Reading Foundations – Teaching Letter Sound Correspondence to Young Students with Developmental and Intellectual Disabilities

by

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Abstract

The purpose of this study was to investigate the effects of explicit Direct Instruction to teach letter sound correspondence to students with developmental disabilities. Additionally, this study sought to provide a basis for further research for a population of students with low incidence disabilities who are oftentimes overlooked in the field of education. The intervention included identification of letter sound correspondence using verbal and nonverbal methods of response; thus, providing opportunities for students with severe communication disorders to demonstrate skill knowledge. Picture probes measured student's ability to transfer skill knowledge of letter sounds to another format. All participants reached mastery. Visual analysis revealed a functional relation between explicit Direct Instruction and the percentage of correct responses on letter sound correspondence probes. The intervention achieved social validity as evidenced by positive feedback received on validity questionnaires. Implications for the intervention and the need for future research with similar populations of students with disabilities are discussed.

Acknowledgments

This research is dedicated to special needs students in need of quality instruction in reading. It is my hope that this research will open the minds of decision makers to fund further research studies for students with low incidence disabilities, and to change the mindset of many in education. I also want to acknowledge my family of educators who came before me who have accomplished so much to advance the field for minorities in education. To my grandfather, Dr. Joseph Matt Brittain who received a Doctor of Philosophy degree during the Jim Crow era. To my mother, Dr. Josetta Brittain Matthews, who became the first African American to graduate from Auburn University. To my aunt, Juanita Brittain Tucker, thank you so much for helping to care for my mother and for your expertise with the writing process and the English language. We are an awesome writing team! Thank you to my husband, Roy, for your unwavering support and to my son Jeffery—I love you. Much love to my family, you have been my source of support, deep inspiration and determination.

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Chapter One - Introduction

The 14th amendment was ratified into our nation's Constitution over 150 years ago, on July 9, 1868. This Amendment to the Constitution includes an equal protection clause which guarantees every American equal protection afforded by law (Johnson, 2017). The 14th amendment played an intricate role in the Supreme Court ruling in the landmark case of Brown v. Board of Education 1954. The Supreme Court ruled that the discriminatory practice of school segregation based on race was illegal in the United States. The ruling ordered all public education institutions to integrate racially to promote diversity and equality in education (Johnson, 2017). This ideology led the way to equal protection for students with disabilities. Americans challenged the legal denial of a free public education for students deemed mentally deficient, mentally retarded, or handicapped (Johnson).

In 1971, the first law that established the right to an education for students with disabilities was passed in Pennsylvania. In this case, Pennsylvania Association for Retarded Citizens v. Commonwealth of Pennsylvania, the court ruled that school aged children with mental retardation had the right to receive a free public education. This legislation laid the foundation for the 1975 law known as the Education for All Handicapped Children's Act (PL 94-142) (U. S. Department of Education, 2020). This signaled a significant change in education for students with disabilities on the national level resulting in the current law known as the Individuals with Disabilities Education Improvement Act, 2004 (IDEIA). IDEIA guarantees a free appropriate public education to students with disabilities and dictates how states and public organizations provide related educational services to students throughout the nation (U. S. Department of Education). Despite the noble efforts of lawmakers and others who champion

equality in education rights, there continues to be a separation from access to literacy for students with significant disabilities.

Who May Become Literate?

Researchers Kliewer, Biklen and Kasa-Hendrickson (2006), conducted a qualitative study using archives and ethnography to investigate constructs that perpetuate the denial of literate citizenship for people with disabilities. In their research, Kliewer et al. (2006) framed the constructs that deny literacy to individuals with intellectual disabilities using four thematic units. The first theme is that of invisibility, the second theme frames disability as a one-dimensional, simple and stagnant construct, thus justifying the denial of literate citizenship. The third theme depicts the condemnation and rejection of accomplishments in literacy made by people with disabilities. The fourth theme addresses proof of literate competence for people with disabilities. In the description of theme one, researchers revealed how influential people discounted evidence of literacy among those marginalized, devalued, and viewed as intellectually inferior, sometimes referred to as sub-human or idiotic (Kliewer et al., 2006).

To support this theme of invisibility, the researcher described the lives of two individuals. First, the life of Phyllis Wheatley, who at age seven was kidnapped into slavery in 1772 from the coast of West Africa. Wheatley learned to speak English shortly after becoming enslaved. Wheatley learned to read and write in English and began learning Latin on her own. By the age of 17, Phyllis Wheatly began writing poetry. When her slave owners sought to capitalize on her writing skills by publishing her poems, Wheatley was brought in front of a tribunal. This tribunal of 18 white men, which included our founding father John Hancock, sought to discredit the obvious fact that Wheatley was a literate African who produced English poetry. During this time

in our nation's history, humanness was a derivative of literate competence. The fact that a slave such as Wheatley could be viewed as human was not acceptable; the cultural dehumanization of Wheatley's race was an ongoing practice in society. Thus, her literate possibility had to be rendered invisible (Kliewer et al., 2006). Second, researchers discussed the life of Helen Keller, a young author who became deaf and blind at an early age from a high fever. In a similar fashion akin to Wheatley's dehumanizing experiences, others viewed Keller as incapable of performing tasks related to literacy and she faced a tribunal for plagiarism in 1954. When Keller was a child, her uncle encouraged her parents to place her in an institution because she was mentally deficient and could not reason. Because of Keller's perceived intellectual disability, society considered her void of spirituality and idiotic (Kliewer et al., 2006).

Keller attended the Perkin's Institute for the Blind and received specialized instruction. Like Wheatley, Keller went on to create numerous works of fictional writing. However, labels of intellectual ineptness prevented them from being recognized as full literate citizens (Kliewer et al., 2006). Others discounted Wheatley and Keller's ability to demonstrate reading skills as elaborate acts of parroting, a process in which a person mindlessly repeats words.

Next, Kliewer et al. (2006) described the experiences of a study subject with autism who was thought of as a fluent reader at home. This young teenage student, who was fascinated by butterflies, read every book at his local library about butterflies. However, at his segregated school, the student received no literacy instruction and others viewed him as an illiterate at his school. His educational institution made this student's literacy invisible and rejected his competence as a function of his autism label. In another ethnography, researchers interviewed a first-grade teacher who revealed her decision to teach at a segregated school for students with disabilities where reading was not in the curriculum versus a regular school. The teacher

informed researchers that the absence of pressure to teach reading at the segregated school was appealing to her as an educator. Even more disturbing, is the fact that this segregated school for students with disabilities had no library, no storybooks or other child friendly reading resources. The absence of literacy instruction experienced by students at this school is validated by rules set forth by expert authority figures and decision makers (Kliewer et al., 2006). These individuals keep in existence the belief of incompetence and the denial of access to literate citizenship for students with disabilities.

Additionally, the categorical dubiousness of a child's literate capacity is evident in the case of Isaac Johnson, a four-year-old student with Down syndrome. At the urging of experts, Isaac's parents initially enrolled him in a segregated program for students with severe disabilities. Isaac's parents withdrew him once they discovered there were no preschool opportunities and no literacy program at the school (Kliewer et al., 2006). Isaac's parents enrolled him in an inclusive preschool program that was taught by a teacher involved in the researchers' literacy ethnography. On Isaac's first day, he experienced joy as he listened with intense enthusiasm as the teacher read aloud to the class. Isaac danced a rumpus along with the book characters in the story and his classmates. The path toward literacy opened for Isaac the moment his parents chose to place him in an inclusive school setting that valued him and his right to literacy (Kliewer et al., 2006). In another ethnography, researchers described the journey toward literate citizenship for Rubin, a young person with autism. Unable to produce intelligible sounds and labeled mentally retarded with little capacity for literacy, Rubin learned to use facilitated communication (an augmentative alternative communication method involving typing). Rubin dispelled the notion that a person with an intellectual disability is incapable of using written communication when effective speech in not plausible. Rubin attended college and

received an Academy Award nomination for a documentary she penned herself (Kliewer et al., 2006). Rubin's story depicts the injustices experienced at the hand of cultural society's systematic devaluation and dehumanizing practices instilled upon students with disabilities. Like many before her, Rubin categorically confirmed her literate citizenship and high level of competency as a person with an intellectual disability.

Society must do away with the practice of denying literacy instruction within the construct of disability. Mirroring the hazards of segregation and racism, denying literate citizenship to people with disabilities is a treacherous practice that must be undone. Kliewer et al. (2006) argue that a transformation in our nation's moral compass must occur before provisions are made for high-quality literacy instruction for those marginalized by society. Without this transformation, it is unlikely that people considered as innately detached from society will find their way into the literate community. Literate citizenship is offered to those without the intellectual disability label—or those able to defy the forces of denial and shed their disability label to acquire a label of literate individual. As evidenced in the lives of participants in the ethnographies examined by Kliewer et al., 2006, literate citizenship may be offered to those no longer viewed as having a detectable disability because of their extraordinary accomplishments (Kliewer et al., 2006). Morality must change to allow people with disabilities to experience innate connectedness to the valued community.

Reading is a very important part of life and is crucial to gaining a level of independence that supports leading a productive life. Literacy is a component in practically every aspect of everyday life. For example, reading is a necessary component of independent living skills such as paying monthly bills, grocery shopping, maintaining one's health, scheduling doctor's appointments, choosing a television show or movie, communicating with friends, and

participating in civic activities such as voting. Individuals must be able to navigate successfully in a myriad of life activities both anticipated and more importantly the unexpected situations in life. For these reasons, it is essential for individuals to possess literacy skills that will enable them to gain knowledge in unfamiliar domains. Unfortunately, qualitative research, ethnographies, and analyses of textbooks show that there is a lack of focus on reading for students with significant cognitive disabilities (e.g., students with moderate to severe cognitive disabilities, autism, and developmental disabilities) (Browder, Wakeman, Spooner, Ahlgrim-Delzell & Algozzinexya, 2006).

Statement of the Research Problem

For too long students with significant cognitive disabilities have been overlooked in research studies for the development of literacy interventions using traditional components of reading. This lack of focus on reading is unjustly supported by the notion that individuals with significant cognitive disabilities are incapable of acquiring literacy skills (Benedek-Wood, McNaughton, & Light, 2016). When teachers make the decision to withhold reading instruction, they restrict students' ability to participate in future endeavors. When students do not have the opportunity to acquire literacy skills, their economic security and overall well-being is in jeopardy (Browder et al., 2006). There are many factors that contribute to the exclusion of reading instruction for this population. First, there is the assumption that individuals with an intelligence quotient of 55 and below are incapable of learning to read. Second, there is the misguided belief that individuals with significant intellectual disabilities can only acquire limited knowledge of sight words instead of learning how to decode words. Third, there is a population of students with communication deficits that prohibit them from successfully engaging in reading instruction that requires oral responses (Browder et al., 2006). When students with low incidence

disabilities receive reading instruction it is usually using sight-word memorization techniques. This type of reading instruction teaches word recognition and is generally limited to teaching sight words related to functional daily living. Functional daily living sight-word instruction enables students to read memorized contextual information strictly related to processes of daily living (Browder et al., 2006). This restrictive form of reading instruction does not promote the use of decoding strategies that enables readers to read untaught words (Browder et al.; Flores, Shippen & Alberto, 2004). Another drawback with using the sight word technique, is that it is absent of phonics instruction consisting of learning letter sound correspondence that formulates words. Historically, many professionals feel that phonics instruction is not plausible for students with low incidence disabilities. Becoming literate is vital to success in school, and key to independence later in life. For most, learning to read is not a difficult process. However, for a student with a disability, learning to read is an arduous task that requires much support.

Fortunately, the outlook on literacy instruction for students with intellectual disabilities (ID) has become one of optimism. Research professionals have conducted studies that provided phonics instruction to students with ID. Study results revealed that students learned to decode letters to read words (Dessemontet, Martinet, de Chambrier, Martini-Willemin & Audrin, 2019). Phonics instruction is a process that teaches learners to identify the sounds produced by letters of the alphabet. Students use this knowledge to decode words. Fundamentally, pupils learn to transform letters into sounds, then interblend the sounds into words (Dessemontet et al., 2019).

Dessemontet et al. (2019) performed a meta-analysis on research studies to investigate the efficacy of phonics instruction to teach students with intellectual disabilities to decode words. A recent review of research found that students with mild intellectual disabilities benefited from phonics instruction. However, the interventions did not yield phonics instruction as an evidence-

based practice (EBP) for students with significant intellectual disabilities, one reason being, the lack of systematic phonics instruction as outlined by the National Reading Panel (2000) for this population of students. Second, the effectiveness of phonics interventions included in the research review could not be determined without a meta-analysis that assessed the quality of methods calculating effect sizes (Dessemontet et al. (2019).

The study found that direct instruction was the most effective instructional strategy for teaching phonics to students with intellectual disabilities. With direct instruction, the instructor teaches specifically and explicitly letter sound correspondence. This process involves delivering explicit instruction, teacher's modeling required behaviors/skills, providing guided practice with feedback as well as verbal, visual and physical prompts. The meta-analysis was performed on eight single-case design studies, and four group design students with a total of 297 participants. Of these studies, only two single-case design, and two group design studies met all quality indicators outlined by the Council for Exceptional Children's standards of high-quality research. The study found that the research design was a significant factor for effect size. The two single-case studies found that phonics instruction yielded large effect sizes. Phonics instruction in the two group designs resulted in small effect sizes ($g = 0.41$) which is similar to effect sizes in other reading meta-analyses for struggling students. The meta- analysis showed single-case design to have large positive effect sizes ($g = 1.94$). The small effect sizes with group studies had reasonable value with regard to observed student performance in the classroom. These findings propose that after receiving phonics instruction, students with intellectual disabilities transferred skill knowledge and generalized to decode unfamiliar words and nonsense words (Dessemontet, et al., 2019).

The meta-analysis is limited in the following ways. The majority of the studies consisted of single case design with small sample sizes. The generalizability of the effects of phonics instruction to the entire population is limited because small samples do not accurately represent all members of a population. Next, there is publication bias, meaning that journals do not publish failed studies. There is a potential for publishers to exaggerate the positive effects of phonics instruction reported in this meta-analysis. Finally, because many students with intellectual/developmental disabilities have language impairments, there is a need for phonics instruction as an evidence-based practice (EBP) for this group of students. The meta-analysis included only one group study that met all quality indicators of the Council for Exceptional Children (CEC) for high quality research. This is an insufficient amount of studies needed to qualify as an EBP for students with language impairments. As a result, there is not enough information to consider phonics instruction as an EBP for students with intellectual disabilities and language impairments using CEC standards. More high-quality research studies using this intervention must occur to establish phonics instruction as an EBP for this population Therefore, offering instruction in letter sound correspondence to students with developmental disabilities may help to decrease the number of students lacking adequate literacy skills. Beginning instruction as early as preschool will set the stage for increased literacy. Research on the science of Early Brain and Child Development showed that there is a positive connection between brain development and early literacy. A child's early experiences has a significant effect on their learning (American Academy of Pediatrics, 2020). Therefore, delivering explicit Direct Instruction in letter sound correspondence to preschool students increases the likelihood they will become literate citizens.

Justification for the Study

Like older students with significant intellectual or communication impairments, young students with developmental disabilities have little access to high-quality reading instruction. Young children with disabilities may have a disability's label of autism or development delay. A young child with a disability labeled as developmental delay experiences significant delay in one or more of the following areas of development: intellectual, communication, social emotional, adaptive behavior or physical. Many professionals who serve students with autism and developmental delays presume that reading and writing outcomes are unattainable for these students (Schnorr, 2011). Students with developmental disabilities take longer to develop literacy skills compared to their normal developing peers; nonetheless, the benefits of high-quality literacy instruction for this population of students are immediate and long lasting. The positive learner outcomes from receiving comprehensive literacy instruction more than justify the increased amount of time and effort required of reading teachers of students with developmental disabilities. Daily instruction should focus on foundational goals such as having an awareness of phonics, phonemic awareness, vocabulary development, fluency, and reading comprehension. Activities to increase students' foundational skills include instruction in identifying letter sound correspondence, shared reading, shared writing with high teacher support, and teacher-led exercises to make and sort words (Schnorr, 2011).

All students deserve the benefits of participation in a comprehensive literacy program consisting of phonological awareness, phonemic awareness, vocabulary, comprehension, and fluency. No longer should students with significant intellectual and developmental disabilities be the recipients of inadequate literacy instruction. This research sought to demonstrate the invaluable rewards of a comprehensive reading program for students with low incidence disabilities. Students in this study received instruction in a component of literacy known as letter

sound correspondence, a precursor to reading. The objective of this research was to extend existing research on literacy development for students with significant intellectual disabilities. Moreover, this study aimed to make the case for the implementation of literacy practices for students with low incidence disabilities that incorporates traditional reading practices (instruction in phonological awareness, phonemic awareness, vocabulary, comprehension and fluency). Connectedness to the literate community may be achieved through breakthroughs in education in the form of EBPs for students with low incidence disabilities.

When children develop literacy skills early in life, the journey to becoming skillful readers is much easier. According to the American Academy of Pediatrics, when children are exposed to literacy at an early age, once in school, those students typically outperformed young children who do not receive early literacy instruction in preschool (raisingreaders.org, 2020). Researchers have discovered that formal literacy instruction facilitates the development of conventional skills that are crucial to early reading achievement. Explicit instruction in letter sound correspondence and phonemic awareness is paramount to reading success for young students at-risk for reading problems (Benedek-Wood, McNaughton & Light, 2016). For students with low incidence disabilities, who may be predisposed to struggle in their quest to become literate, the provision of evidence-based practices such as phonics instruction in letter sound correspondence should be included in the preschool curriculum.

Purpose of the Study

Evidence-based practices for teaching literacy to students with low incidence disabilities can only be established by increasing the number of high-quality research studies in the field. This study sought to contribute needed research to develop evidence-based practices in reading using the traditional components of literacy outlined by the National Reading Panel (2000). More

specifically, this study focused on the aspects of teaching letter sound correspondence to preschool students with developmental delay, low incidence disabilities and intellectual disabilities.

Research Question

What are the effects of delivering a literacy intervention using explicit Direct Instruction to teach letter sound correspondence to young preschool students with developmental delay, low incidence disabilities, and intellectual disabilities?

Definition of Terms

Explicit instruction – a clear and distinct method of instruction focusing on essential content through teacher modeling, guided practice, independent practice, systematic fading prompts/supports, requiring responses, giving corrective feedback, monitoring performance, repeated purposeful practice and clarity of presentation

Direct Instruction – presenting skills systematically and explicitly – consists of six elements: review, beginning new lessons with a statement of purpose/overview of the skill, guided practice, feedback and correction, independent practice, and frequent review

Letter sound correspondence – refers to the sounds associated with individual letters of the English alphabet

Literacy – knowledge and skills needed to use printed and written information to develop knowledge and function in society

Phonics – sounds produced by letters of the alphabet

Phonemic awareness – part of phonological awareness that includes knowledge and manipulation of parts of spoken speech

Vocabulary – body of words used in language

Comprehension – understanding what is read

Fluency – reading with speed and accuracy

Meta-analysis – a research design that involves systematically evaluating previous research results to draw conclusions about the body of research

Ethnography – the study of people in their environment to gather information by conducting face-to-face interviews and observation

Effect size – a numerical measure in statistics to describe the magnitude of an intervention

Literate citizenship – receiving literacy instruction that enables one to become a literate and more competent individual

Low incidence disabilities – areas of disability in low occurrence such as autism, developmental disability, significant intellectual disability, and developmental delay

Intellectual disability – significant below-average intellectual functioning with significant deficits in adaptive behavior

Developmental Delay – significant delay in one or more of the following domains: adaptive development, social emotional development, cognitive development, communication development, or physical development—applies to children ages three to nine years of age

Autism – a developmental disability characterized by deficits in social interactions, learning and communication

Communication impairment/disorder – inability to communicate effectively—characteristics may include limited use of spoken language, or unintelligible speech/nonverbal, and difficulty understanding language and speech

Limitations of the Study

As with all research studies, there are limitations that should be considered. The small sample size of four preschool students affects the generalizability of the intervention. Without replication, establishing whether the intervention's effect will carry over to other students with developmental disabilities cannot be accomplished. Although the study targeted the effects of instruction on letter sound correspondence, instruction in other areas of reading (e.g., phonemic awareness) should take place. It is important to note that the intervention was not taught in isolation within the preschool classroom, students engaged in various reading activities such as read-alouds, shared stories, educational videos and songs related to letters and their sounds as well as letter worksheets and art activities. Because letter sound correspondence was only taught for the letters *m, a, s* and *t*, it is impossible to confirm whether the intervention works for all letters of the alphabet. Once this is confirmed, it would be interesting to know the effects of letter sound correspondence knowledge on decoding skills of young students with developmental disabilities.

Summary

This study sought to replicate previous research conducted by Benedek-Wood, McNaughton, and Light (2016). Similar to the previous study, this study taught letter sound correspondence to young students with developmental disabilities, autism, and communication disorders. Students received instruction to learn letter sound correspondence using explicit, Direct Instruction. Unlike the previous study, this study targeted a different group of letter sounds such as *m, a, s* and *t,* versus *o, t, r, l, u,* and *p* in the previous work. This study extended prior research by Flores, Shippen, Alberto, and Crowe (2004), and Bradford, Shippen, Alberto, Houchins, and Flores (2006). Like Flores et al. (2004), and Bradford et al. (2006) this study taught letter sound correspondence using Direct Instruction to students with low incidence

disabilities and targeted similar letter sounds (*m, a, s, t*). Unlike Flores et al. (2004) and Bradford et al. (2006), the intervention in this study employed explicit, Direct Instruction without the use of a commercial reading program. This research study adds to the literature in a field of special education research with limited data that teaches letter sound correspondence to students with communication disorders.

Chapter Two – Literature Review

In 1997, a National Reading Panel formed to evaluate over a thousand reading studies to determine the most effective techniques for teaching reading to children. Results from the National Reading Panel's review revealed five evidence-based practices for teaching reading which includes: phonological awareness, phonemic awareness, fluency, vocabulary and comprehension (National Reading Panel, 2000). Phonological awareness is knowing that the letters of the English alphabet represent sounds, known as phonemes, and when blended together, the sounds form words. Possessing phonological awareness also means to be cognizant of the components of spoken language including words, syllables, rimes, and onsets. Phonemic awareness, a subcategory of phonological awareness, includes manipulation and knowledge of parts of spoken language (Carnine, Silbert, Kame enui, Tarver & Jungjohann, 2006). Additionally, reading fluency means having the capacity to read aloud accurately with proper expression, speed, and with more understanding (Carnine et al., 2006). Text comprehension is having the ability to understand what is read. Instructional strategies that facilitate comprehension include summarizing text. This helps students to remember and communicate to others what was read. Vocabulary, whether learned indirectly or taught explicitly, enhances reading comprehension. Teaching vocabulary includes instructing students on the meaning of

new words; this is essential to reading comprehension. Repeating lessons and providing multiple opportunities to read words are important to vocabulary development (Carnine et al., 2006).

In efforts to discover which evidence-based practices from the National Reading Panel's (2000) review were used with students with significant intellectual disabilities, researchers Browder et al. (2006) conducted an analysis that reviewed literature from 128 reading studies. There were 1,123 participants with moderate and severe intellectual disabilities, autism, and unspecified developmental disabilities. The results showed that most reading instruction, over 70%, focused on the acquisition of functional sight words, and 33% of the studies showed reading instruction aimed towards picture identification. Additionally, in 28% of the studies, the type of reading instruction implemented focused on fluency, 24% on comprehension, and a mere 10% of the reading instruction included phonics. Even fewer studies, less than 10%, consisted of instruction in phonemic awareness (Browder et al., 2006). Browder et al. found 42 studies involving 155 participants that implemented instruction using a massed trial format. In this format, students responded to flash cards. Researchers used systematic prompting procedures, and incorporated time delay to facilitate errorless learning. As the number of trials increased, researchers faded prompts delivered to students (Browder et al., 2006). At the time of the review, there were no evidence-based practices for teaching phonological and phonemic awareness to students with significant intellectual disabilities using single-subject research design. Additionally, Browder et al. (2006) failed to identify studies that provided evidence of implementing comprehensive reading instruction that used the National Reading Panel's five components of reading. According to the National Reading Panel (2000), a comprehensive reading program incorporates instruction in phonics, phonemes, comprehension, vocabulary and fluency. Furthermore, a meta-analysis performed more than three decades ago found that

instruction in phonemic awareness was an efficacious form of reading instruction for students with significant intellectual disabilities versus alternative methods. Likewise, systematic instruction in phonics demonstrated more effectiveness than methods that withhold phonics instruction or employing non-systematic phonics teaching with students with significant intellectual disabilities (Browder et al., 2006). Browder's review showed that only 23 of the studies either measured or included instruction in comprehension. Of the 23, about half (11) of these studies had strong effect sizes with information to promote an evidence-based practice for teaching comprehension. These studies relied on students answering questions to demonstrate comprehension. The methodologies to establish comprehension included usage of a sight word in a functional context or matching words with pictures (Browder et al., 2006). As with phonics and phonemic instruction, there is also a need for further investigation of methods to teach comprehension to students with significant intellectual disabilities. Additionally, fluency is another component of literacy that is rarely taught to students with low incidence disabilities. Although research shows that guided oral reading helps students to increase performance on fluency measures, this strategy has not been the focus of research in fluency for students with low incidence disabilities (e.g., students with significant intellectual disabilities). Studies involving fluency with this population have focused on deriving at a rate of error with errorless learning procedures (Browder et al., 2006).

Though the National Reading Panel's (2000) investigation has demonstrated that the best way to teach reading to students is to implement a program consisting of instruction in phonics, phonemes, vocabulary, comprehension, and fluency; however, the main method of instruction for students with significant intellectual disabilities continues to use stimulus control for sight word instruction. Numerous researchers have performed meta-analyses which showed that

students with significant intellectual disabilities learned sight words using stimulus control procedures as well as systematic prompting procedures such as time delay (Browder et al., 2006). For a population of students with limited working memory to attain this goal, it seems that instruction in phonics and phonemic awareness should take place without question because they do not have the capacity to memorize all words as sight words. Instead, knowledge of phonics and phonemic awareness would allow students to use their skills to read unfamiliar words or discriminate between words using these literacy skills. Perhaps systematic prompting procedures can be implemented to teach the components of reading instruction other than vocabulary (i.e., sight word instruction) instruction. Furthermore, sight word instruction could be used to teach irregular words, thus, increasing the reading level of students with significant intellectual disabilities (Browder et al., 2006). More research is needed for students with low incidence disabilities that includes implementing reading methods that have been shown effective for students with high incidence disabilities or without disabilities. For example, some of these students may benefit from explicit direct instruction (Browder et al., 2006). For all the reasons not to teach reading to students with low incidence disabilities, there are even more reasons and evidence to support literacy instruction for this population. For example, the results of studies involving teaching phonics to students with severe intellectual disabilities have shown strong effect sizes. Phonics, phoneme awareness, and letter knowledge are good predictors for improving students' ability to read (Browder et al., 2006). Studies' strong effect sizes and instruction in phonics, phoneme awareness and letter knowledge validate the need for research-based and evidence-based practices to teach reading to students with significant intellectual disabilities. We cannot know how many individuals with significant, moderate, and severe

intellectual disabilities will become readers. The only way to find out is to provide reading instruction as well as access to literature to all members of this underserved population.

Conceptual Foundation for Instruction

Fortunately, researchers have begun to perform work to identify ways to teach reading to students with low incidence disabilities. For example, researchers have performed work to provide education practitioners with a conceptual foundation for teaching early literacy skills to students with severe developmental disabilities (Browder, Gibbs, Ahlgrim-Delzell, Courtade, Mraz & Flowers, 2009). In their work, Browder et al. (2006) aimed to deliver a framework for literacy instruction that improved independence in reading as well as enhanced quality of life by providing opportunities to interact with literature for students with severe developmental disabilities. Researchers sought to provide guidelines to access to literature and instructional strategies for teaching the components of reading prescribed by the National Reading Panel (2000). Further, researchers acknowledged challenges to literacy instruction for students with significant intellectual disabilities. For instance, many literacy models assumed students have oral language skills that students with low incidence disabilities may not possess. Some pronunciation tasks were too difficult for students with communication disorders. Additionally, a portion of nonverbal students required the use of an augmentative communication device. Using an augmentative communication device during phonemic tasks was a complex process (Browder et al., 2009). Students functioned at a literacy far below their grade level (e.g., a tenth-grade student functioning on a first-grade reading level).

When provided, this population might only receive comprehensive reading instruction in elementary school. During upper elementary and middle school, reading instruction primarily consisted of functional sight words and some reading instruction. At the high school level,

students only received instruction on functional words, for example, grocery store words or words related to a work schedule. This predicament demanded a conceptual foundation for literacy that provided opportunities for students to participate in chronologically age-appropriate instruction that benefited students with significant intellectual disabilities. One outcome of the conceptual foundation model was to provide access to literacy beyond daily living skills (Browder et al., 2009). Although some members of this population of students ceased to become readers, all members of students' educational team should work collaboratively to teach reading to students. Nonreaders needed access to literature. Hence, literacy is the largest part of the conceptual foundation literacy model. Researchers discovered students required the support of a reader or technological support such as a text reader software application to access literature. Additionally, students achieved access to literature through shared reading, read-alouds, book sharing or shared stories. Researchers adapted text to facilitate access to literature for students. Examples of adaptations included: text summaries, picture symbols, picture response boards, Braille, and enlarged texts or raised pictures for individuals with visual impairments (Browder et al., 2009).

Further suggestions for gaining access to literature included providing instruction to teach students to manage their own books during group reading activities. Specific suggestions included teaching students to locate chapters, turn pages, identify key terms by providing definitions before and during read-alouds; pointing to words being read aloud; or activating a switch for a DVD player, etc. Researchers suggested implementing read-alouds using the following steps: (a) choose age-appropriate books that interest students, (b) view materials prior to instruction, (c) model reading fluency, (d) engage students in discussions on questions related to text throughout readings, (e) clearly establish the purpose for reading with students, and (f)

help students to make connections with previous texts (Browder et al., 2009). The second outcome of the conceptual foundation model was to facilitate independence in reading through implementation of a reading program that utilizes the National Reading Panel's (2000) model for a comprehensive instructional approach to literacy. The benefits of independence in reading were immeasurable. Reading independence increased access to reading for pleasure, work, health, and technology (Browder et al., 2009).

As previously mentioned, phonemic awareness is a component of the National Reading Panel (2000) model. Phonemic awareness is the ability to hear and manipulate phonemes, which are the smallest parts of speech. Phonemic awareness is a skill that is strictly auditory; it does not involve looking at words and is an indicator of reading success (Carnine et al., 2004). Students with significant intellectual disabilities may benefit from receiving phonemic awareness instruction over an extended period during the primary years. Additionally, phonemes should be presented with pictures and printed letters to give nonverbal students a visual to aid their response. Nonverbal students with disabilities can use voice output technology to articulate letter sounds. The pairing of phonemes with printed letters and pictures may also increase the development of phonics acquisition. Teachers can implement strategies with nonverbal students to demonstrate acquisition of phonemic awareness skills. For example, when assessing knowledge of word segments, instead of verbalizing the syllables in a word, the student can clap out each syllable as the teacher says the word aloud (Browder et al., 2009).

Additionally, students need an awareness of phonics and print awareness to become independent readers. Instruction in phonics includes teaching reading in a manner that focuses on learning letter sound correspondence (LSC) and applying that knowledge to aid reading and spelling. Systematic instruction in phonics explicitly taught teaches students to convert letters

into sounds and to blend the sounds to read words (Carnine, Silbert, Kame' emui, Tarver, & Jungjohann, 2006). Emerging readers need to know how speech and print are connected to successfully decode words. Students who have an awareness of print understand that print represents speech, can differentiate between words and nonwords, know that spaces separate words, and that English words are read from left to right (Browder et al., 2009).

Further, the next component of the National Reading Panel (2000) model is vocabulary which may be expressive (i.e., definition of a word) or receptive (i.e., understanding the meaning of spoken words). As previously stated, students with significant intellectual disabilities can acquire vocabulary knowledge through systematic prompting methods, for example, using time delay procedures. With time delay, the teacher presents the word, and then immediately models the correct response. The student then repeats the correct behavior that the teacher modeled. This procedure is followed by additional trials in which the teacher presents the prompt (e.g., a vocabulary word) and waits for students to perform the correct behavior (e.g., choosing its definition) modeled by the teacher during the introduction phase of a new vocabulary word. After a delay of a few seconds, if the correct response is not given, the teacher models the correct behavior. Students learn the meanings of vocabulary through this procedure (Browder et al. 2009). Vocabulary terms can be paired with pictures to teach students the word meanings. Students also need to participate in activities that incorporate vocabulary into reading activities to gain conceptual knowledge of vocabulary terms (Browder et al., 2009).

Fluency is another component of the National Reading Panel (2000) framework that is included in the conceptual foundation model. Fluency is the ability to decode words with automaticity and to read with oral intonation, expression, pitch, and phrasing. This task is difficult for students with low incidence disabilities. Realistic fluency goals for this population

may include reducing reading errors and response time (Browder et al., 2009). Comprehension, the final component of the National Reading Panel (2000) model, demands readers to think about what has been read and assemble meaning from text or oral language. When teaching comprehension, researchers suggest teaching students to use pictures to retell the story, and to utilize graphic organizers to compare and contrast characters, and to identify events in a story or make predictions in a story. Participation in comprehension activities should be broadened beyond the usage of sight words in functional context and word-to-picture matching activities to demonstrate comprehension. Students should strive to engage in answering WH questions. For nonverbal students, this can be achieved by selecting a picture from an array of illustrations in a story book that represents an understanding of textual information. Teachers may choose to implement response prompting procedures to help students with their answers. Teachers may also ask students questions relating to a sentence that contains the answer (Browder et al., 2009). The conceptual foundation of literacy model for students with significant intellectual disabilities leads to a need for research-based techniques to teach the components of the model.

Research-Based Techniques

Similar to Browder et al. (2009), Allor, Mathes, Champlin and Cheathan (2009) recommended reading instruction that was aligned to the components of the National Reading Panel (2000) model. More specifically, Allor et al. (2009) suggested using research-based instructional procedures to teach early literacy skills to students with intellectual disabilities. Allor et al. conducted research that examined the effects of using the *Early Intervention in Reading* curriculum, a comprehensive reading program developed for struggling readers, with students with intellectual disabilities. In this research report, researchers provide readers with definitive lessons from their study that outlines how instructors taught the components of reading

to students with significant intellectual disabilities. Researchers categorically meshed isolated reading skills to one another and joined skills to instruct students on how to gain meaning from textual data. First, lessons incorporated teaching and practicing the following instructional strands: oral language and vocabulary development, phonological awareness, phonemic awareness, phonics and word recognition, fluency, and comprehension (Allor et al., 2009).

As learning progressed in one strand, students learned to apply the knowledge and abilities gained from one strand to other content strands. Beginning with oral language and vocabulary development, students participated in read-alouds using narrative and expository books. Teachers taught students to focus on a distinct set of vocabulary terms. Students developed vocabulary by engaging in multiple activities using videos, gestures, and games. Students read books three times and participated in activities such as discussions about stories read to enhance expressive language skills. Students joined in *Point and Read* activities to integrate oral language and print. This action supported finger tracking from left to right and repeating words in sentences (Allor et al., 2009). During the phonological and phonemic awareness strands, students participated in various blending and segmenting tasks, each consisting of uniform language and activities such as *Say the Word* which used a puppet named Maxwell to stretch words. Further, researchers recommended consulting with a speech pathologist, reading coach/specialist or another professional able to provide assistance on phonological awareness tasks to minimize distortion of sounds during blending activities (Allor et al., 2009).

Additionally, researchers noted that blending and segmenting tasks should begin with continuous sounds in the initial phoneme position of words, and slowly progress to blending and segmenting with stop sounds in the initial phoneme position. Researchers connected phonemic

awareness to oral language by giving meaning to words through pictures. Researchers presented pictures to students and required participants to identify the picture that corresponded to a given phoneme. Instruction in phonics and word recognition skills began with the most common letter sounds before progressing to more complex letter patterns. Students learned sight word techniques to facilitate reading irregular words (Allor et al., 2009). Researchers promoted the integration of segmenting, letter sound correspondence knowledge and the skill of sounding out words using a method known as *Stretch and Spell*. During this activity, implementers required students to stretch out the sounds in each word and write its spelling. Teachers also provided students with opportunities to create sentences from decodable words presented on cut pieces of sentence strips. This helped students understand word meanings during word recognition tasks. Researchers extended word reading activities using word cards to teach fluency. Teachers helped students to stop sounding out words they knew by instructing them to read the words quickly. By incorporating repeated readings of decodable text and unison reading, teachers further promoted fluency. Teachers taught oral comprehension during storybook read-alouds. After learning basic word recognition, students learned comprehension strategies by reading decodable text. Researchers offer novels and expository text as excellent sources of information to improve students' level of general knowledge related to academic content. This research provides more literature to an area of research that currently has meager amounts of research-based information for professionals who teach reading to students with intellectual disabilities (Allor et al., 2009). Not only should students with low-incidence disabilities receive comprehensive reading instruction using research-based techniques but instruction must be intensive in delivery.

Intensive Instruction

Allor, Champlin, Gifford and Mathes (2010a) offered strategies for increasing the level of intensity in reading instruction for students with low-incidence disabilities. Allor et al. (2010a) recommended increasing opportunities for students to practice reading skills. The first deliberation must be to provide students with a significant quantity of teacher-led instruction that also includes behavior modification plans to facilitate full participation of students with behavioral concerns. Allor et al., 2010a, provided students with 40 – 50 minutes of daily instruction delivered to small groups of one to four students. Researchers conducted ongoing progress monitoring and assessments to determine which skills needed to be addressed and to avoid spending instructional time on mastered skills. Researchers suggested implementing strategies to keep students motivated such as using tangible reinforcers. Researchers also recommended implementing goal setting procedures with students to help students gain a sense of self-control and to aid students with self-determination (Allor et al., 2010a).

Additional methods to increase intensity were procedures to provide practice to students aside from teacher-led instruction. Students used appropriate text on their reading level to engage in practice reading sessions with peers, family members, paraprofessionals or others. Researchers suggested providing students with opportunities that allow them to engage in meaningful reading practice. Researchers made reading practice meaningful by including words used in students' spoken vocabulary and using pictures to connect words with their meaning (Allor et al., 2010a). Research teachers engaged students in conversations using words students had learned to sound out. Researchers suggested that teacher-led instruction be intensified by introducing new skills quickly, and incorporating a fast-paced cumulative review of previously learned material while allowing ample time for processing. By employing techniques such as using tangible reinforcements to keep students on-task, and by efficiently using instructional time by avoiding

time spent on obviously mastered skills, teachers increased intensity during instruction (Allor et al., 2010a).

Allor et al. (2010a) proposed implementing additional word level practice, sentence level practice, text level practice, and words within text reading practice sessions. In their research, Allor et al. discovered students experienced difficulties unitizing words (i.e., recognizing words automatically without sounding out words). Researchers recommended flashcards to provide review sessions to students during word level practice. Researchers created crossword puzzle pages and flashcard games using target words for students to use during word practice with peers. Once students learned enough words to create sentences, they cut out words and organized them to make sentences and wrote the sentences they created. Text level activities consisted of instruction on ways to select appropriate books that were not too complex. Researchers provided students with information from leveled reader websites such as www.readinga-z.com. Researchers offered incentives to encourage book reading. Activities to target words within text included methods to correct students' errors (Allor et al., 2010a). During teacher-led instruction, researchers used a chart they developed to document the word in the text that corresponded to the pronunciation error made by the student reading the text. This allowed teachers to keep a record of the words that would be problematic for students when selecting text for independent reading sessions. Students kept a journal of new words and marked the words they experienced difficulties with reading quickly. This helped students to perceive difficult words as new learning opportunities instead of viewing them as a source of frustration. These recommendations provided teachers with activities used by researchers that benefited students with intellectual disabilities (Allor et al., 2010a). Because research on reading for students with significant intellectual disabilities was limited, the extent of their reading abilities is unclear. However,

recent research has been conducted with participants with low incidence disabilities to produce instructional methods and strategies to access text that benefits this population of students.

Shared Story Reading

Research showed that providing access to stories and text using read-alouds and shared reading facilitated the development of vocabulary, decoding techniques, and language comprehension. Moreover, the research of Roberts, Leko and Wilkerson (2013) used adapted text during shared story reading to integrate instruction in functional goals and academic content with students with significant intellectual disabilities. Roberts et al. integrated functional Individualized Education Program (IEP) goals with grade-level academic goals using shared story reading. In this study, researchers investigated the following: 1) whether story-based task analytic lessons were effective in instructing students on functional IEP goals and academic content goals, 2) whether the use of story-based task analytic lesson plans and self-monitoring techniques for teachers enhanced student outcomes, and 3) whether implementers' perceptions of the intervention change based on students' performance toward achieving functional and academic goals (Roberts et al., 2013).

Roberts et al. (2013) used a multiple baseline design incorporating an intervention phase I and intervention phase II. The study took place at secondary schools located in a sizeable urban school district in the Midwest. Three special education teachers, two special education paraprofessionals, and three sixth grade special education students participated in the study. The students, Kobe, Silvo, and Emily had moderate to severe intellectual disabilities. The teachers and students formed three dyads. In this study, researchers selected academic content from the curriculum or from grade level standards. Research staff selected individual functional goals from each student's IEP. Researchers adapted selected general education text by rewriting text to

an appropriate listening comprehension level. Additionally, researchers adapted text by inserting picture symbols above targeted vocabulary as well as repeating story lines in rewrites, and employing the use of attention grabbers such as videos related to the stories (Roberts et al., 2013).

The dependent variables in this study were the percentage of lesson plan components executed during instruction and the answers provided on nine, 20-question, 5-point Likert scale social validity surveys administered to paraprofessionals and teachers. The third dependent variable was the percentage of correct answers provided by students. Lesson plan components consisted of the following seven elements: 1) an opening activity, 2) incorporating work from a minimum of one component of literacy instruction outlined by the National Reading Panel (2000), 3) using grade level, age appropriate text, 4) discussing comprehension questions, 5) giving a functional literary component, 6) assessing and monitoring student's progress, and 7) self-monitoring edification (Roberts et al., 2013). Further, the independent variables were the individualized lesson plans to target academic and functional goals and the seven lesson components. Additionally, the second independent variable was an introduction to and use of an individualized lesson plan. The third independent variable was a reformatted task analytic lesson plan that implemented the use of boxes to record self-monitoring data and student data. Each lesson with adapted text provided students with 10 – 40 chances to identify target vocabulary words. The number of opportunities to identify target vocabulary grew as students advanced through textual information to learn additional words. Students received instruction on functional goals during intervention sessions such as matching names with pictures, reading names, and answering yes/no questions about the stories (Roberts et al., 2013).

The data from this research study demonstrated a functional relation between the independent and dependent variables. In dyad one, the baseline percentage of lesson plan components executed was 43%. During lesson plan introduction, the percentage increased to 71%, then to 100% with the task analytic lesson plan format. In dyad two, baseline was 0%, which increased to 71% during the introduction phase, and ended with 100% of lesson plan components executed with the formatted lesson plan. The baseline percentage of components executed in dyad three was 14%. This number increased to 71% during the introduction phase and ended with 100% execution with the formatted lesson plan (Roberts et al., 2013). Additionally, Kobe demonstrated 0% correct responses in baseline. Kobe increased to 33% and 20% correct on academic and functional trials during lesson plan introduction. Kobe increased to 41% correct responses on academic trials with the formatted lesson plan. The baseline percentages for Silvo was 0% and 29%, and Emily scored 40% and 40% on academic and functional trials, respectively. During the introduction phase, Silvo increased to 76% and 86%, and Emily increased to 33% and 80% on academic and functional trials, respectively. During the task analytic formatted phase, Silvo correctly responded on 85% and 100%, and Emily correctly responded to 67% and 80% on academic and functional trials, respectively. Social validity measurements showed teachers' favorable perceptions that ranged from 83%, 79% and 74%, respectively, to 88%, 92% and 93%, respectively. Teachers stated they appreciated the adapted grade level content, viewed lesson plans as user friendly, felt the picture symbols were effective, and planned to use the resources with other students (Roberts et al., 2013).

In contrast, there were challenges in the study. Most challenges resulted from behavioral issues presented by students that complicated implementation procedures. Instructors theorized that students exhibited negative behaviors to avoid or escape the new routine the intervention

presented. Further, students failed to respond to certain sections of the intervention. Teachers also indicated that the amount of time it took to adapt the materials was problematic due to daily time constraints. Nevertheless, prior to the intervention, students did not engage in academic tasks and after the intervention they read words in text and answered comprehension questions at the end of each chapter. (Roberts et al., 2013).

Read-Alouds

Another aspect of the conceptual foundation framework is read-alouds. Courtade, Gurney and Carden (2017) conducted a single case research study that used read-alouds and adapted grade-level social studies text to teach comprehension to students with an intellectual quotient of 55 and below. The students' disabilities included cerebral palsy, autism, or a hearing or visual impairment. The study employed a modified system of least prompts to teach students with severe disabilities to answer WH questions related to grade-level social studies text about the U.S. government (Courtade et al., 2017). Study participants consisted of three fifth grade students, two males and one female, ages 10 to 12 years, enrolled in a self-contained special education classroom with participation in general education for part of the day. Intervention sessions took place in a room located down the hall from the students' special education classroom. Researchers adapted the book, *The U.S. Senate,* by Ella Cane (2014), using Boardmaker® software by summarizing text, inserting picture symbols, repeating story lines, and using graphic organizers to display the rules for responding to WH questions. The WH rules instructed students to listen for the following: 1) a thing, when they hear *What*, 2) a reason, when they hear *Why,* 3) a person, when they hear *Who*, 4) time or date, when they hear *When*, and 5) a place, when they hear *Where*. Researchers developed 10 literal comprehension questions (i.e., Who? What? Where? and Why?) related to the three branches of U.S. government (i.e.,

judicial, executive, and legislative branch). Students responded to an array of four answer choices created using Boardmaker® software. The choice display consisted of one correct answer choice and three distractor choices. The dependent variable was the number of correct responses to the 10 comprehension questions given by students after read-alouds. Students reached mastery after responding with a minimum of 80% accuracy on three consecutive sessions (Courtade et al., 2017).

The study results demonstrated a functional relation between the use of a system of least prompts and adapted grade-level social studies text during read-alouds to advance comprehension (Courtade et al., 2017). The data showed that two students received average scores of 1.6 questions correct, and another received a score of 2.0 questions correct in the baseline phase. However, in intervention phase, on average students responded correctly to 5.9, 7.7, and 6.1 questions, respectively. Students performed well on maintenance probes. The average number of correct responses on maintenance probes was 10, 9, and 6.33, respectively. This study was important for several reasons. Not only were students able to answer comprehension questions, but the intervention acquired social validity status (Courtade et al., 2017). The students' special education teacher favored the intervention and indicated the least prompts method was appropriate. Teachers indicated the intervention was beneficial to students and was user-friendly. The study extended research using the least prompts method, and added to a lack of research using least prompts with social studies text to teach comprehension to students with severe developmental disabilities. It is important to note that procedures utilized in this study enabled students with communication deficits to respond by pointing (Courtade et al., 2017). There is a need for more evidence-based practices in literacy to benefit students with communication disorders. Further, with the development of the conceptual foundation model by

Browder and colleagues (2009) there is a need for an assessment instrument. Since the passing of the Individuals with Disabilities Education Improvement Act, 2004, a federal law that holds school systems accountable for the progress of all students who have access to the general education curriculum, it is important that teachers have literacy assessment instruments for all students including those with communication disorders.

The Legitimacy of Nonverbal Literacy Measures

Before the passage of the Individuals with Disabilities Education Act (IDEA, 1997) which mandated all students with disabilities participate in educational assessments on the state and district level, there was little interest is addressing the academic needs of students with significant intellectual disabilities. Because traditional reading assessments require verbal responses, there was a need for an alternative assessment for nonverbal students (Baker, Spooner, Ahlgrim-Delzell, Flowers & Browder, 2010). Researchers created the Nonverbal Literacy Assessment (NVLA) to measure early literacy skills in students with severe developmental disabilities who experience communication difficulty. Further, the IDEA assessment mandate created a need for an instrument that connected reading instruction with states' alternate achievement standards. The NVLA assesses four of the components of reading outlined in the National Reading Panel (2000) report, and two components of the conceptual foundation model. The NVLA consists of six factors: phonics, phonemic awareness, vocabulary, comprehension, text awareness, and listening comprehension. The administration of the NVLA is scripted and utilizes a receptive response format that allows students to respond using alternative methods. Students may respond using the following methods: finger pointing, eye-gazing, pulling responses from selections on response cards, or responding verbally when

possible. Researchers conducted a study to evaluate the processes of three models created using the components of the NVLA (Baker et al., 2010).

This study implemented a five-step confirmatory factor analysis method to test the data of the three theoretical models. The first test examined a six-factor model: phonics, phonemic awareness, vocabulary, comprehension, text awareness, and listening comprehension. The second investigation implemented a two-factor model: conventions of reading (listening comprehension and text awareness) and phonological skills (phonics, phonemes, vocabulary and comprehension). Additionally, model two investigated students' gains in listening comprehension during read-alouds. The third model investigated the NVLA using a global literacy model. The results were positive (Baker et al., 2010). The data indicated that the NVLA may assess a unidimensional literacy construct for students with severe disabilities. Furthermore, the results showed that the NVLA can be used as a tool to assess literacy skills with students with low incidence disabilities who experience communication difficulty, and that generalizations can be made from its findings. The data supported the theory that there should not be one superior element used to teach reading. The study further supported literacy instruction that used an integrated approach and incorporated the National Reading Panel's (2000) components as well as increased opportunities to access literature (Baker et al., 2010).

Comprehensive Literacy Instruction

Since the assessment demonstrated that students with significant developmental disabilities needed literacy instruction that went beyond sight words, there was a need for a comprehensive reading intervention. Allor, Mathes, Roberts, Jones, and Champlin (2010c) conducted research to evaluate the effectiveness of a comprehensive, direct instruction reading intervention that targeted oral language, phonemic awareness and decoding, alphabetic

knowledge as well as basic comprehension strategies for students with IQs between 40 and 55. The research study lasted a year and a half. The intervention, *Early Intervention in Reading* (Mathes & Torgesen, 2005a), benefited at-risk students with average IQ levels. Researchers modified the reading techniques and incorporated oral language storybook strategies to address the needs of learners with significant intellectual disabilities. Students participated in activities that provided practice sessions, in-depth modeling with feedback along with activities that advanced phoneme segmentation and blending skills (Allor et al., 2010c).

The research study used a randomized trial method with repeated measures of phonemic decoding and phonemic awareness with pretest and posttest assessments. Twenty-eight elementary students in grades one through four participated in the study. Researchers recruited from ten public schools in an urban southwestern school district, and one private urban school that only serves students with intellectual disabilities. Researchers randomly assigned sixteen students to the treatment group and twelve students to a contrast group. Students in the contrast group received the type of special education instruction usually received by this population (Allor et al., 2010c). Researchers developed lessons that consisted of instruction that overlapped in academic content, thus allowing one skill to overlap with another skill. Researchers implemented seven instructional strands using the intervention which consisted of the following: concepts of print, phonological and phonemic awareness, letter knowledge, word recognition, fluency with connected text, comprehension strategies, and vocabulary and oral development. Researchers created 60 lessons they referred to as the *Foundational Level* to teach pre-basal level literacy skills and an additional *Level One* component. Students in the *Foundation Level* advanced their concepts of print by participating in storybook read-alouds. During the next strand, phonological and phonemic awareness, students clapped out syllables and engaged in

phoneme blending and segmentation, initial sound isolation, and phoneme discrimination. Researchers taught students to map phonemes with newly introduced letter sound correspondence and students participated in cumulative review activities. Additionally, research staff taught students to decode regular words, blend letter sounds, and read high-frequency irregular sight words (Allor et al., 2010c).

During *Level One*, students participated in fluency tasks with connected text focused on word recognition strategies using decodable stories. Teachers engaged students in repeated readings of stories and taught methods to assist with gaining meaning from textual information. Students participated in discussions about stories, made predictions and received prompting to activate prior background knowledge to expository text. Comprehension tasks included identifying story grammar components for narrative stories (Allor et al., 2010c). During instruction in the vocabulary and oral strand, students at the *Foundation Level* participated in read-alouds as they received explicit direct instruction in spoken language and engaged in discussions using open-ended questions. Students in *Level One* read themed books to enhance vocabulary and received support during story retell activities to support usage of complete sentences when speaking (Allor et al., 2010c).

The results showed a significant increase in literacy skills for students in the intervention group compared to the performance levels of students in the contrast group (Allor et al., 2010c). The *Comprehensive Test of Phonological Processing* revealed statistically significant results on measures of blending non-words, segmenting words, and stop matching (CTOPP; Wagner, Torgesen & Rashotte, 1999). Assessments using the *Test of Word Reading Efficiency* (TOWRE; Torgesen, Wagner & Rashotte, 1999) returned significant results on phonemic decoding efficiency. Results of *The Woodcock Language Proficiency Battery-Revised* (WLPB-R;

Woodcock, 1991) were statistically significant on measures of letter-word identification and word attack (Allor et al., 2010c).

Furthermore, the *Dynamic Indicators of Basic Early Literacy Skills* (DIBELS) posttest data indicated that students in the intervention group experienced a large rate of growth on measures of Phoneme Segmentation Fluency (PSF) and Nonsense Word Fluency (NWF) (Allor et al., 2010c). The DIBELS measures of Initial Sound Fluency (ISF), indicated that students in the intervention group and the contrast group experienced growth at the same rate of change. Researchers attributed this non-significant result to challenges resulting from the language and cognitive requirements essential to demonstrating phoneme isolation tasks (Allor et al., 2010c). Additionally, effect sizes were strong on the TOWRE Word Reading, .72, and on WLPB-R Letter Word Identification, .99. Measures of oral language and comprehension were favorable with moderate to strong effect sizes that ranged from .36 to .71. The outcome of this study confirmed that, when provided with instruction using a systematic approach to delivery which integrated instructional content strands, students with significant intellectual disabilities benefited from a comprehensive reading program. This study added to the literature and showed that students with significant intellectual disabilities incorporated individual phonics skills and phonemic awareness skills to decode untaught words. The study showed that under these conditions, this population of students increased sight word recognition as well as oral language skills and basic comprehension skills (Allor et al., 2010c). This research was important because it showed that students with significant intellectual disabilities could achieve reading gains. Further research would be needed to confirm the notion that students with intellectual disabilities can become skilled readers over time.

Therefore, Allor and other colleagues continued to study the effects of the *Early Interventions in Reading* program (Allor, Mathes, Roberts, Cheatham & Champlin, 2010b). Unlike the previous research with Allor and other colleagues (2010c), this study investigated the effects of the program across an extended period time using students with IQs between 40 and 69. This study included participants with mild and moderate intellectual disabilities who received the intervention for two to three years. Paralleling the work of Allor et al. (2010c), fifty-nine participants, in grades one through four participated in random assignment to either the treatment group (35 participants) or to the contrast group (25 participants). Researchers recruited participants from a larger sample of students created by Allor and other colleagues (2010a, 2010c) from the same southwestern school district and one private urban school for students with disabilities. Students in the contrast group received typical instruction in their special education classroom which consisted of either a structured reading curriculum, an unstructured basic literacy program, or sight word instruction (Allor et al., 2010b). Students in the intervention group received 40 to 50 minutes of instruction using lessons researchers created with the *Foundation Level, Level One* and *Level Two* of the *Early Intervention in Reading* curriculum (Mathes & Torgesen, 2005a, 2005b). This study focused on the same instructional strands as did Allor et al. (2010c) in the year and a half study. The intervention received an implementation fidelity rating of 92%, and students received an average of 79.54 weeks of instruction (Allor et al., 2010b).

The results revealed significant levels of reciprocity between time and treatment on measures of blending nonwords, segmenting words, and word attack. Effect sizes were moderate on measures of phonemic awareness and phonemic decoding. Low to moderate effect sizes were observed on measures of language and word identification as well as negligible effect sizes were

found on the measure of comprehension. DIBELS progress monitoring measures for phoneme segmenting fluency (PSF), nonsense word fluency (NWF), and oral reading fluency (ORF) revealed the intervention group made significant gains versus the contrast group on all three dependent variable measures (Allor et al., 2010b). The data also showed that following 105 weeks of instruction, the participants in the treatment group would continue to outperform the contrast group on DIBELS measures for PSF, NWF and ORF. Students in the treatment group outperformed students in the contrast group on standardized measures of language and reading following two to three years of instruction with the intervention. Students in the intervention group made significant achievements on assessments involving oral language and vocabulary, phonemic awareness, comprehension, phonemic decoding and sight word reading (Allor et al., 2010b). Predicted scores suggested that a student in the treatment group would earn an oral reading score of 44 words per minute, which indicated the ability to read first grade reading passages, after receiving 105 weeks of the reading intervention. The findings in this study validated the results of prior studies. The findings showed that students with intellectual disabilities could demonstrate the ability to gain and employ phonemic, decoding, and phonological awareness skills to read words. The results supported that explicit, direct reading instruction, systematically delivered to students with intellectual disabilities, over an extended time period, enabled them to become skillful readers (Allor et al., 2010b). Researchers Allor, Mathes, Roberts, Cheatham, and Otaiba (2014) further substantiated this point in their cumulative report of a four-year, longitudinal randomized control trial reading intervention using the *Early Interventions in Reading* (Mathes & Torgesen, 2005a, 2005b). This study was different from other studies in that it used a larger sample of participants and students with IQ levels ranging from 40 to 80. Researchers divided participants into three groups according to the

guidelines of traditional IQ score categories for intellectual disability: moderate IQ levels ranging from 40 – 55, mild IQ levels ranging from 56 – 62, and borderline IQ levels between 70 – 80. The study design included the assignment of 76 students to the intervention and 65 students to the contrast group. The study spanned across four years (Allor et al., 2014). This study report encompassed data from students in the borderline range and moderate range not included in previous findings. This report also examined the findings on additional research questions. First, the researchers in this study explored whether a comprehensive reading program shown to benefit struggling readers would benefit students with IQ levels ranging from 40 to 80. Second, researchers wanted to know whether IQ levels affected students' rate of response to the intervention. Third, researchers sought to determine if there were significant differences in listening comprehension or reading comprehension on the outcomes of end-of-the-year assessments following treatment (Allor et al., 2014).

The results showed that the scores of the students in the treatment group were statistically significant on nearly all measures. This included blending nonwords and real words, vocabulary (expressive and receptive), segmenting, decoding, and timed high frequency words. The treatment group also had statistically significant different results on oral reading fluency measures (Allor et al., 2014). Moreover, researchers elaborated on the nonsense word fluency model and the oral reading fluency model. The results of the DIBELS NWF, which measured phonemic decoding, predicted values model showed that after 130 weeks of instruction with the intervention, students in the borderline IQ group, the mild IQ group and the moderate IQ group outperformed contrast group students, respectively (Allor et al., 2014). Likewise, the predicted values formula for the DIBELS ORF measure showed that after receiving 130 weeks of

instruction, students in the intervention group in each IQ category outperformed students in the contrast group in each category (Allor et al., 2014).

This research provided the first of its kind evidence to support the benefits of a comprehensive structured reading intervention implemented, over an extended period, to students with intellectual disabilities. As anticipated, in most cases but not all, the progress of students with low IQs in the intervention group was not equal to that of others with higher IQs. Further, an analysis of data revealed that a student's IQ level had a statistically significant effect on the individual's rate of response to intervention. This finding was true of students in the intervention and contrast groups on assessments evaluating ORF, phonemic decoding, vocabulary, and word recognition. In contrast, IQ level did not have a statistically significant effect of response measures of phonological processing (Allor et al., 2014). The results showed that it took a student with an IQ in the borderline range of 75, 52 weeks of treatment to advance from an ORF level of 20 words per minute to 60 words per minute. In other words, the data showed that a student with an IQ between 70 and 80 would need to spend a year and a half of school years in the intervention to master an end of year first grade reading level. Additionally, the data showed that a student with an IQ in the mild range would require three school years of instruction with the intervention to progress from 10 words per minute to 60. A student with an IQ in the moderate range of 40 to 55 would demand three and a half school years in the intervention to progress from zero words per minute to 20 words per minute. This is equivalent to the reading level of middle first grade (Allor et al., 2014).

These research findings showed statistically significant differences in support of the treatment group on reading comprehension but not on listening comprehension (Allor et al., 2014). Researchers speculated that if students in the treatment group experienced gains in

language, fluency, and reading, they would experience increased listening and reading comprehension. Additionally, the research targeted reading comprehension as opposed to listening comprehension (Allor et al., 2014). The findings of this study were momentous in that they resulted in well-founded empiric evidence of significant increases in literacy spanned across multiple academic years. Unlike similar studies in literacy, this study included a comparatively sizeable sample of students with low IQs in a randomized control trial that delivered a comprehensive, structured, direct instruction program using explicit teaching strategies. Highly trained teachers delivered the intervention with high fidelity (Allor et al., 2014). This study revealed that reading is an achievable skill for students with low IQs. Not only was it important for researchers to demonstrate that students with significant intellectual disabilities can read words, interventions to facilitate reading comprehension were also essential to developing a beneficial reading program.

Teaching Comprehension of Text

Comprehension is another important component of reading instruction that should be included in literacy instruction. Browder, Hudson and Wood (2013) implemented a reading comprehension intervention with three participants with significant intellectual disabilities with intellectual quotients in the range of 55 and below. The research design consisted of a multiple probe across participants design. Researchers sought to evaluate participants' ability to answer the following WH comprehension questions: Who? What? When? Where? Why? and How? Two dependent variables were measured during the study: 1) the correct number of independent WH words paired correctly with the definitions, and 2) the number of comprehension questions answered correctly. Participant one had an IQ of 51, participant two had an IQ of 45, and participant three had an IQ of 47 (Browder et al., 2013).

Browder et al. (2013) implemented a treatment package that consisted of instruction using time-delay, graphic organizers to teach definitions of WH words, and a modified system of least intrusive prompting to teach students to answer comprehension questions. Participants in this study could decode short reading passages on the middle first grade reading level. Researchers adapted grade level text to create four reading books that consisted of 10 chapters (Browder et al., 2013). Researchers formulated six WH questions based on the adapted reading materials. Participants read two book chapters per session. Researchers used word cards and time delay to teach students to pair WH words with the correct definition, say the definition, and identify examples of each WH word. Participants learned to find the definition card from an array and place the WH word card and its definition card on the graphic organizer. As in the WH definition procedures, the participant placed the WH example and the WH question on a graphic organizer (Browder et al., 2013).

During the comprehension phase of the research study, participants read each book aloud. Teachers provided assistance to students during read-alouds to help with missed and unfamiliar words. Students read each chapter a second time after receiving assistance from the interventionist. Prior to receiving comprehension questions, researchers gave students graphic organizers with WH words, and their definitions (Browder et al., 2013). Participants could answer with a verbal response or touch text in the book. When participants failed to respond correctly, the interventionist provided a prompt using a modified system of least intrusive prompting. The level of prompting assistance increased with each incorrect response. A level one prompt included restating the question with the definition. The highest prompt included restating the question, the definition and giving the student the answer as well as the location of the

answer in the text. Researchers praised students throughout the intervention, however, as sessions progressed praise faded (Browder et al., 2013).

Study results showed that there was a functional relation between the comprehension intervention and the number of comprehension questions independently answered correctly by participants. Study participants demonstrated behaviors that showed they reached criteria for maintenance on WH definition probes. Furthermore, there was a functional relation between the time delay procedure and the number of WH word definitions correctly identified by participants. The study results showed a substantial increase in the number of WH words and definitions paired correctly, and the number of comprehension questions answered correctly after receiving the intervention (Browder et al., 2013). First, participants answered *where* questions most frequently with an average of 79.7% correct responses. Second, *what* questions were answered frequently with an average of 77.78% correct. Third, *who* questions were answered often with an average of 65% answered correctly. Individual results showed that all participants benefited from participation in the intervention (Browder et al., 2013). For example, participant number one experienced significant increases in the number of WH word definitions as well as comprehension questions. Participant number one's performance on WH questions from baseline to intervention was as follows: *what* questions increased from 50% to 90%, *where* questions increased from 30% to 90%, *who, when, how,* and *why* questions increased from 10% to 57.5%, 75%, 60%, and 55% respectively (Browder et al., 2013). Participant two experienced increases in the number of *what* questions answered correctly from 30% to 63.33%, *who* questions from 20% to 60%, and from 10% in *where* and *how* questions to 66.7%, and 50%, respectively, after receiving the intervention. Participant two increased from 0% correct responses on *why* and *when* questions to 43.33% of *why* questions, and 13.33% of *when* questions after receiving the

intervention. The third participant, experienced gains in the ability to answer *where* questions from 40% to 82.5%, *what* questions from 30% to 80%, *why* questions from 30% to 55%, *how* questions from 39% to 67.5%, *who* questions from 20% to 77.5%, and *when* questions answered correctly increased from 0% to 62.5% (Browder et al., 2013).

Teachers and participants indicated that the intervention was socially valid. The participants indicated on the questionnaire that they liked answering questions, reading books that other students were reading, learning definitions, reading books by themselves, and using graphic organizers. Moreover, teachers indicated that students with significant intellectual disabilities can learn to read, and students benefited from using graphic organizers (Browder et al., 2013). This study added to the literature that is lacking in the number of research studies for teaching comprehension to students with significant intellectual disabilities. Research-based instructional practices for literacy development for students with significant intellectual disabilities will have a major impact on the lives of these members of society. This study also showed that graphic organizers can be used to support instruction in reading comprehension with this population of students. Further, this research added to the number of studies showing that time delay and least intrusive prompting is an effective instructional strategy when teaching essential skills to students with intellectual disabilities (Browder et al., 2013). Equally important, this study focused on the complexed skill of comprehension. The text used in this study was appropriate for this group of students with below grade level reading skills because the study used age appropriate textual content that was also interesting to the participants. Teachers should strive to implement reading programs that utilize age appropriate text and seek to achieve comprehension of relevant information for their students. Without regard to their ability to read

textual information, all students with significant intellectual disabilities should have the opportunity to interact with textual information (Browder et al., 2013).

Udio - UDL Online Literacy Environment

Technology provides a mode for 21st century students with disabilities to interact with various genres of literature. Research shows that students with significant intellectual disabilities should have access to grade level texts. Too often, because the level of literacy development for students with intellectual disabilities is significantly lower than their grade level, it is difficult for them to access appropriate literature. Being able to access appropriate text and engage with peers on social issues and topics of interest is very important. Something as simple as creating a grocery list to make a favorite snack with a friend is an important task for a young person. Recently, Coyne, Evans and Karger (2017) performed qualitative research to investigate the experiences of students with significant intellectual disabilities in an online literacy environment. Coyne et al. explored Udio, an online literacy environment that employed the principles of Universal Design for Learning (UDL). UDL incorporated three principles to maximize learning through multiple means of engagement, multiple means of action and expression, and multiple means of representation (CAST, 2018). Udio, a UDL digital literacy environment, was designed to increase literacy achievement for middle school students with high incidence disabilities. (Coyne, Evans & Karger, 2017). Udio aimed to boost reading comprehension and cultivate interest and time spent reading for a population of students marginalized by long established practices (Coyne, et al., 2017). Udio consisted of three main components: Explore, Dashboard, and Create. Students received feedback about their selections and activities in the Dashboard component. The Explore feature enabled students to browse topics and literature. The Create module provided templates in which students created reading projects based on the materials

they read. Further, Udio provided tools that supported students such as the following: drawing tools, writing tools, videos, sentence starters, audio recording, and audio-assisted reading (text readers) as well as dictionary support, and a single word Spanish translator (Coyne et al., 2017).

In this study, ten students with intellectual and developmental disabilities (IDD), ages 10 to 14 years, and seven teachers participated. All students communicated verbally. One student read on the kindergarten level, six students read on the first-grade level, and one student read on a third-grade level. Once trained on the usage of Udio software, teachers provided one-on-one instruction to their students on how to use the features of Udio. Teachers received technological support from researchers on a continuous basis during the study. Students used Udio instead of their regular reading program three times a week and engaged in sessions that lasted 20 minutes (Coyne et al., 2017). Teachers provided students with a substantial amount of one-on-one support. However, the need for one-on-one instruction from teachers dissipated over time. Teachers indicated 100% independence among students with their usage of all three components of Udio within a short period of time. Additionally, it was reported that once students learned to use Udio, they only needed teachers to assist with spelling or mechanics issues (Coyne et al., 2017).

Udio event logs showed that the students published 65 projects, commented on discussion boards 257 times, and read 195 articles (Coyne et al., 2017). All students used the audio-assisted reading feature, and half of the students posted comments and responses using sentence starters which helped them with their writing. Students made online comments to teachers and peers with the text, audiorecord, and draw response features of Udio. One of the teachers commented that the audio-assisted reading feature eliminated frustration associated with reading difficulty because students could hear text as they read (Coyne et al., 2017).

Three themes emerged from data analysis of students' perceptions of Udio: age-relevant content, socializing, and opportunities for choice. Teachers noted that students' interests increased on topics in areas such as cyberbullying, the 2010 earthquake in Haiti, and Beyonce. Teachers indicated that these topics were of high interests to students and facilitated discussions between students (Coyne et al., 2017). Classroom observations revealed that students chose articles that interested them. For example, one student, with an interest in animals, selected an article about the ethical concerns of renting pets. Teachers and students engaged in online conversations about age-appropriate topics of interest to students such as dating violence. Further, students gained access to textual information beyond their reading levels. Teachers expressed delight in seeing readers accessing level five and six texts (Coyne, et al., 2017). The amount of self-rule students experienced made them enthusiastic as they accessed materials, articles, and discussion boards independently. Students exhibited a high level of self-reliance in their abilities to select what, when, and how to read articles that interested them without being dependent on a reader, or under the auspice of someone else because of their disability. Teachers saw value in students being able to access various types of bona fide, age appropriate literature. Students socialized with peers, discussed literature, and engaged in discussions of social importance with teachers and peers using Udio (Coyne et al., 2017). Additionally, students made a significant number of relevant comments related to academic content areas. Teachers utilized the online environment to praise their students for their participation in online literacy. Online socializing between peers led to socializing and interacting offline as students met and helped each other with literacy projects before they published them online. Currently, this is the only study of its kind which investigated the benefits of an online UDL literacy environment to improve literacy skills of middle school students with IDD (Coyne et al., 2017).

The findings in this qualitative study demonstrated that students with significant intellectual disabilities successfully navigated an online environment to access age-relevant text. The study revealed that students with intellectual disabilities gained a deeper understanding of grade-level appropriate text. Students interacted with peers about academic content using an online platform that was designed to benefit students with high incidence disabilities (Coyne et al., 2017). This research added to the literature showing that students with significant intellectual and developmental disabilities benefited from instructional resources originally designed for general education students such as online literacy (Coyne et al., 2017). Perhaps this brand of research for turning instructional resources, and practices for general education students into resources and practices to benefit students with low incidence disabilities will become a trend. Researchers have performed work to add to the literature for investigating the benefits of literacy practices beyond sight word instruction for students with low incidence disabilities.

Systematic Explicit Direct Instruction

Thus far, only a limited number of studies examined teaching letter sound correspondence, phonic decoding, and word reading with students with significant intellectual disabilities. Flores, Shippen, Alberto, and Crowe (2004) investigated a Direct Instruction reading program to teach letter sound correspondence, blending letter sounds, and phonic decoding as well as word reading to students with significant intellectual disabilities. Researchers recruited six students, three males and three females, ages ranged from eight to thirteen years, from a self-contained special education classroom (Flores et al., 2004). Two students required special education speech services and a third student displayed problem behaviors. Study participants had IQ levels that ranged from 38 to 52 and adaptive behavior scores from 44 to 63. Pre-

intervention assessments showed that participants lacked prior knowledge on letter sounds and C-V-C words targeted in the study (Flores et al., 2004).

The intervention was a modified version of the *Corrective Reading: Word-Attack Basics, Decoding A* Direct Instruction reading program (Englemann, Carnine & Johnson, 1988). Students received explicit direct instruction on the letters *m, a, s,* and *t*. Researchers modified the original program by excluding the letter *e* due to its visual similarity to the letter *a*. Researchers altered the order of presentation and taught the letter *m* before *a* because *a* had been previously taught as a sight word (Flores et al., 2004). The intervention incorporated three instructional conditions. Condition one consisted of three phases, and conditions two and three involved four phases. Instruction was scripted, and the teacher modeled target behaviors and guided students on how to perform target behaviors. Next, the teacher engaged students in independent practice followed by reinforcement activities. The teacher employed a scripted, model, lead, and test strategy when correcting students during instruction (Flores et al., 2004). During instruction, the teacher used letters and consonant-vowel-consonant (c-v-c) words printed on sheets of paper along with recordings of letter sounds created using a single-switch alternative augmentative communication (AAC) device. Additionally, the teacher used pictures of formerly taught compound words and a rubber band to teach fast and slow blending techniques to students and during the decoding phases of the intervention (Flores et al., 2004).

In condition one, phase one, the teacher taught letter-sound identification for the letter *m* followed by letter-sound identification for the letter *a* in phase two. In phase three, students received instruction to discriminate and blend the letters *m* and *a* (Flores et al., 2004). In condition two, the teacher repeated the instructional procedures listed in condition one for the letters *s* and *t*, respectively. Condition two included a fourth phase that consisted of instruction to

discriminate and blend the letters *m, a, s,* and *t*. Condition three focused on word decoding tasks. In phase one of condition three, the teacher taught students to blend the c-v-c word *mat*. Phase two of condition three consisted of instruction to decode the word *mat* by blending and saying the sounds fast (telescoping). In phase three of condition three, the teacher taught students to blend the word *sam*. Instruction in phase four of condition three involved blending *sam* then saying the blend fast (telescoping) (Flores et al., 2004).

In this study, the independent variable entailed the use of explicit, Direct Instruction methods used with a modified version of the *Corrective Reading Program: Basic Word-Attack, Decoding A* reading program to teach letter sound correspondence, blending, and telescoping c-v-c words created using the letters *m, a, s,* and *t*. The dependent variables measured students' performance on the following probes: single-letter identification, discrimination, and slow and fast blending c-v-c words (Flores et al., 2004). Dependent variable probes correlated with the instructional phases presented during the intervention. Additionally, students had to reach criterion of mastery across three probes in each phase of the intervention to qualify for participation in the next phase. On single-letter identification probes, the teacher presented several versions of displays using the target letter (i.e. *m, a, s* or *t*) along with pictures of diversions. Next, the teacher asked the student to say the sound represented by the target letter pictured on the display (Flores et al., 2004). During discrimination and blending probes, the assessment employed the presentation of letters (two or four letters) then required the student to say the sound made by the target letter. Discrimination probes demanded students to differentiate between the following letter combinations: *m* and *a*, then *s* and *t,* and ending with all four letters, *m, a, s,* and *t* (Flores et al., 2004). During the first decoding probe, the teacher showed the student a sequence of c-v-c words and prompted the student to articulate the words slowly. The

second decoding probe required students to articulate c-v-c words fast. During decoding probes, the teacher required students to blend taught and untaught c-v-c blends slow and fast (Flores et al., 2004).

The data showed that prior to the intervention, students failed to identify the target letters *m, a, s,* and *t.* After receiving explicit, Direct Instruction, all students attained a level of 100% accuracy on criterion for letter-identification of the letters *m* and *a* (Flores et al., 2004). One student, who had an articulation deficit, failed to say the letter *s* sound within three probes, and did not respond with the correct sound on the letter *t* probe. Because this student did not respond correctly on all single-letter probes, only the five remaining students who performed correctly continued to participate in the study. The participants reached levels of 100% accuracy and met criterion on blending and discrimination probes for *s*|*t*, and the letters *m, a, s,* and *t.* Students used their knowledge of letter sound correspondence and blended and telescoped the words *sam* and *mat*. Additionally, students participated in a generalization phase one month after they received the intervention. All five students exhibited criterion level mastery on slow blending with two untaught words presented during the generalization phase. Students demonstrated mastery of letter-identification, blending, and decoding to articulate two taught words fast and two untaught words slow. One student articulated both untaught words fast (telescoping) (Flores et al., 2004).

Researchers conducted follow-up probes that consisted of blending and telescoping tasks with the three participants who attended the special education extended school year program. Two students performed blending activities with words explicitly taught and unfamiliar words with 100% accuracy. The third student made only one error on the follow-up probes (Flores et al., 2004). Participants experienced different results on follow-up telescoping tasks that involved

taught and untaught words. On follow-up probes, one student performed accurately on 7/8 trials, the second student successfully telescoped one taught word, and the third student failed on all telescoping tasks (Flores et al., 2004).

Bradford, Shippen, Alberto, Houchins, and Flores (2006) extended the line of research on Direct Instruction to teach reading to students with low incidence disabilities. Bradford et al. used the *Corrective Reading Program* (Engelmann, Becker, Hanner & Johnson, 1980), which is an explicit Direct Instruction reading program. Researchers examined whether decoding skills could be generalized to unfamiliar functional and community words (Bradford et al., 2006).

Three male middle school students, ages ranged from 12 to 15 years, participated in the study. Participants' IQ scores ranged between 46 to 55 and adaptive behavior scores ranged from 38 to 57 (Bradford et al., 2006). Two students had moderate intellectual disabilities and the third student had a traumatic brain injury. Prior to the intervention, participants received instruction that involved sight words which was halted during the study. Participants had not received any instruction on letter sound correspondence before entering the intervention. The research consisted of a pre- and post-test design. The criterion referenced intervention, *Corrective Reading Decoding,* Level A (Engelmann, Carnine & Johnson, 1988), was scripted and required students to provide verbal responses. The intervention lasted six months. Students received 55 to 65 minutes of instruction two to three times per week, a total of 65 sessions. Initially during instruction, students participated in oral activities to produce letter sounds, manually wrote letter sounds and engaged in word reading exercises (Bradford et al., 2006). Next, teachers modeled target behaviors and provided guided practice to students with corrective feedback. Students engaged in independent practice sessions and activities that required oral responses using words with like sounds. Students identified middle sounds in words and engaged

in activities to sound out words. Additionally, students completed workbook assignments in which they spelled words, wrote letter sounds and words from dictation, identified sounds on worksheets, and performed matching tasks as well as reading tasks that used sentences and short stories (Bradford et al., 2006).

At the end of the intervention, students mastered criterion referenced measures on the following tasks: oral letter sound correspondence, word recognition, and written letter sound correspondence (Bradford et al., 2006). Students exhibited the ability to decode irregular words, blend sounds to decode and read words, identify letter sound correspondence and sound out words. Students demonstrated the ability to read passages that exceeded the first- grade reading level. Post-test data showed that the students increased knowledge of functional and community sight words on the Edmark® (1992) Functional Word List and the Dolch (1955) Sight Word List. One participant increased the number of words identified on the Edmark word list from 123 to 155 words, an increase of 21%. The second participant increased his knowledge of Dolch words from 32 to 100 words, a 60% increase, and the third participant demonstrated an increase from 49 to 100 words, a 51% increase (Bradford et al., 2006).

Post-test data revealed that students utilized their new decoding skills to read untaught regular sight words. The results showed that middle school students with significant intellectual disabilities could acquire literacy skills using an adapted version of a pre-existing reading program designed for general education students (Bradford et al., 2006). Nevertheless, the discriminatory biases of notions that students with significant intellectual disabilities are unable to acquire traditional literacy skills continues to plague this population. The erroneous assumption that students with significant intellectual disabilities are unable to benefit from research-based instructional programs and methods designed for general education students, at-

risk or struggling students should end as evidenced in another study by Benedek-Wood et al. (2016). Benedek-Wood and colleagues went beyond the work of Bradford et al. (2006) and investigated teaching letter sound correspondence to students with communication disorders (Benedek-Wood et al., 2016).

Instruction in Letter Sound Correspondence with Students with Autism

Researchers estimate that nine out of ten persons with communication deficits such as those with Down syndrome, cerebral palsy or autism spectrum disorder (ASD) will not learn functional reading skills. This high rate of illiteracy is due in part to students not receiving appropriate instruction or no instruction in reading. At present, there is limited research to help educators and researchers understand how to effectively teach literacy to young children with severe communication disorders (Benedek-Wood, McNaughton & Light, 2016). Researchers Benedek-Wood et al. (2016) conducted a study to explore the effects of explicit instruction in letter sound correspondence to three preschool children with ASD. This study was important because roughly 30% of people diagnosed with ASD will not possess speech and there are other students with developmental and intellectual disabilities who experience severe communication disorders (Benedek-Wood et al., 2016). Participant one was three years six months in age. Participant two was age five years six months, and participant three was age four years eleven months. The participants attended a school that specifically provided early childhood special education services to students diagnosed with ASD. All three participants possessed severe communication disorders. These students exhibited the following behaviors: unable to demonstrate effective speech, able to follow simple one-step directions, and able to choose visual targets from an array of choices in response to a request (Benedek-Wood et al., 2016).

The intervention, which took place during the final two months of school, aimed to teach letter sound correspondence for the letters *o*, *t*, *r*, *l, u*, and *p* using explicit instruction (Benedek-Wood et al., 2016). The researchers implemented a multiple probe across participants research design. Each 20-minute intervention session included the following: 10 minutes of instruction, five minutes engaging in an extension activity, and five minutes participating in a chosen activity (Benedek-Wood et al., 2016). Researchers defined the independent variable as instruction in letter sound correspondence (LSC), and the dependent variable was the number of correct responses on LSC probes. Instruction employed explicit instruction techniques which involved the following: teacher modeling, guided practice, corrective feedback with increasing levels of support, independent practice, and providing extra practice using extension activities (Benedek-Wood et al., 2016). Instructional materials included the following: (a) 2 x 2-inch target and nontarget letter cards using an 83-point Arial font, (b) a box to place the cards in, (c) a place mat, and (d) 3 x 3-inch picture cards containing words that represented the sounds of target letters. Extension materials consisted of a book of pictures representing target sounds, a game for identifying hidden letters, and color and pasting activities that represented sounds in target words (Benedek-Wood et al., 2016).

During instruction, the researcher modeled the correct behavior to demonstrate letter sound knowledge for the target letter. The researcher demonstrated by looking at the letter and pointing to the correct letter and saying its sound. The teacher demonstrated how to select a letter card for a given letter sound (Benedek-Wood et al., 2016). Throughout guided practice, the researcher and the participant performed the behaviors together, and provided opportunities for the participant to mimic the teacher's behavior. For example, the teacher and the student touched the target letter together after the teacher supplied the target sound. Next, the teacher prompted

the student to touch the target letter without the teacher's assistance. The goal was for the student to point to the target letter that corresponded to the letter sound made by the teacher from a choice field of six letters (Benedek-Wood et al., 2016). Researchers provided multiple trials during independent practice activities and ample amounts of practice to facilitate mastery on letter sound correspondence probes. Each instructional session concluded with an extension activity of interest to the participant which served as a reward for student's participation in the lesson (Benedek-Wood et al., 2016).

The results of the study showed that students increased their knowledge of letter sound correspondence. The procedural integrity rating for steps correctly implemented during instruction was 100%. The interobserver agreement for independent practice and LSC probes averaged 99%. Following the intervention, data revealed that participant one increased from 1.3 LSC, 11% accuracy, before the intervention to master all six (*o, t, r, l, u,* and *p*) letter sound correspondences with 92% accuracy (Benedek-Wood et al., 2016). The second participant responded correctly to two letters on letter sound correspondence probes with 17% accuracy before receiving the intervention. Due to time constraints (end of the school year), the remaining students did not receive instruction on all six letters. Participant two only received instruction on five (the letters *o, t, r, l* and *u*) of the six target letters. After receiving the intervention, participant two correctly responded to four of five letters on LSC probes with 97% accuracy for the letters *o, t, r,* and *l.* The third participant received instruction on four target letters, *o, t, r,* and *l*. Prior to receiving the intervention, participant three correctly responded to 2.3 LSC probes with 19% accuracy. At the end of the intervention, participant three demonstrated 87% accuracy with the letters targeted during the intervention, this included the letters *o, t, r,* and *l* (Benedek-Wood et al., 2016).

Additionally, information from the participants' teachers indicated that the research had socially validity. The results of a questionnaire distributed to teachers revealed that the intervention improved participants' reading skills, benefited students with ASD, and could be implemented in student's natural environment. Observations of the participants showed that students laughed and smiled during activities and did not require reinforcement to remain engaged during the intervention (Benedek-Wood et al., 2016). Moreover, an analysis of data showed the intervention to be an efficient method of instruction. For example, participant one required six sessions of instruction for acquisition of each letter sound correspondence, participant two received six and half intervention sessions to acquire knowledge of each letter sound correspondence, and participant three only required three and half instructional sessions to acquire letter sound correspondence knowledge (Benedek-Wood et al., 2016). The study showed that students with autism spectrum disorder (ASD) benefited from explicit systematic instruction, corrective feedback, scaffolding supports, and adaptations to oral response methods of instruction (Benedek-Wood et al., 2016).

These aforementioned studies exemplify a need for reading research for people with low incidence disabilities using comprehensive literacy elements such as phonemic awareness and phonics instruction. These are the components of this study for teaching letter sound correspondence to preschool students with disabilities. Due to the lack of research, the probable effects of explicit phonics instruction with this population has yet to be determined. The purpose of this study is to investigate the effects of teaching letter sound correspondence to preschool students with developmental delay, autism, and intellectual disabilities using systematic explicit instruction strategies. Furthermore, because of the communication difficulties experienced by students with developmental delay, intellectual and developmental disabilities such as autism, a

need exists for literacy research of this kind that uses verbal and nonverbal students. The current study included participants with communication disorders. Researchers anticipate the intervention will yield data to support the development of an evidence-based practice that will enable students with low incidence disabilities to exhibit knowledge of letter sound correspondence. Researchers hypothesize that a significant positive change in student achievement of letter sound correspondence will be experienced by the study participants.

The literacy intervention in this research used explicit instruction strategies and techniques to teach students with low incidence disabilities. Archer and Hughes (2011) have identified several delivery procedures of explicit instruction that were employed in this study. The procedures outlined by Archer and Hughes include zooming in on skills that enable students to acquire future learning and that are appropriate given students' educational needs. Explicit instruction involves sequencing skills to build on previous skills. Instructional strategies must be implemented that break down compound skills into smaller, simpler attainable tasks and implement well-organized, concise lessons with clear goals to facilitate unambiguous expectations for students. Based on students' performance data, teachers provide instruction necessary to ensure mastery of prerequisite skills. Teachers demonstrate to students each step needed to perform target skills or steps needed when applying strategies. Language used during instruction should be clear and the level of speech should be appropriate based on students' level of receptive vocabulary. Multiple opportunities for practice must be provided with previous and newly learned skills with supports to help students achieve mastery. Explicit instruction also includes providing students with multiple opportunities to engage in responding to questions with teachers. Instructors must continuously monitor performance and give students feedback with corrections. The rate of instruction must be fast enough to avoid listlessness and

appropriately matched to students' abilities. Teachers must also help students make connections with skills and concepts. Explicit instruction teaching functions address reviewing materials, presentation procedures, guided practice and independent practice, corrective feedback, and cumulative review sessions (Archer & Hughes, 2011).

Explicit instruction has been recognized as a "High Leverage Practice" by the Council for Exceptional Children and has been included in practices by the Institution of Education Sciences (Hughes, Morris, Therrien & Bishop, 2017). Explicit instruction is an unambiguous method of teaching consisting of five key components: segmenting complex skills, focusing on essential features of content through modeling/think-aloud, systematic fading of support/prompts, requiring student responses/giving feedback, and purposeful practice (Hughes et al, 2017).

As previously mentioned, Direct Instruction methods described by Carnine et al. (2006) have been shown to be effective with students with low incidence disabilities. No longer should students with low incidence disabilities be the recipients of inadequate literacy instruction. Furthermore, instruction should begin as early as the preschool level, including students with developmental delay. This work demonstrates the invaluable rewards of a comprehensive reading program for these students.

Chapter Three – Research Methods

The research intervention employed an explicit Direct Instruction approach which has been shown effective with struggling students and students with disabilities (Archer & Hughes, 2011; Carnine, Silbert, Kame ennui, Tarver & Jungjohann, 2006). The dependent variable was the number of correct responses on letter sound correspondence (LSC) probes. The independent variable was explicit Direct Instruction in letter sound correspondence. Many students with intellectual and developmental disabilities experience significant communication disorders;

therefore, there is a need for literacy research that includes participants who are verbal and nonverbal. This research extended previous research studies in letter sound correspondence to include students with moderate intellectual disabilities, developmental disabilities, and communication disorders (Flores, Shippen, Alberto & Crowe, 2004; Benedek-Wood et al., 2016). The researcher implemented a model, lead, test instructional procedure. The teacher provided instructional supports and scaffolds to students as well as corrective feedback during lessons.

Participants

The primary investigator recruited from an inclusive preschool classroom at an urban public school located in the Southeastern United States. The school received Title I government funding to support its large concentration of students from low socioeconomic backgrounds. Although not a requirement for participation, it is interesting to note that all preschool participants qualified for and received Early Intervention services under part C of IDEAIA, 2004. The focus of Early Intervention is to help infants and toddlers, ages birth to two years, with a medical diagnosis or developmental concern that may cause a delay. The criteria for participation in this study consisted of the following: a) participation in a self-contained, preschool inclusion program for students with disabilities and typically developing students who serve as peer models; b) students had an individualized educational program; c) were eligible for special education services under the categories of developmental delay, intellectual disability, or autism; d) ranged in age from three to five years old; e) earned a passing score on vision and hearing screening; f) able to engage in instruction for 15 – 20 minutes, and g) made responses verbally, by pointing or eye-gazing (i.e., alternative format). Four preschool students with disabilities met the criteria for participation in the intervention.

Zaine. Zaine, an African American male student, was four years, four months old at the beginning of this study. Zaine had a history of tantrums involving screaming, crying, throwing himself to the floor, and exhibiting self-injurious behavior such as scratching. However, when provided with rules, redirection and clearly defined routines, the tantrums and unproductive behaviors subsided. Zaine received a diagnosis of autism at age three. A psychologist administered the Autism Diagnostic Observation Schedule (ADOS) to Zaine. Zaine earned an overall score of 19 which indicated an ADOS classification of moderate autism. Zaine's diagnostic impression on the ADOS was F84.0, autism spectrum disorder requiring substantial support for social communication, and support for restricted, repetitive behaviors with accompanying language impairment (limited vocal communication). When administered the Developmental Assessment of Young Children, Second Edition (DAYC-2), Zaine received the following scores: adaptive behavior domain = 82, cognitive domain = 71, communication domain = 54 (receptive language = 54 and expressive domain = 54), physical domain = 83 (gross motor = 79 and fine motor = 87), and social emotional = 72. These scores indicated delays in adaptive behavior, cognitive, communication, and social emotional development. Zaine received an assessment using the Vineland Adaptive Behavior Scales, Second Edition (VABS-II). Zaine earned the following standard scores: communication = 59, daily living = 79, socialization = 68, and motor skills = 70. Zaine received an adaptive behavior composite score of 66. Scores for all areas assessed on the VABS-II fell in the low to moderately low range level. Zaine received speech services at his preschool. Zaine's teacher reported that he communicated primarily with gestures. Zaine used unintelligible vocalizations to obtain the attention of teachers and caregivers. Zaine interacted with peers but often played alone. Zaine enjoyed music and sang along to familiar songs by mimicking sounds of musical notes and words in the song. Zaine

made some single vowel and consonant sounds. Zaine repeated a limited amount of one syllable words and had been observed saying "no" purposefully when told to stop running in the halls. Near the end of the study, Zaine began to exhibit some intelligible vocalizations such as saying, "oh no!" Zaine learned to copy his first and last name from a sample, recognize his name in print, color and paint inside the lines with minimal strokes outside of line borders. Zaine enjoyed storytime, looked at books independently, chose books for his enjoyment, turned pages appropriately, and printed letters from a sample (initially required modeling).

Venn. Venn, the second participant, an African American male student, was age four years, nine months old at the beginning of the study. Venn has a diagnosis of autism. Venn received early Intervention services to address difficulties with expressive and receptive language as well as behavior. According to structured interview data from parent, Venn experienced problems verbalizing his wants and needs, accepting limits, staying on task, and changing locations and activities. Venn pointed to indicate his wants and needs. Single words began to emerge only after Venn reached age three. Just prior to age three (at 30 months old), special education personnel administered the DAYC-2 to Venn. Venn received the following scores on the DAYC-2: adaptive behavior = 80 (age equivalent 24 months), cognitive < 50 (age equivalent 10 months), physical = 77 (age equivalent 23 months), and social emotional = 63 (age equivalent 19 months). Venn's scores in adaptive behavior, cognitive, social emotional and communication domains indicated significant delay. Additionally, special education personnel administered the Early Learning Accomplishment Profile (ELAP) to Venn. Venn received the following scores: adaptive behavior = 100 (30 months age equivalent, average, within normal limits), cognitive = 57 (age equivalent 17 months), communication < 50 (age equivalent nine months), physical = 70 (age equivalent 21 months), and social emotional = 80 (age equivalent 24

months). The scores on the ELAP indicated significant delay in cognition and communication, and delay in physical and social emotional development. Venn received the following scores on the Preschool Language Scale, Fifth Edition (PLS-5): Auditory Comprehension Subtest, receptive score = 75, expressive score = 66, total language score = 69, which indicated a moderate-severe communication delay. Venn named simple objects and pictures. Venn produced present progressive speech (i.e., producing -ing words) and struggled to form two-word combinations. Venn encountered difficulty when choosing an object named of something that was not of interest to him. Venn's teacher reported that he struggled to answer open-ended questions, and often responding with blank stares and looks of confusion. Venn seldom initiated conversation and often spoke using sentence fragments. Venn received speech services at his preschool.

Anthony. Anthony, the third student, an African American male, was age four years, eight months at the beginning of the study participated in the intervention. Anthony received Early Intervention services beginning at age two to address concerns with communication and social emotional development. Anthony had a history of behavior issues involving tantrums and aggressive behaviors toward other children. Anthony's pediatrician referred him for a speech evaluation due to his inability to acquire communication milestones. Anthony's mother and teacher completed a formal survey and interview. Information gathered from these instruments revealed that Anthony used gestures (pointing), vocalizations (understandable to those familiar to Anthony), and some words to communicate. Anthony's use of intelligible speech varied, particularly when referring to an item or topic of high interest to him (e.g., when choosing a favorite food or toy). Anthony tended to speak quickly without enunciating the sounds in words (i.e., mumbling phrases and sentences). Anthony communicated using simple sentences and

short phrases of up to six words. Anthony earned the following scores on the Preschool Language Scale, Fifth Edition (PLS-5): auditory comprehension = 63, expressive communication = 68, and total language = 63, which indicated moderate communication delay. Anthony received an additional assessment using the Battelle Developmental Inventory, Second Edition (BDI-II). The BDI-II is a standardized, norm-based assessment tool to determine the level of functioning in communication, physical development, cognitive, adaptive behavior, and social emotional domains. On the BDI-II, a score of 100 represents the statistical mean score and average scores range between 85 to 115, with a standard deviation (SD) of 15. Anthony received the following scores on the BDI-II: adaptive behavior = 55 (2.33 SD below the mean), cognitive = 72 (1.87 SD below the mean), communication = 65 (2.33 SD below the mean), physical development = 93 (average, within normal limits), and social emotional = 63 (2.47 SD below the mean). The scores in communication, social emotional, cognitive, and adaptive behavior domains fell in the delayed range of development.

Mark. Mark, the fourth participant, an African American male student, was five years old at the beginning of the study. Mark received Early Intervention services and had a medical diagnosis of hydrocephalus. Hydrocephalus is a condition caused by a buildup of cerebrospinal fluid (CSF) in cavities located deep in the brain. Hydrocephalus may cause enlargement of the head, bulging fontanel (spaces between bones in the skull of developing infants), walking/gait disturbances, cognitive challenges, and brain damage. Treatment of hydrocephalus involves the surgical placement of a tube, known as a shunt, in the brain. Mark has a shunt to drain excess fluid in the brain. Due to his inability to walk independently, Mark used a walker to navigate his environment. Mark began walking independently after his fourth birthday. Mark experienced significant delay with toileting skills. Mark gained independence in this area once he began

walking without the use of a walker. Mark walks with an abnormal gait and falls frequently. Mark breaks his falls with his hands, recovers and continues to his destination. Mark requires minimal assistance with stairs and curbs. Information received from formal observation surveys completed by Mark's caregiver and teacher showed that Mark exhibited a short attention span, was impulsive, and at times acted without thinking. Mark exhibited problems retaining information. When administered the BDI-II, Mark earned a score of 62, moderate delay, in the area of motor development. Mark received the following scores on the DAYC-2: adaptive behavior = 82 (delay), communication = 84 (receptive language = 76, delay, and expressive language = 92, average), cognitive = 79 (delay), physical domain = 69 (gross motor = 51, significant delay, and fine motor = 85, average), and social emotional = 84 (85 is average). Mark qualified for special education services, including physical therapy, under the label of developmental delay. Mark communicated effectively, spoke in phrases, used sentences of at least six words, and engaged in age appropriate conversation.

Table 1

Participant Characteristics

Name	Age	Eligibility	Race	Communication	Adaptive Behavior	Cognitive Ability
Zaine	4 yrs. 4 mths.	AUTISM	African American	54[a] (Total)	66[e]	
Venn	4 yrs. 9 mths.	AUTISM	African American	66[b] (Total)		55[c]
Anthony	4 yrs. 8 mths.	DEVELOPMENTAL DELAY	African American	63[b] (Total)	55[d]	72[d]
Mark	5 yrs.	DEVELOPMENTAL DELAY	African American	76[a] (Receptive)	82[a]	79[a]

a. Developmental Assessment of Young Children, Second Edition (DAYC-2) (average 85 up)

b. Preschool Language Scale, Fifth Edition (PLS-5) (average 85 – 115)

c. Early Learning Accomplishment Profile (ELAP) (Birth to 36 months, average 100)

d. Batelle Developmental Inventory, Second Edition (BDI-II) (average 85 – 115)

e. Vineland Adaptive Behavior Scales, Second Edition (VBAS-II) (100 average)

Table 2

School Demographics

Race	**Enrollment**
Black or African American Female	211
Black or African American Male	231
Hispanic/Latina Female	21
Hispanic/Latino Male	25
Two or more races	
White or European American Female	2
White or European American Male	2
Total Student Enrollment PreK-12	492

Source: alsde.edu

Setting

Initially, the intervention sessions took place in the participants' inclusive preschool classroom. The intervention lasted eleven weeks. Anthony, Venn and Mark attended school three days per week from 9:00 a.m. to 1:00 p.m. Zaine attended school five days per week from 9:00 a.m. to 1:00 p.m. Study participants engaged in one-to-one activities with the teacher (also referred to as the interventionist or researcher) in the classroom as other students participated in their usual instructional activities for the first couple of weeks. Daily enrollment consisted of eight to ten students, some with communication disorders and various behaviors such as unintelligible vocal outburst, and tantrums involving screaming, kicking, and crying. These daily activities and behaviors of students, due to their disabilities, hindered the implementation of the intervention. These distractions made it necessary for part of the intervention to take place in an

unoccupied classroom next door to students' preschool classroom. Students received one-to-one instruction in letter sound correspondence in a classroom setting free of distractions for approximately four weeks. However, due to other instructional program needs, the extra classroom was no longer available. The remainder of the study took place back in the preschool setting. However, by this time, classroom paraprofessionals and study participants had become accustomed to intervention procedures. This helped to minimize the effects of other students' activities and mild disruptions that occurred during the study. The researcher also took advantage of opportunities in which the rest of the class was out the room to conduct the study.

Assessment Materials

The interventionist used the classroom computer, printer and word software to generate assessment materials. The researcher created word documents and designed a Letter Sound Correspondence Probe Data Collection Sheet, a Letter Sound Correspondence Treatment Implementation Checklist, and an Instructor Behavior sheet. The data collection sheet consisted of a table with a column for the teacher or reviewer to enter the date, a column to enter the target letter/picture and eight columns to document participant's responses (e.g., +/-). Study reviewers also used data collection sheets to determine the percentage of interobserver agreement (IOA) on the accuracy of participants' performance on LSC probes. The Letter Sound Correspondence Treatment Implementation Checklist was designed to assist the instructor when administering the intervention. The checklist served as a guide to facilitate instruction and assist the instructor with self-monitoring to promote treatment fidelity. The Instructor Behavior sheet was developed for reviewers to use when assessing treatment fidelity. This document listed the instructor's behaviors for correctly administering the intervention during introduction, guided practice, independent practice and feedback/correction procedures.

Assessment Procedures

The researcher administered several probes to determine student's level of letter sound correspondence knowledge throughout the research study. Study participants engaged in LSC probes, and a picture probe and a maintenance probe. Baseline probes targeted each of the four target letter sounds, m, a, s, t, in random order. When administering the LSC baseline probe to the student, the teacher presented instructions orally and modeled the expected behavior for clarity. For example, the teacher said, "I'm going to show you some letter sound cards, then make a letter sound, and ask you to pick a card that makes that sound." The teacher modeled picking up a card. The teacher said the letter sound, for example, "Show me the card that makes the /a/ sound," the teacher waited up to 5 seconds for the student to respond. The student did not receive corrective feedback. After allowing up to five seconds for a response, the teacher thanked the student for participating in the probe and/or praised the student for selecting a card. For instance, after receiving an LSC card the teacher replied, "That was great touching, thank you for working with me!"

Next, the teacher conducted intervention phase LSC probes at the beginning of a session. This method allowed the researcher to assess the previous session's instruction. Each probe consisted of two trials for each of the four letters targeted in the study (m, a, s, t). The teacher presented a letter sound orally (e.g., /m/) and asked the student to choose the target letter from a field of four LSC cards (one target and three distractors). For a response to be scored as correct, the student selected the correct letter within 5 seconds. After successfully completing two LSC probes, the teacher administered a picture probe to the student. A student had to meet the minimum criteria of 7/8 trials correct (for 88% accuracy), on two consecutive probes, to achieve mastery on the letter sound correspondence probes. The focus of the letter probe was on the

target letter's sound. For example, during the /m/ phase, the teacher presented the student with four LSC cards, one target, m card and three distractors. The teacher recorded the percentage of correct responses for the /m/ sound.

After the student mastered the criterion for each letter sound, the teacher presented the picture probe, an array of picture cards representing letter sounds. During the picture probe, the teacher presented four LSC picture cards (one target and three distractors). The pictures represented things that began with the four target LSCs and two pictures of nontarget items (i.e., a ball and a donut). The array included a picture from each target group of LSCs (m, a, s, t) unless the teacher presented one of the two nontarget pictures (the ball or the donut picture card). During the picture probe, the teacher presented each picture card while stressing the beginning sound of the picture, for example, "This is an aaaple, a mmmuffin, a ssslide, and a table. Show me the picture that makes the /t/ sound." Picture probes allowed students to see the letter sounds presented in word formats. The name of each picture was printed on each picture card. The first letter of the word on each card was printed using a larger font and underlined on each picture card. The researcher designed maintenance probes for implementation three weeks after the intervention ended. The maintenance phase of the study was developed to determine student's ability to identify the four LSCs (m, a, s, t) taught once instruction ended. This included the presentation of four LSC cards (one target and three distractors). Once the researcher provided a target sound, the student would be directed to select the card that corresponded to the target sound. However, due to school closure because of the Covid-19 pandemic, the researcher did not administer the maintenance probes.

Treatment Fidelity

Investigators used an experimenter-made treatment integrity checklist of instructional procedures to evaluate treatment fidelity during 30% of the intervention sessions (randomly selected) to achieve high quality standards (Smith, Daunic & Taylor, 2007). Researcher staff calculated treatment fidelity using the number of items correct divided by the total number of items, then multiplying that number times 100 to yield the percentage. The checklist consisted of an itemized list of the steps involved in each phase of the study. For example, it had a list of the steps involved in the introduction of a new target letter, the steps involved in guided practice, and the steps involved in independent practice. The teacher video-recorded study sessions to facilitate accuracy and consistency of intervention procedures and data scoring. Research assistants compared information on the video to data on the implementation checklist to determine treatment fidelity. For example, examiners assessed whether a teacher modeled pointing to the correct letter-sound card after giving the letter-sound prompt to the participant. The teacher implemented self-monitoring procedures using an instructor's checklist to aid implementation. The checklist consisted of procedures involved in lessons. A copy of the Treatment Integrity Checklist found in Appendix C.

Inter-rater Reliability

The researcher trained two classroom paraprofessionals, a certified early childhood teacher intern, and two special education doctoral students to serve as examiners/reviewers. The two paraprofessionals had over 10-years of experience working with students with disabilities. The special education early childhood master's level intern had over three-years of early childhood teaching experience. The doctoral students had special education teaching experience. Examiners received training on the correct sound that corresponded to each target letter (/m/, /a/, /s/, /t/) for verbal responses. The researcher informed examiners on various alternative modes of

response such as finger pointing, eye gazing, and physically picking up the LSC card. Examiners also received training on incorrect responses, for example, student gives multiple responses either verbally, or by pointing to or picking up multiple LSC cards. Examiners viewed videotapes or observed students' performances during LSC probes, compared LSC probe results with each other, and calculated interobserver agreement. If a student verbalized, pointed to, touched, or placed a hand on the correct LSC card, the response was correct. If a student eye-gazed the correct letter card the response was correct. However, if a student eye gazed multiple LSC cards or touched more than one card, the response was incorrect. Researchers and examiners calculated inter-rater reliability for 25% (randomly selected) of the LSC probes across phases. Examiners viewed videos or observed students' performances in real time, made comparisons of their results and reached a decision to agree or disagree on their scoring results. The observed inter-rater reliability (Interobserver Agreement, IOA) is the percentage of which the two examiners agree. Researcher staff calculated the percentage interobserver agreement percentage as follows: (agreements plus disagreements)/100, multiplied by 100 (Viera & Garrett, 2005).

Instructional Materials

The researcher used the following items to create letter sound correspondence (LSC) cards: white cardstock, beige cardstock, fine tip black permanent marker (i.e., black Sharpie®), blue permanent marker, black ink pen, and 17 sheets of 8 ½" x 11" white copy paper, each sheet cut into four equal rectangles/squares. The researcher created a white set of lowercase alphabet cards and a beige set using the card stock and blue permanent marker. The researcher printed a lowercase letter on each card, scaled to fit the size of the card to aid visibility. The researcher used the cut copy paper to create a deck of independent practice cards. Using the black ink pen,

the researcher printed each target letter to create a set of nine cards for each target letter (i.e., *m, a, s, t*). These independent practice cards were randomly compiled to create a mixture of letter cards referred to as a deck of cards. The classroom computer, printer, white card stock, and copy paper were used to create picture cards of things that began with the four LSC target sounds. For example, a picture of an astronaut, /a/ sound, a muffin, /m/ sound, turtle, /t/ sound, and a snake, /s/ were used to create picture cards. The researcher also printed a picture of two highly preferred items (a ball and a donut) that were not target sounds to incorporate during the presentation of pictures. The teacher printed the spelling of each item shown on picture cards using the fine tip black permanent marker. The first letter of each word was underlined to draw attention to the beginning sound of the word. All LSC cards (letters and pictures) were laminated for durability.

Instructional Procedures

Lesson one the /m/ sound.

The teacher began the lesson by telling the students what they would be learning. For example, the teacher would say, "Now we are going to learn about the sounds that letters of the alphabet make." The teacher introduced the letter /m/ sound using three steps. First, the teacher presented the m LSC card, pointed to the m and said, "This is the /m/ sound, /mmm/." Next, the teacher showed the student three LSC picture cards of things that began with the target letter /m/ sound. For example, a picture of a monkey, a mop, and a motorcycle. The teacher pointed to the target letter m on the picture card while stressing the target sound when naming the picture shown (e.g., mmmonkey, mmmop, mmmotorcycle). The teacher showed the picture of the motorcycle and said, "The word motorcycle begins with the /m/ sound mmmotorcycle." The teacher showed the picture of the motorcycle while pointing to the letter m in the word motorcycle. Next, the teacher showed the picture of a monkey, and repeated the previous

procedure. The teacher said, “This is a monkey, the word monkey begins with the /m/ sound, mmmonkey.” The teacher pointed to the letter m in the word monkey while stressing the /mmm/ sound. Then the teacher showed letter m LSC card, pointed to the letter m and repeated its sound, “/mmm/.” Afterwards, the teacher presented the third picture, a mop. The teacher said, “This is a mop, the word mop begins with the /m/ sound, mmmop.” The teacher pointed to the letter m in the word mop while stressing the /mmm/ sound. The teacher reiterated the letter sound correspondence by presenting the m letter card and saying, “This is the /m/ sound, /mmm/.”

The next part of instruction was guided practice which involved the student and the teacher choosing the target LSC card together from an array of four LSC cards. The teacher modeled behaviors for selecting the card that corresponded to the target /m/ sound. The teacher explained the procedures for identifying letter sound correspondence. For instance, the teacher performed the behaviors while saying, “Watch me! I say a sound, /m/, look at the cards on the table and I point to the sound.” Next, the student and teacher performed the activity together. The teacher began by saying, “Let’s do it together!” The teacher issued the prompt by saying, “Listen while I say a sound, then let’s touch the letter that makes that sound. Get ready!” The teacher showed the target letter and three foils (e.g., m, n, o, a). The teacher said, “Point to the /mmm/ sound.” Both student and teacher selected the m LSC card. If the student failed to respond, the teacher provided a verbal prompt and modeled the correct behavior. The teacher said, “Touch the letter that says, /mmm/” and the teacher modeled the correct behavior by pointing to the target letter (e.g., the m LSC card). Following this procedure, the teacher issued a prompt to the student to perform the task by saying, “Get ready!” The teacher prompted the student to touch the letter independently. The teacher said, “Your turn, you point to the sound this time.” The teacher showed the LSC cards (one target /m/ and three distractors) and said,

"Point to the /m/ sound." The teacher paused up to five seconds, which allowed time for the student to select a card before providing corrective feedback for an error, or praise for a correct response. The teacher omitted the request for an oral response for nonverbal students. Each subsequent trial required the use of different foils and changing the position of the target letter. The student continued to engage in guided practice until they achieved criteria of three consecutive correct trials.

If needed during guided practice, the teacher provided additional instructional supports to foster correct responses. For example, reducing the number of cards presented in an array. The teacher began by presenting a small number of letter cards, for example, two cards, one target, m and one distractor n or a. Once the student discriminated between m|n or m|a, the teacher slowly increased to reach the maximum number of four LSCs as student's level of competency increased. Other supports during presentation of LSC cards included pausing and anticipatorily looking at the student for a response. The teacher also delivered physical gestures to facilitate correct responses such as finger pointing, reaching toward the target letter, head gestures (nodding), and eye gazing the correct response.

Once the participant completed guided practice, the teacher asked the student to complete tasks without assistance. Independent practice consisted of a minimum of twelve trials: eight trials of the newly introduced LSC and four trials using previously taught LSCs. The teacher did not provide supportive prompts during independent practice sessions. Students received a directive from the teacher asking them to identify a letter sound. For example, the teacher said, "This time do it by yourself, point to the /m/ sound" from a maximum field of four letters (one target and three distractors). Study participants practiced using this method a minimum of twelve trials. Students also engaged in additional independent practice sessions using the deck of LSC

independent practice cards (minimum nine trials for each LSC target sound). The teacher presented the student with nine target m LSC cards, one at a time and said, “What sound is this?” or “Give me the /m/ sound.” The student identified the sound of the LSC independent practice card presented either by giving the m LSC card to the teacher, pointing to the target, mimicking the /m/ sound or verbally saying the /m/ sound. Students learned to use the independent practice cards to practice among themselves either alone or in groups of two or more. When a student failed on a probe, the teacher delivered more instructional support. The teacher provided more instruction that included leading/prompting the student to select the correct letter card with the teacher (e.g., hand-over-hand assistance). The teacher tested the student by instructing the student to independently choose the correct letter sound, then take turns selecting the missed letter sound and previously taught letter sounds. The instructor also decreased the pause between the student’s response time to model the correct behavior. The teacher decreased the choice field during practice sessions (e.g., reducing the field from three LSC cards to two).

When the student required more intense support, the teacher implemented reteaching the missed LSC lesson. The teacher faded additional supports as the student gained competence in selection of the target sound. Following two consecutive responses made independently, scaffolds decreased and pauses between modeling increased. The choice field’s size gently increased by one letter and continued until the maximum number of letters was presented.

Lessons two through four and sounds a, s, t.

The teacher used the same procedures from lesson one in lessons two, three and four to teach letter sound correspondence for the letters *a, s,* and *t,* respectively. The teacher introduced the sound, modeled the sound, provided guided practice and independent practice. The teacher provided instructional supports and scaffolds to students such as the following: teacher

modeling, decreasing the size of the choice field during guided practice, delivering physical gestures to promote correct responses, and reteaching. Finally, the teacher provided corrective feedback as described in the section above.

Social Validity

Upon conclusion of the intervention, the primary investigator administered social validity questionnaires to the study participants, parents, teachers and service providers of students. Students' social validity questionnaire consisted of a 2-point Likert-type scale that asked students to indicate agreement or disagreement with the intervention. Students demonstrated social validity by choosing a happy face or a sad face on the questionnaire that asked, "Did you like learning letter sounds this way?" The social validity questionnaire for parents, teachers and service providers was a four-point Likert-type scale comprised of four questions about the intervention. Parents and teachers indicated whether they agreed, strongly agreed, disagreed, or strongly disagreed with the intervention. For example, one question asked, "Is this an important skill for the student to learn?" Another question asked, "Will this skill help the student as they progress to the next grade level?" Copies of social validity questionnaires are located at the end of this paper. The Parent-Teacher Social Validity Questionnaire is found in Appendix A, and the Student Social Validity Questionnaire is found in Appendix B.

Research Design

The study implemented a multiple probe across participants research design (Horner & Baer, 1978). Multiple probe design enables researchers to achieve experimental control by replicating the effects of the treatment across participants (O'Neill et al., 2011). Furthermore, unlike multiple baseline design, multiple probe design decreases the amount of time spent on baseline data collection with the use of non-continuous baseline data collection (O'Neill et al.).

The independent variable in the study was instruction in letter sound correspondence (LSC). The dependent variable was the number of correct responses divided by the total number of possible responses multiplied by 100, thus, yielding the percentage of correct responses on letter-sound correspondence (LSC) probes. The study included three phases: baseline, intervention, and maintenance. The first participant entered the intervention after receiving a stable baseline of at least five data points within 30% of the mean data path. The remaining participants had at least four consecutive data points at the beginning of the intervention. Once participant number one mastered one letter sound correspondence as defined as two consecutive probes at 88% accuracy or higher, and one picture probe of at least 88% accuracy or higher, the next participant entered the intervention. The third participant, having a stable baseline, entered once participant two mastered a letter-sound correspondence. This process continued until all participants entered the intervention phase of the study. The intervention phase began with instruction on the letter m sound, /m/. When the student achieved 88% accuracy or higher on two consecutive probes, the student completed a picture probe in which student selected the picture that began with the target sound, m. Students chose from an array of picture cards that included three distractors and one target, for example, m. Next, the intervention included the letter a. When the student mastered a, they completed a picture probe identifying pictures that began with the /a/ sound. The next part of the intervention included the letter s. After mastering two consecutive probes with 88% accuracy or higher, the student completed a picture probe. The last part of the intervention included instruction on letter sound correspondence for the letter t. When the student reached mastery of two consecutive probes at 88% or higher, the student completed a picture probe on identifying pictures that began with the t sound. The researcher completed a visual analysis of graphed data collected to evaluate evidence of trend, level, immediacy of effect, non-overlapping

data points, and variability. This method of data analysis is recommended when measuring the presence of a functional relation between an independent and dependent variable in single-subject research studies (Horner et al.; O'Neill et al.).

Chapter Four – Results

Zaine

The researcher administered baseline LSC probes to Zaine before implementing the intervention. The researcher defined stability as at least five data points with the last three data points within 30% of the mean data path. The level of Zaine's baseline was 10% with a range from 0% to 25%. On the first target, m, Zaine reached criterion for letter sound correspondence of the /m/ sound after two probes. The criterion for mastery was two consecutive probes at 100% accuracy. The intervention data for letter /m/ sound had a level of 100%. Reporting the range for the /m/ sound was not applicable because both data points were 100%. There was an immediacy of effect from the last baseline data point to the first intervention data point with an increase from 25% to 100%, respectively. The percentage of non-overlapping data points (PND) was 100% (Scruggs, Mastropieri & Castro, 1987). Zaine identified the /m/ sound on the picture probe with 100% accuracy.

On the second target letter, a, Zaine reached criterion for letter sound correspondence of the /a/ sound after two probes. The intervention data for letter /a/ sound had a level of 100%. Reporting the range for the /a/ sound was not applicable because both data points were 100%. There was an immediacy of effect from the last baseline data point to the first intervention data point for /a/ with an increase from 25% to 100%, respectively. The PND was 100%. Zaine identified the /a/ sound on the picture probe with 100% accuracy.

On the third target, s, Zaine reached criterion for letter sound correspondence of the /s/ sound after two probes. The intervention data for letter /s/ sound had a level of 100%. Reporting the range for the /s/ sound was not applicable because both data points were 100%. There was an immediacy of effect from the last baseline data point to the first intervention data point with an increase from 25% to 100%, respectively. There was an increase in the direction of the data path. The PND was 100%. Zaine identified the /s/ sound on the picture probe with 100% accuracy.

On the fourth target, t, Zaine reached criterion for letter sound correspondence of the /t/ sound after two probes. The intervention data for letter /t/ sound had a level of 100%. Reporting the range for the /t/ sound was not applicable because both data points were 100%. There was an immediacy of effect from baseline to intervention with an increase from 25% to 100%, respectively. The PND was 100%. Zaine identified the /t/ sound on the picture probe with 100% accuracy. The Tau U calculation for effect size revealed a score of 1 for Zaine, which indicated a strong effect size.

Anthony

The researcher administered baseline LSC probes to Anthony before implementing the intervention. The researcher defined stability as at least five data points with the last three within 30% of the mean of the data path. The level of Anthony's baseline was 0%. Anthony scored 0% accuracy on all data points in baseline. On the first target, m, Anthony reached mastery criterion for letter sound correspondence of the /m/ sound after two probes. The intervention data for letter /m/ sound had a level of 100%. Reporting the range for the /m/ sound was not applicable because both data points were 100%. There was an immediacy of effect from last baseline data point to the first intervention data point with an increase from 0% to 100%, respectively. The percentage

of non-overlapping data points (PND) was 100%. Anthony identified the /m/ sound on the picture probe with 100% accuracy.

On the second target letter, a, Anthony reached the mastery criterion for letter sound correspondence of the /a/ sound after two probes. The intervention data for letter /a/ sound had a level of 100%. Reporting the range for the /a/ sound was not applicable because both data points were 100%. There was an immediacy of effect from the first baseline data point to the first intervention data point for /a/ with an increase from 0% to 100%, respectively. The PND was 100%. Anthony identified the /a/ sound on the picture probe with 100% accuracy.

On the third target, s, Anthony reached the mastery criterion for letter sound correspondence of the /s/ sound after two probes. The intervention data for letter /s/ sound had a level of 100%. Reporting the range for the /s/ sound was not applicable because both data points were 100%. There was an immediacy of effect from last baseline data point to the first intervention data point with an increase from 0% to 100%, respectively. The PND was 100%. Anthony identified the /s/ sound on the picture probe with 100% accuracy.

On the fourth target, t, Anthony reached the mastery criterion for letter sound correspondence of the /t/ sound after two probes. The intervention data for letter /t/ sound had a level of 100%. Reporting the range for the /t/ sound was not applicable because both data points were 100%. There was an immediacy of effect from the last baseline data point to the first intervention data point with an increase from 0% to 100%, respectively. The PND was 100%. Anthony identified the /t/ sound on the picture probe with 100% accuracy. The Tau U calculation for effect size revealed a score of 1 for Anthony, which indicated a strong effect size.

Venn

The researcher administered baseline LSC probes to Venn before implementing the intervention. The researcher defined stability as at least five data points with the last three data points within 30% of the mean data path. The level of Venn's baseline was 35%. The range of baseline was 0% to 75%. On the first target, m, Venn reached the mastery criterion for letter sound correspondence of the /m/ sound after two probes. The intervention data for letter /m/ sound had a level of 100%. Reporting the range for the /m/ sound was not applicable because both data points were 100%. There was an immediacy of effect from the last baseline data point to the first intervention data point with an increase from 0% to 100%, respectively. The PND was 100%. Venn identified the /m/ sound on the picture probe with 100% accuracy.

On the second target letter, a, Venn reached the mastery criterion for letter sound correspondence of the /a/ sound after three probes. The intervention data for the /a/ sound had a level of 94%. The range of intervention for the /a/ sound was 88% to 100%. There was an immediacy of effect from the last baseline data point to the first intervention data point for a, with an increase from 0% to 88%, respectively. There was a change in the data path direction; it was decreasing in baseline and increasing in intervention. The PND was 100%. Venn identified the /a/ sound on the picture probe with 100% accuracy.

On the third target, s, Venn reached the mastery criterion for letter sound correspondence of the /s/ sound after two probes. The intervention data for the letter s sound had a level of 100%. Reporting the range for the /s/ sound was not applicable because both data points were 100%. There was an immediacy of effect from the last baseline data point to the first intervention data point for s, with an increase from 0% to 100%, respectively. The PND was 100%. Venn identified the /s/ sound on the picture probe with 100% accuracy.

On the fourth target, t, Venn reached the mastery criterion for letter sound correspondence of the /t/ sound after two probes. The intervention data for letter /t/ sound had a level of 100%. Reporting the range for the /t/ sound was not applicable because both data points were 100%. There was an immediacy of effect from the last baseline data point to the first intervention data point with an increase from 0% to 100%, respectively. The PND was 100%. Venn identified the /t/ sound on the picture probe with 100% accuracy. The Tau U calculation for effect size revealed a score of 1.26 for Venn, which indicated a strong effect size.

Mark

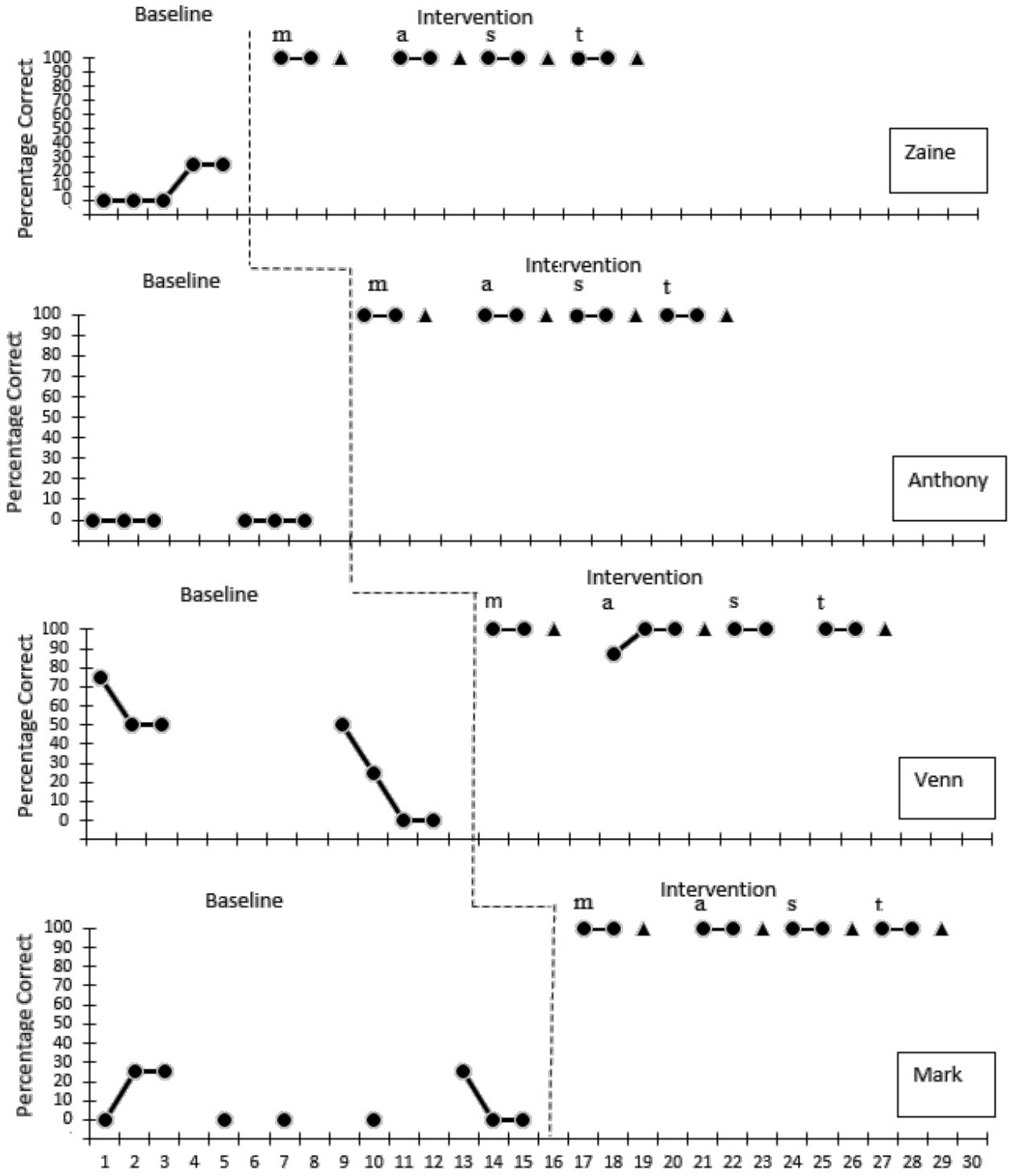
The researcher administered baseline LSC probes to Mark before implementing the intervention. The researcher defined stability as at least five data points with the last three data points within 30% of the mean data path. The level of Mark's baseline was 8% with a range from 0% to 25%. On the first target, m, Mark reached the mastery criterion for letter sound correspondence of the /m/ sound after two probes. The intervention data for letter /m/ sound had a level of 100%. Reporting the range for the /m/ sound was not applicable because both data points were 100%. There was an immediacy of effect from baseline to intervention with an increase from 0% to 100%, respectively. The PND was 100%. Mark identified the /m/ sound on the picture probe with 100% accuracy.

On the second target letter, a, Mark reached the mastery criterion for letter sound correspondence of the /a/ sound after two probes. The intervention data for letter /a/ sound had a level of 100%. Reporting the range for the /a/ sound was not applicable because both data points were 100%. There was an immediacy of effect from last baseline data point to the first intervention data point for /a/ with an increase from 0% to 100%, respectively. The PND was 100%. Mark identified the /a/ sound on the picture probe with 100% accuracy.

On the third target, s, Mark reached the mastery criterion for letter sound correspondence of the /s/ sound after two probes. The intervention data for letter /s/ sound had a level of 100%. Reporting the range for the /s/ sound was not applicable because both data points were 100%. There was an immediacy of effect from last baseline data point to the first intervention data point for s with an increase from 0% to 100%, respectively. The PND was 100%. Mark identified the /s/ sound on the picture probe with 100% accuracy.

On the fourth target, t, Mark reached the mastery criterion for letter sound correspondence of the /t/ sound after two probes. The intervention data for letter /t/ sound had a level of 100%. Reporting the range for the /t/ sound was not applicable because both data points were 100%. There was an immediacy of effect from the last baseline data point to the first intervention data point for t with an increase from 0% to 100%, respectively. The PND was 100%. Mark identified the /t/ sound on the picture probe with 100% accuracy. The Tau U calculation for effect size revealed a score of 1 for Mark, which indicated a strong effect size.

Figure 1. Results for Zaine, Anthony, Venn and Mark



Treatment Integrity and Inter Observer Agreement

To corroborate and ensure treatment integrity and accuracy of data scoring, 90% of the study sessions were videotaped. The study employed two trained paraprofessionals, who worked with the students in their preschool class, to score the accuracy of students' performance on letter sound correspondence probes. The study also employed one master's level intern in Early Childhood Special Education and two special education doctoral students to score students' performance on letter sound correspondence probes and treatment fidelity. To calculate treatment fidelity, these trained study reviewers used the Instructor Behavior Sheet, found in Appendix D, to record whether the instructor accurately administered the intervention. The Instructor Behavior Sheet indexed all instructor behaviors necessary to accurately execute the intervention. Reviewers used the Letter Sound Correspondence Data Collection Sheet, found in Appendix E, to calculate and document the percentage of correct responses on letter sound correspondence probes. Reviewers scored a randomly selected 30% of instructional sessions and letter sound correspondence probes. The percentage of instructional steps implemented correctly to determine treatment integrity equaled 100%. The percentage of interscorer reliability of students' performance on letter sound correspondence probes equaled 100%. The percentage of Inter Observer Agreement was calculated by adding the number of agreements plus disagreements among reviewers and dividing that total by 100, then multiplying the result by 100 to get the percentage of agreement (Viera & Garrett, 2005).

Social Validity and Follow Up

Due to the Covid-19 Pandemic, school closures were mandated by federal and state government officials, making it impossible to collect in-person data and distribute questionnaires by sending documents home. Therefore, the researcher implemented alternative methods and procedures to obtain maintenance data and social validity data. The researcher collected

information via telephone calls, videoconferencing, and email messages. Using Google Meet, a communication software product, the researcher implemented maintenance data collection and gathered social validity questionnaire data from two participants and their parents.

Venn and his mother participated in social validity questionnaires. The student social validity questionnaire consisted of one question, "Did you like learning letter sounds this way?" Below this question was a thumbs up, smiley face emoji and a sad face emoji. Venn indicated he liked learning letter sounds this way with a smile. His mother remarked, "Yes, he loved it." The parent social validity questionnaire, a four-point Likert-type instrument, asked four questions. The responses ranged from strongly disagree to strongly agree. Venn's mother responded, "yes, strongly agree" to the four social validity questions. Venn's mother's responses supported the importance of the skill, its usefulness, and the future benefits of learning letter sound correspondence using explicit, Direct Instruction.

Although administering post intervention letter sound correspondence probes in the classroom was not feasible, the results of a teleconference probe indicated that Venn maintained letter sound correspondence of all four target sounds (i.e., /m/ /a/ /s/ /t/). Venn responded to a follow up activity to determine the level of skill retention with 100% accuracy. Using a blue permanent marker, the teacher wrote one target letter on a sheet of paper, then scanned them into a word document. The researcher used the screen share feature of Google meet to present each target letter, m, a, s, and t. After showing each letter to the student, the researcher asked "What sound does this make? What's the sound?" Venn responded with 100% accuracy, "/m/, /s/, /a/, and /t/." Venn's mother expressed joy as she commented, "Wow, I didn't know he knew all the sounds!" At the end of the video conference, Venn's mother expressed willingness to allow him to participate in future studies using this intervention to teach traditional reading

skills.

The researcher administered the social validity questionnaire to Zaine and his mother using the same platform. The researcher read the social validity questionnaire to his mother. Zaine's mother replied, "yes, strongly agree" when asked whether the skill was important for the student to learn, useful in the everyday life of the student, helpful to the student in the next grade level, and whether learning letter sound correspondence this way benefited the student. The researcher presented each of the laminated letter sound correspondence cards to Zaine using the computer camera and asked, "What sound does this make? What's the sound?" Zaine failed to respond to these requests using the LSC cards that were used in the classroom. Zaine appeared to be perplexed by the visual of seeing the researcher (i.e., the teacher) on the computer instead of in person. The researcher and Zaine's mother experienced difficulty in engaging Zaine in the maintenance activity. Zaine exhibited increased physical movement and unintelligible vocalizations during this time. Zaine's mother indicated that he had difficulty following directions at home during the stay at home mandate. Unlike his peers, Zaine attended school five days a week instead of three days a week. Zaine's mom indicated that his routine had been abruptly ended because of school closure. Zaine had not responded well to the alternative of online distance learning via computer.

However, when the researcher presented the target letters using the 8 ½" x 11" sheets of Zaine responded on two occasions. The researcher presented each target letter to Zaine using the same procedures implemented with Venn. The teacher used the same scanned copy of the teacher made letter sound correspondence sheets for each letter created with a permanent marker. The researcher used the screen share feature of Google Meet to present each target letter, m, a, s, and t. When shown the letter m, and asked, "What sound?" Zaine responded, "/m/." When

presented with the letter s, Zaine pointed to the s on the computer keyboard twice, and responded, "/s/." Zaine gave no response when presented with the letters a and t. He vocalized unintelligible utterances and increased body movement. Zaine's mother also stated that he did not respond favorably to his speech teacher from school when the speech teacher tried to implement speech therapy via Google meet. Zaine did not respond to the social validity questionnaire via computer, but he cooperated with the researcher throughout the study. Zaine progressed from using alternative nonverbal responses to making verbal responses during practice sessions and on letter sound correspondence probes. It appears that after watching his peers respond verbally during the intervention, Zaine learned to make verbal responses. Unfortunately, several attempts to make contact to gather social validity data and follow up data from the other participants and their families ended unsuccessfully.

The researcher distributed social validity questionnaires to other education professionals who worked in the classroom with the students in the study. Two Early Childhood professionals completed the social validity questionnaire. The certified Early Childhood Special Education master's level teacher intern who worked with the students completed the questionnaire. The intern responded strongly agreed to the question that asked whether learning letter sound correspondence is an important skill for preschool students with disabilities. The intern strongly agreed that students would use the skill in everyday life. The teacher intern strongly agreed that the skill would help students as they progressed to the next grade level, and that learning more letter sound correspondence this way would benefit the students. The intern made the following open-ended comment at the end of the questionnaire, "I was impressed with how receptive nonverbal students were and their ability to excel at acquiring foundation skills in reading." The second respondent, a veteran special education paraprofessional, who worked with the students

strongly agreed that the skill is important for the students to learn. The paraprofessional agreed that the students would use the skill in everyday life. The classroom paraprofessional strongly agreed that the skill would benefit the students in the next grade level, and that learning more letter sound correspondence with the intervention would help students. The paraprofessional commented favorably to observing Mark interacting with his peers the day he led independent practice on his own during center time. The paraprofessional stated that she really enjoyed watching the students learn from one of their peers who also had a disability. The paraprofessional complimented the researcher for allowing the student to do this. Perhaps future research will include a component that incorporates an activity in which students work with each other on letter sound correspondence using the LSC independent practice cards.

Chapter Five – Discussions and Implications

Discussion

The purpose of this study was to explore the effectiveness of explicit Direct Instruction in letter sound correspondence with preschool students with developmental delay, intellectual disabilities, and autism. The results of the intervention provided evidence that preschool students with low incidence disabilities can learn letter sound correspondence. All four study participants met criterion across behaviors for letter sound correspondence with the target letters m, a, s, t. Participants demonstrated letter sound correspondence on letter probes, picture probes, and exhibited positive attitudes towards learning and participating in the intervention. A visual analysis of the data showed a functional relation between explicit Direct Instruction in letter sound correspondence and the percentage of correct responses on probes. The study confirmed findings from a similar study by Benedek-Wood et al. (2016) that taught letter sound correspondence to young students with autism spectrum disorder, and communication disorders.

Benedek-Wood et al. (2016) showed that students with severe communication deficits learned letter sound correspondence. The results of the current study also replicated the findings of Flores, Shippen, Alberto, and Crowe (2004), and Bradford, Shippen, Houchins, and Flores (2006). Flores et al. (2004) taught letter sound correspondence to elementary students and Bradford et al. (2006) taught middle school students, respectively, with moderate intellectual disabilities. This study added to existing literature because it substantiated the effectiveness of explicit Direct Instruction to teach phonics to students with low incidence disabilities.

Through replication, the current study helped pave the path toward establishing this intervention as an evidence-based practice for students with low incidence disabilities. The current study mirrored various aspects of work performed by Benedek-Wood et al. (2016). Both studies taught letter sound correspondence. Benedek-Wood et al. taught a different set of sounds with six target letters (o, t, r, l, u, p) compared to the set of four target letters (m, a, s, t) in this study. Both studies included young pupils ages four to five years old with communication disorders and autism. Researchers in both studies implemented similar instructional procedures and activities. For example, the researcher implemented many of the same procedures such as introducing and modeling letter sound correspondence, providing teacher modeling of target behaviors, engaging students in guided practice and independent practice, as well as providing corrective feedback and praise. The researcher also provided instructional scaffolds akin to those used by Benedek-Wood et al., such as decreasing the number of response cards presented in the choice field during practice, looking anticipatorily for a response, and reaching for (without touching) the correct response. In contrast, the current study did not end instructional sessions with an extension activity such as the color-and-paste task used by Benedek-Wood et al. (2016). The current study targeted a smaller number of letter sounds, four instead of six letter sounds.

The students in the current study mastered letter sound correspondence (LSC) with 100% accuracy on LSC probes. In the study by Benedek-Wood et al. (2016) the performance of students on mastery probes and the amount of instruction received on LSC targets was adversely affected due to time constraints. The study terminated prematurely because of the ending of the school year. In the study by Benedek-Wood et al. (2016), one student received instruction on and demonstrated acquisition of LSC on all six letters. The second student received instruction on five letters and demonstrated acquisition of four LSCs. The third participant received instruction and demonstrated acquisition of four LSCs. An analysis of effects between the two studies revealed medium to strong effects sizes for the study by Benedek-Wood et al. (2016) and strong effect sizes in the current study. For instance, using non-overlapping data points, the effect size for each participant in the Benedek-Wood et al. (2016) LSC study revealed the following: a strong effect size of .99 for participant one, a medium effect size of .90 for participant two, and a medium effect size of .88 for participant three. In contrast, all four participants in the current study reached criterion (100% accuracy) on all four targets. Using Tau-U scores, all participants experienced strong sizes of 1, 1, 1, and 1.26.

Resembling the works of Flores et al. (2004) and Bradford et al. (2006), this study delivered systematic Direct Instruction to teach letter sound correspondence on the letters m, a, s, t. The two previous studies mentioned here delivered instruction to elementary and middle school students with moderate intellectual disabilities. The studies used adapted versions of a commercial literacy program, the *Corrective Reading Program, Decoding A* (Engelmann, Carnine & Johnson, 1988). Students received instruction that, in addition to letter sound correspondence, included teaching continuous sound blending, sounding out words, and decoding skills. The results of the intervention conducted by Bradford et al. (2006) showed that

middle school students read sentences and passages on a second-grade level. The evidence from the current study and previous works affirms the need for instruction in letter sound correspondence (LSC) for preschool students with developmental disabilities. Delivering LSC instruction to preschool students with disabilities may help to provide a firm foundation toward achieving maximum reading success. For over twenty years, researchers have provided evidence to support that students with low incidence disabilities benefit from traditional reading instruction (Flores et al., 2004). Yet, education professionals, policy makers, and stakeholders continue to ignore the scientific data that confirms that students with low incidence disabilities must receive comprehensive reading instruction.

Letter sound correspondence is a pre-skill needed for reading. Teaching this skill to students with disabilities at an early age may empower young learners to more easily acquire complex reading skills such as blending, decoding, and telescoping. The National Reading Panel (2000) described five main ideas in reading as phonological awareness, vocabulary, knowledge of the alphabetic principle, comprehension, and fluency. The ability to read may be adversely affected when students lack skill development in one of the five main areas listed above. The alphabetic principle relates to having an understanding of the internal phonological components of the words of language (Liberman, Shankweiler & Liberman, 2020). The performances of students in this study signify that preschool students with developmental delay, intellectual disability, and communication disorders can acquire letter sound correspondence, which is a precursor to reading.

Once students became familiar with the process of learning letter sound correspondence, the time between introduction and mastery decreased. For example, after mastery of m and a, the length of time to acquire LSC for s ant t decreased. The teacher in the current study noted that

when presented with the letters m and s and asked, “What is this?” students responded with the letter sound instead of giving the letter name. For instance, Mark’s teacher presented a worksheet on the letter m and asked, “What’s this?” Mark replied, “/m/.” When given a letter s coloring sheet, Anthony and Venn made the /s/ sound. On one occasion, after instruction ended, Mark picked up a stack of LSC cards used for independent practice and sat on the rug used for circle time. Mark instructed students to come join him on the rug. Mark began placing cards on the rug in front of students and prompted them to say its sound. Students engaged in this activity with Mark during informal play time. The teacher and other classroom professionals observed students responding correctly to Mark’s prompts to identify letter sound correspondence for the four target sounds. The positive results of the current study revealed that students with autism and other low incidence disabilities can attain reading and writing outcomes. For example, although it was not a focus of the study, students demonstrated proper handwriting skills to create their own LSC cards. First, the teacher asked students would they like to make their own cards. After receiving positive responses, the teacher used blank sheets of copy paper to create 3” x 4” blank LSC cards. The teacher modeled letter formation to create a sample. Students used pens or pencils to create letter t and s LSC cards. Students also enjoyed creating letter s cards with sparkling glitter glue on 3” x 4” cut pieces of cardstock. Once the glue dried, it created a three-dimensional letter s LSC card with a raised texture that students could rub their fingers across.

The results of the current study, and similar research, confirm the need for reform in reading instruction for students with low incidence disabilities, including autism, and severe communication disorders. Because the study demonstrated that this population of students can master this important component of traditional reading, teachers and stakeholders must change

the limited mindset of functional sight word reading. Based on the study results, students would likely achieve LSC mastery for the entire alphabet. Students in this study have learned a skill needed for decoding letters and word reading. This skill is a far cry from the less beneficial memorization technique of sight word instruction traditionally taught to this population. Unfortunately, the classroom teacher could not continue delivering the intervention after the end of the research study. This was due to school closure as a result of a pandemic. In March 2020, school systems throughout the United States ended face-to-face instruction to prevent the spread of the Covid-19 virus. Fortunately, preschool students with disabilities in this study will transition to kindergarten with a unique literacy skill. Their knowledge of letter sound correspondence formed the cornerstone for a solid foundation in reading. Imagine the effects on these students' ability to read had the study lasted long enough to include the most common sounds of the entire alphabet.

Implications

The intervention in this study is an easy, low-cost method for teaching the critical literacy skill of letter sound correspondence. The purchase of a high-cost commercially designed reading program was not necessary. The researcher in this study implemented explicit, Direct Instruction in letter sound correspondence using teacher-made products. Materials consisted of inexpensive items commonly found in every classroom. The letter sound correspondence cards and picture cards were made using the following items: white copy paper, cardstock paper (can substitute file folders), permanent marker, pen/pencil, glue, pictures and scissors. The data collection sheets, and checklists can be generated using a computer, word processing software and printer. In the event computer generated sheets is not possible, these sheets can be designed using blank paper, a ruler and a pen. Instructional sessions averaged 10 to 15 minutes. Letter sound

correspondence probes took no more than five minutes to administer. The rewards and benefits of this type of reading instruction for students with disabilities far outweigh the time and energy required of teachers.

Limitations

As with any research project, limitations exist that must be carefully contemplated. First, because the population of students had low incidence disabilities, the availability of participants was limited. Unlike the large number of students in special education with high incidence disabilities, fewer students make up the population of special education students with low incidence disabilities. For this reason, this study included only four students. It is difficult to obtain a large sample size when the sample population is small. Therefore, additional research is necessary to determine generalizability of the intervention. Second, due to school closure, the researcher could not administer maintenance probes in the classroom. As a result, the researcher could not confirm whether participants retained their knowledge of letter sound correspondence for the target letters. Third, the intervention limited instruction to teaching one element of reading recommended by the National Reading Panel (2000). As stated in the review of literature in this study, students must receive comprehensive reading instruction consisting of the five components of reading, which includes phonological awareness, phonemic awareness, comprehension, vocabulary, and fluency. Instruction should also incorporate a broad range of language and literacy activities such as shared story reading and vocabulary enrichment. Fourth, at the beginning of the study, to avoid major distractions and disruptions, the researcher found it necessary to move instruction from the preschool classroom full of students to a separate room. Because of various disabilities, at times students in the preschool classroom exhibited behaviors that interfered with successful implementation of the intervention. The researcher found it

necessary to deliver instruction in a quiet setting. The instructor continued utilizing the separate classroom during instruction on the letters m and a. Once students had grown accustomed to receiving the intervention, sessions took place in the preschool setting with others present. This use of a separate setting is a limitation since typical conditions do not include such resources.

Conclusion

The findings of this study point strongly toward the conclusion, yet again, that preschool students with low incidence disabilities can learn letter sound correspondence. Study participants mastered letter sound correspondence when taught using explicit, Direct Instruction. This study legitimizes the need for establishing this intervention as an evidence-based practice for students with low incidence disabilities.

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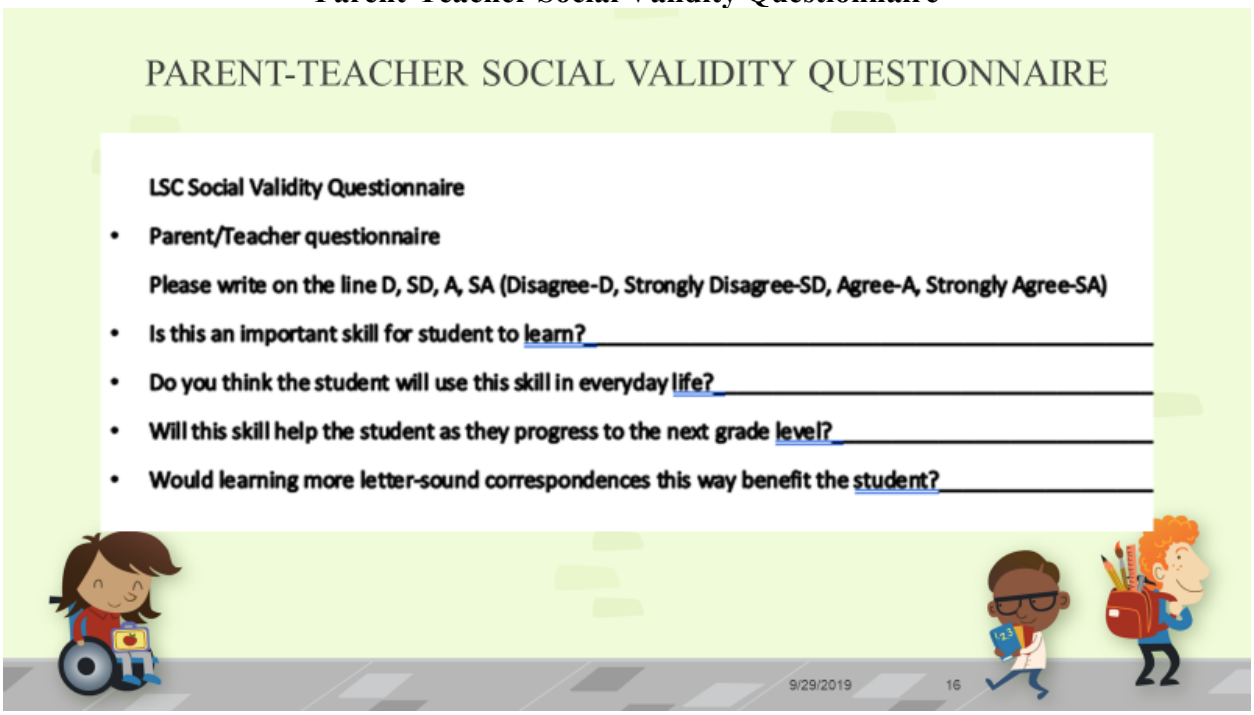
Appendix A
Parent-Teacher Social Validity Questionnaire



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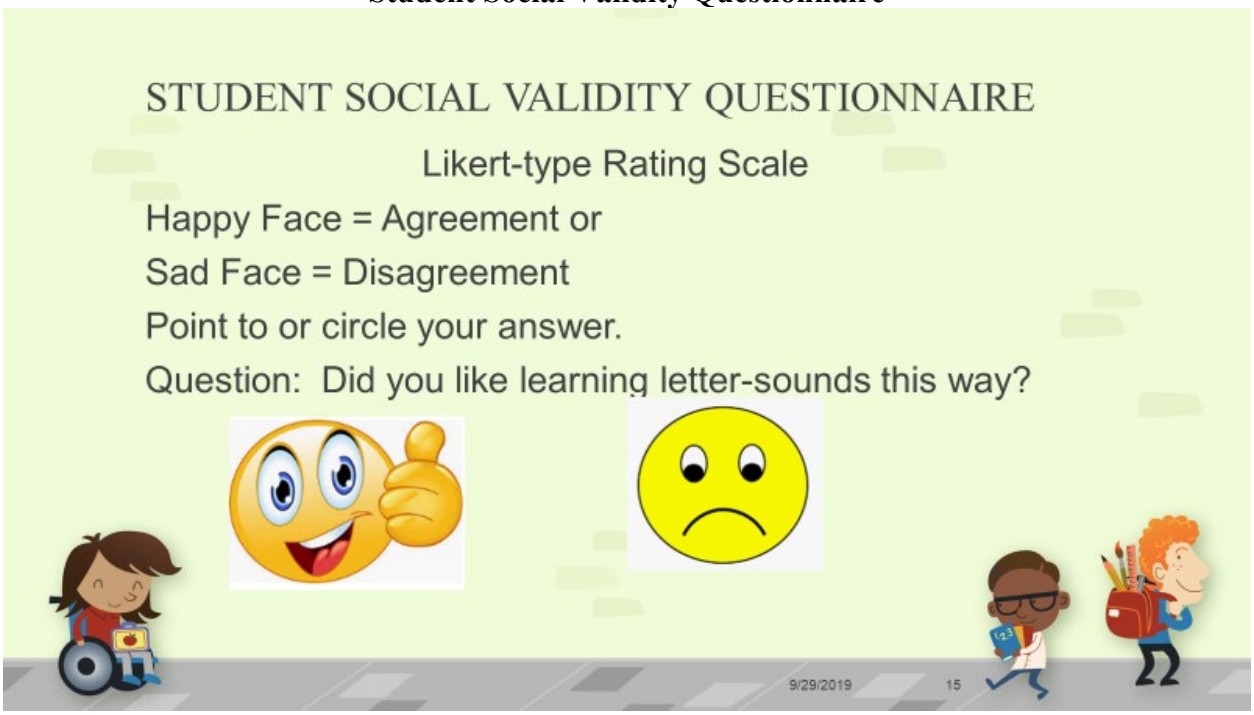
Appendix B
Student Social Validity Questionnaire



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Appendix C

Teaching Letter Sound Correspondence Treatment Integrity Checklist

Date _____ Form completed by_____

	Instructor Behavior	Yes	No
1	All materials ready prior to lesson.		
2	Provides instruction to students to begin the lesson - tells the student what he/she will be doing in the lesson.		
3	**Introduction** of a letter sound • Gives letter sound with LSC card presentation ____ • Presents pictures of things that begin with the letter sound ____ • Stresses letter sound during presentation ____ • Presents LSC card, says its sound after presenting each picture ____		
4	**Guided Practice** • Explains tasks involved e.g., "Let's do it together!"		
	• Models expected behavior e.g., "My turn"		
	• Prompts student to perform e.g., "Get ready, point to…"		
	• Provides corrective feedback (models correct behavior – Model, Lead- when applicable, Test) _____ **OR** • Provides praise for correct response		
5	Engages students in instruction during demonstration and guided practice by prompting their participation, asking questions, etc…		
6	**Independent Practice** – student instructed to perform task • e.g., "Your turn, point to the letter that says, "/__/" • No supportive prompt provided (performed independently)		
7	Individual student turns spread throughout the group		
8	Positive feedback and praise/reward for participation given to students		

COMMENTS:

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Appendix D
Instructor Behavior Sheet

Page 1 of 2 *Instructor's Checklist*
Letter Sound Correspondence Treatment Implementation Checklist
Date _____ Session _____Completed by_____

Instructor's Checklist		**Yes**	**No**
1	All materials ready prior to lesson ✓ LSC card(s) ✓ Pictures for LSC ✓ Applicable Form(s): ▪ Checklist(s)_____ ▪ Data Collection Document(s)_____ ▪ Probe(s)_____		
2	**Provides instruction to students to begin the lesson** – tells the student what he/she will be doing in the lesson, for example: • "Now we are going to learn about the sounds that letters of the alphabet make." ***OR*** • "You did a great job with our first letter sound /m/. Now we are going to learn more about sounds and letters of the alphabet." ***OR*** • "It's time to learn a new sound that another letter of the alphabet makes. We've learned the /m/ sound and the /a/ sound" (the teacher shows the letter *m* and *a* LSC cards and points to the corresponding letter card while making its sound).		
3	**Introduction** of a letter sound 1) Presents LSC card, points and says its sound ____ 2) Presents picture of a thing that begins with the letter sound ____ 3) Stresses letter sound during picture presentation ____ 4) Presents LSC card, says its sound after presenting each picture ____ 5) Repeats steps 2 – 4 until all three pictures presented____		
4	**Modeling the LSC task** Materials = LSC cards _____ target LSC _____ foil LSC cards 1) Explain procedures for identifying LSC "Watch me! I say a sound, look at cards and I point to the sound" 2) Teachers models expected behavior- "Watch me, my turn!"		

Page 2 of 2 ***Instructor's Checklist Continued***

Letter Sound Correspondence Treatment Implementation Checklist

Date _____ **Session** _____ **Completed by** _____

Instructor Behavior		Yes	No
5	All materials ready prior to lesson ✓ LSC cards		
6	Provides instruction to students to begin the lesson - tells the student what he/she will be doing in the lesson. • "Now we are going to practice choosing letter sounds together!"		
7	**GUIDED PRACTICE** 1) Teacher says, "Listen while I say a sound, then I want you to touch the letter that makes that sound. Get ready!"		
	2) Teacher shows the LSC target and LSC foil(s) "Show me the /___/ sound" (Pauses 3 – 5 seconds)		
	3) If incorrect= Provide verbal prompt and model correct response, e.g. "Touch the letter that says, /_/" teacher touches correct LSC card		
	4) Teacher issues prompt to student to touch letter independently "Get ready! Now, it's your (names the student), touch the letter that says /__ /."		
	5) If correct = Provide praise, provide additional support if incorrect		
8	Engages students in instruction during demonstration and guided practice by prompting their participation, asking questions, discussion, etc.		
9	Three consecutive correct trials (max. field) = Independent Practice Begins		
10	**Independent Practice** – student instructed to perform task 6) e.g., "Your turn, point to the letter that says, "/__/" 7) No supportive prompt provided (performed independently)		
11	Independent Practice		
12	LSC Trials Correct on Independent Practice		
I	**Administer LSC Probe (Data Collection)**		
II	**Administer Generalization/Picture Probe** New materials and new format		
	(Data Collection)		
III	Introduce new LSC		
IV	**Maintenance Probe** (3 weeks post intervention)		
	LSCs presented with foils which are selected from lowercase nontarget letters of the alphabet **(Data Collection)**		

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Appendix E
Letter Sound Correspondence Probe Data Collection Sheet

Student Name_____
LSC Target Letter:_____
Data Collector:_____
Indicate in columns the letter or picture being assessed at each trial.

Date	LSC/Picture Target	Trial +/-	Trial +/-	Trial +/-	Trial +/-	Trial +/-	Trial +/-	Trial +/-	Trial +/-

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