physical guidance.

_____iPad Page e-book2.5B, After reading each sentence, point to each word in the sentence as the student reads it on the iPad.

- If the student presses the buttons to read each word one sentence at a time, praise.
- If the student presses the incorrect word, point to correct answer and say, *Here is "(correct word)".* If no response, say *Read the story.* Model pressing each word, state words, and say, *You press the words.*

_____iPad Page e-book Comp 2.5B , *Let's talk about our e-book. Use your iPad to answer a question.*

- *Which boy won?* (Tim)
- *Which girl won?* (Tam)

_____*If correct, praise. If incorrect or no response, say Let's read the story on the iPad to find the answer. Here is the sentence with the answer. Use your iPad to read this sentence aloud.* If necessary, model*. Now you do it*. If still incorrect, use physical guidance.

Fidelity Checklist

Teacher: _____Date: _____ Observer: _____Lesson 3, Day 1-0s 2-2s 3-4s 4-4s

_____ **Anticipatory Set:** Explore book, explore iPad.

_____**Letter Given it's Sound:** iPad page: Sounds1: Sounds game*: You press the letter /m/, /s/, /a/ like this. /__/. Your turn.* (If correct, praise. If incorrect,*This is* ___. Teacher presses it.)

_____**First Sound in Words:** iPad page: Sounds 1: A new sounds game: *Tell me the first sound you hear when I say the word.* After practice set: *Now I'm going to see if you can do it by yourself.* 5 words. . (If correct, praise. If incorrect,*This is* ___. Teacher presses it.)

_____**Segment Words:** iPad Page: Segment 1. *Now lets use those letters to sound out some real words.* Example item. *"xxx". Press the sounds in "xxx".* (1 word each day). . (If correct, praise. If incorrect,*This is* ___. Teacher presses it.)

_____**Blend Sounds to Form Words:** iPad page: Blend 1: *Let's see if you can find that word a new way if I say the sounds. (/aaamm/, /sssaamm/)* . (If correct, praise. If incorrect,*This is* ___. Teacher presses it.)

_____**Blend Sounds to Form Words (pictures):** iPad page: Decode 1. *Let's find the picture of a word we read. Read this word using your letter sounds. Point to the picture of the word. .* (If correct, praise. If incorrect,*This is* ___. Teacher presses it. *Now you read Sam and find the word*. Physical guidance if necessary.)

_____**Sight Words:** iPad page: Sight Words 1. *To put our sentence together we need a few tricky words. I will say the word, then you quickly find the word on the iPad.* One example, followed by 4 words . (If correct, praise. If incorrect,*This is* ___. *You press it.)*

_____**Read Text and Comprehension:** iPad page: ebook: *Now we get to read our e-book. This book is about a boy named Sam. Today we will read more about Sam.* Point to each word in the sentence as the student reads it on the iPad. . (If correct, praise. If incorrect, *Use the iPad to read the story.* Teacher model. If wrong word, *Here is "___".* Physical guidance if necessary.)

_____**Comprehension and Application:** iPad page: Comp 3.__: *Let's talk about the ebook page. Use your iPad to answer a question. Who do you see?(If student needs help: No zero delay here. Reread sentence and answer question. Provide physical guidance if necessary.)*

_____**Close lesson:** *We will read more tomorrow.*

Fidelity Checklist

Teacher: _____Date: _____ Observer: _____ Lesson 3, Day 5

_____Lead In: *You have worked very hard, so now we get to read our e-book. Today you will get to read the rest of the story My Friend Tam. I want to read the story using the iPad. We will take turns reading. First I will read a sentence. Then, you will have a turn to read that sentence to me.*

_____iPad Page*:*e-book 3.5A, After reading each sentence, point to each word in the sentence as the student reads it on the iPad.

- If the student presses the buttons to read each word one sentence at a time, praise.
- If the student presses the incorrect word, point to correct answer and say, *Here is "(correct word)".* If no response, say *Read the story*. Model pressing each word, state words, and say, *You press the words.*

_____iPad Page e-book Comp 3.5A , *Let's talk about our e-book. Use your iPad to answer a question.*

- *What does Sam do?* (toss)
- *Is Tam a friend?* (yes)
-

_____*If correct, praise. If incorrect or no response, say Let's read the story on the iPad to find the answer. Here is the sentence with the answer. Use your iPad to read this sentence aloud.* If necessary, model*. Now you do it*. If still incorrect, use physical guidance.

_____iPad Page*:*e-book 3.5B, After reading each sentence, point to each word in the sentence as the student reads it on the iPad.

- If the student presses the buttons to read each word one sentence at a time, praise.
- If the student presses the incorrect word, point to correct answer and say, *Here is "(correct word)".* If no response, say *Read the story*. Model pressing each word, state words, and say, *You press the words.*

_____iPad Page e-book Comp 3.5B , *Let's talk about our e-book. Use your iPad to answer a question.*

- *Who is the tot?* (Mim)
- *Who does Mim sit on?* (Ron)
-

_____*If correct, praise. If incorrect or no response, say Let's read the story on the iPad to find the answer. Here is the sentence with the answer. Use your iPad to read this sentence aloud.* If necessary, model*. Now you do it*. If still incorrect, use physical guidance.