Effectiveness of the ALL Curriculum to Teach Basic Literacy Skills to Groups of Students With Severe Disabilities and Complex Communication Needs

by

Melissa K. Ainsworth
A Dissertation
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The Requirements for the Degree
Doctor of Philosophy
Education

Committee:

_____________________________ Chair

_____________________________

_____________________________

_____________________________ Program Director

_____________________________ Dean, College of Education and Human Development

Date: _________________________ Fall Semester 2013
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Fairfax, VA
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Melissa K. Ainsworth
Master of Education
George Mason University, 2000
Master of Arts
University of Wyoming, 1988
Bachelor of Arts
West Virginia University, 1986

Director: Anya Evmenova, Assistant Professor
College of Education and Human Development

Fall Semester 2014
George Mason University
Fairfax, VA
DEDICATION

This is dedicated to my amazing family. To Caroline for the inspiration to pursue this field; to Emily for her encouragement; and to Blake for his support of this dream of mine.
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LIST OF ABBREVIATIONS

Complex Communication Needs ................................................................. CCN
Intellectual Disabilities ............................................................................. ID
Autism............................................................................................................ Aut
Physical Disabilities and Intellectual Disabilities ..................................... PD/ID
Augmentative and Alternative Communication ......................................... AAC
Speech Generating Device ............................................................................ SGD
ABSTRACT

EFFECTIVENESS OF THE ALL CURRICULUM TO TEACH BASIC LITERACY SKILLS TO GROUPS OF STUDENTS WITH SEVERE DISABILITIES AND COMPLEX COMMUNICATION NEEDS

Melissa K. Ainsworth, Ph.D.

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Dissertation Director: Dr. Anya Evmenova

For students who have severe and multiple disabilities including intellectual disabilities, complex communication needs, physical and/or sensory disabilities, there are many barriers to literacy acquisition. Some barriers are a result of extensive support needs, some due to the attitudes and low expectations of parents, teachers, and administrators, and some are due to a general shortage of evidence-based research supporting effective instructional strategies for use with this student population (Agran, 2011; Bailey, Angell, & Stoner, 2011). However, literacy remains a “critical component of an independent adult life” (Downing, 2005, p. 12). Literacy also remains an elusive reality for many individuals with severe and multiple disabilities.

The purpose of this study was to determine if middle school students who have significant intellectual disabilities and communication disorders could be taught basic literacy skills in small group settings using the ALL (Accessible Literacy Learning)
The target skills taught were letter-sound correspondence and sight word recognition. The ALL Curriculum was developed for learners with special needs including students with autism, cerebral palsy, Down syndrome, and multiple disabilities and is specifically designed to meet the needs of individuals who have difficulty with speech and may utilize augmentative and alternative (AAC) communication devices.

This study employed a single-subject, multiple-baseline across groups and participants design and was replicated across two skill sets. Participants were individually assessed but the instruction was delivered in four small groups of two participants each for a total of eight total participants. The participants ranged in age from 11 to 16 years of age and had primary diagnoses of cerebral palsy, autism, Rett syndrome, Down syndrome, and intellectual disabilities. All of the participants were considered to be functionally nonverbal meaning that spoken language was not their primary means of communication.

Findings from this study indicate that there is a statistically significant functional relation between use of the ALL Curriculum and participant progress toward letter-sound correspondence and sight word recognition. Each of the participants demonstrated increased treatment phase means over baseline means for each of the dependent variables. There were no differences noted between participants with a primary disability of intellectual disabilities and those with a primary disability of autism on either skill set. Further analysis of the data indicated that age, IQ score, and home language were not factors in determining the scope of participant progress in this study for these participants.
CHAPTER ONE

Literacy is arguably one of the most important skills students will learn, for upon literacy hangs the ability to access information and to communicate. When, in the early 1990s, it came to light that 40% of fourth graders were unable to demonstrate basic grade-level skills on national reading tests, presidents and governors alike took action organizing reading initiatives, targeting monies for research and professional development, and culminating in the creation of the National Reading Panel in 1998 (Manzo, 2002). Literacy is even touted as a survival skill and advertised as being “the difference between getting ahead and barely getting by” (Literacy Council of Northern Virginia, n.d.).

Statement of the Problem

For students with severe and multiple disabilities, the road to literacy is not so easily paved as they are conspicuously left out of the national debate on literacy (Copeland, Keefe, Calhoon, Tanner, & Park, 2011; Erickson, Hatch, & Clendon, 2010; Keefe & Copeland, 2011). Despite the emerging awareness, fueled by No Child Left Behind, that all students including those who have severe disabilities and complex communication needs (CCN) deserve the same access to literacy instruction as individuals without disabilities, the gap between these groups remains wide. It is estimated that up to 90% of students who have cerebral palsy do not have basic literacy.
skills or have literacy skills much below those of their same-age peers (Machalick et al., 2010). Yet Kliewer and Bilken (2007) note that “we are unaware of any policy discussions that have begun with the literate lives of people” with significant disabilities, while Keefe and Copeland (2011) note that even organizations such as the Program for International Student Assessment excludes from their literacy assessments those students who cannot access written text. Literacy expectations for students with severe and multiple disabilities, even among professionals in the field of special education, have historically been low, thus beginning the cycle of a self-fulfilling prophecy in which opportunities are not presented thereby making literacy acquisition an impossible dream (Agran, 2011; Allor, Champlin, Gifford, & Mathes, 2010; Browder et al., 2008; Erickson & Koppenhaver, 1995; Joseph & Seery, 2004; Keefe & Copeland, 2011; Kliewer & Biklen, 2007; Mirenda, 2003).

Students with intellectual disabilities and/or significant autism who also have complex communication needs (CCN) present a challenge to teachers in that it is hard for teachers to know what their students are learning when the students cannot easily repeat back for comprehension checks. Teachers may feel unprepared to effectively assess or teach literacy skills to students who present with this combination of needs, as did the teachers interviewed for the current study. Compounding the problem is a dearth of research on effective strategies for teaching literacy skills to this population of students. While there is only a small body of research in the area of literacy acquisition for students with severe disabilities in general, for those with CCN in particular there is a tremendous lack of research on effective strategies to teach literacy skills (Bailey, Angell, & Stoner,
This void of researched and evidence-based strategies fuels the low expectations of professionals by failing to provide the tools teachers need to teach these students. Conversely, this paucity of research on the topic of literacy for those students with intellectual disabilities/autism and CCN is also reflective of the low expectations and interest in teaching literacy skills to this population (Browder et al., 2008). This yin and yang of lack of research causing low expectations and low expectations resulting in a lack of research can present to teachers and practitioners as a reason not to even attempt to teach literacy skills to students with severe disabilities and CCN. It also results in fewer published curriculums specifically designed to include learners with this level of support needs.

So, while the use of multiple choice is a standard response adaptation for individuals who are functionally nonverbal (Johnston, Davenport, Kanarowski, Rhodehouse, & McDonnel, 2009; Truxler & O’Keefe, 2007), few published curriculums present multiple choice as the standard basis for response. Therefore, teachers are often working with curriculums designed for learners who can orally produce letter-sounds, rehearse decoding and encoding, and read back words and sentences. Combined with the dichotomy that the lack of research presents, it is of little wonder that teachers feel unprepared to teach literacy skills beyond basic picture communication to students with severe disabilities and CCN.

More research detailing effective strategies for teaching specific literacy skills to students with severe disabilities and CCN is desperately needed (Agran, 2011; Bailey et al., 2011; Erickson et al., 2010). Machalick et al. (2010) point out that the most pressing
area of need in the research gap is for studies that use rigorous experimental designs. Current study, which uses a rigorous single-subject, multiple-baseline design, has the aim of adding to the small body of research targeting the literacy acquisition for this population of learners who have complex communication needs (CCN) as well as intellectual disabilities, physical disabilities, and significant autism and who are at risk for low literacy acquisition expectations. Additionally, in an attempt to provide practitioners with strategies that will work in their classrooms, this study also replicated the realities of the classroom through use of small group instruction in a school environment.

**Significance of the Problem**

For students who have severe and multiple disabilities including intellectual disabilities, complex communication needs, and physical and/or sensory disabilities there are many barriers to literacy acquisition. Some barriers are a result of extensive support needs; some due to the attitudes and low expectations of parents, teachers, and administrators; and some are due to a general shortage of evidence-based research supporting effective instructional strategies for use with this student population (Agran, 2011; Bailey et al., 2011). However, literacy remains a “critical component of an independent adult life” (Downing, 2005, p. 12). Literacy also remains an elusive reality for many individuals with severe and multiple disabilities.

**Importance of Literacy**

Literacy is recognized as being a foundational skill for all aspects of adult life. It is the basis upon which our educational system is built with texts and textbooks as the
elemental purveyors of knowledge. Students in classrooms from kindergarten through graduate school read and produce text as a means of furthering and demonstrating knowledge. Reading is vital for navigating the physical world and is the most efficient way of gathering information (Agran, 2011; Downing, 2005). Indeed individuals with severe and multiple disabilities are living in a society that assumes at least some level of literacy competence (Morgan, Cuskelley & Moni, 2011).

Being literate in a literate society is more than a convenience; it is also a highly valued social role (Downing, 2005; Forts & Luckasson, 2011) and thusly an issue of quality of life. Those who struggle with and/or have limited/no ability to use the printed word are often dismissed as an in-valid person (Agran, 2011; Yoder, 2001). Having access to the predominant communication mode in a society affords individuals with severe disabilities opportunities for self-determination and independence. Individuals with severe and multiple disabilities have limited control over their lives; the ability to interpret and use the symbols of literacy affords these individuals choices by allowing them to access the literacy rich environments in which we all live. “Literacy is power: Power to control your own life and influence the world around you” (Downing, 2005, p. x). Indeed the power of literacy is reflected in the US educational policy which, until the middle of the 20th century, restricted literacy education to Whites only, excluding African Americans from literacy education even by force of law (Prendergast, 2002).

Literacy even plays a significant role in our social relationships with the advent of social networking, online dating, email, and blogging which are all text based. Literacy offers ways to find and maintain friendships and other social connections. For one
individual with intellectual disabilities, she “is clear about her primary motivation for reading and writing. She uses these skills to build and enhance her relationships which are an important part of her life and well-being” (Forts & Luckasson, 2011, p. 123).

For students who use augmentative and alternative communication (AAC), literacy plays an even more important role (Bailey et al., 2011; Light & Kent-Walsh, 2003; Ruppar, Dymond, & Gaffney, 2011). These students are not only more at risk for being excluded from literacy instruction (Downing, 2005), they are also the population that most needs direct literacy instruction as naturally occurring opportunities for conversation and other language development opportunities are often limited (Bailey et al., 2011; Downing, 2005). However, for students who use AAC, literacy provides educators with a means to access educational assessment, provides the individuals themselves with access to learning opportunities, provides for a greater range of employment options, and promotes independence in the community and self-empowerment (Light & Kent-Walsh, 2003). Unfortunately, multiple barriers to literacy acquisition exist not only for students who require the use of AAC but for those with intellectual disabilities, physical disabilities, and autism. These very real barriers to literacy are discussed in detail below.

**Barrier One: Nature of Support Needs**

For students with severe and multiple disabilities, literacy education is more than the sum of opportunities presented. If literacy instruction opportunities are not presented in ways that allow a student with severe disabilities to actively participate, then those opportunities are lost to them (Copeland & Keefe, 2007). Due to extensive needs for
supports, literacy opportunities and instruction should be constructed in a way to make it possible for these students to access the opportunities presented. Educators must take into consideration each individual student’s unique support needs in order to tailor a literacy program that is accessible for them (Copeland & Keefe, 2007). A lack of individualized instruction, especially for students with severe and multiple disabilities who have extensive support needs, has led to either their exclusion from literacy opportunities or to those opportunities being presented in ways that do not meet their learning needs (Copeland et al., 2011).

For students with complex communication needs (CCN), the inability to produce sounds and read back text presents multiple teaching challenges for educators (Ruppar et al., 2011). Additionally, these students often have had limited opportunities to ask and answer questions, to converse with a communication partner and to build a foundation of communication literacy upon which to begin applying more conventional literacy skills (Bailey et al., 2011). As a result, teachers often make the assumption that students with CCN are either not ready for literacy instruction or that they are not capable of learning traditional literacy skills (Kliwer, 2008).

Students who have comorbid physical and intellectual disabilities may be coming to formal literacy instruction with limited experience with or access to printed materials (Browder, Spooner, & Ahlgrim-Delzell, 2011; Copeland & Keefe, 2007). Additionally educators must consider a student’s physical needs such as a stable and comfortable position with proper supports or use of positioning equipment. A student’s range of motion will dictate positioning of literacy materials for access purposes. In addition,
Educators must have the knowledge and skills to implement use of adaptive equipment such as switches and scanning software in order to make materials assessable for students with comorbid physical disabilities (Copeland & Keefe, 2007; Zascavage & Keefe, 2004).

For all students with severe and multiple disabilities, literacy instruction needs to be explicit and intensive (Allor, Champlin, et al., 2010) as well as systematic and sequential (Erickson et al., 2010). Unfortunately, adapting materials requires a significant amount of time and “providing intensive instruction in the school setting is extremely challenging” (Allor, Champlin, et al., 2010, p. 500).

Barrier Two: Emphasis on Functional Life Skills

For many students with severe disabilities literacy instruction is considered a secondary issue to curriculum deemed more functional (Zascavage & Keefe, 2004). Functional skills are generally considered to be those skills that an individual would use in daily life at home and in the community which consist primarily of domestic skills, vocational skills, and recreational skills with some basic academic skills that specifically pertain to completion of the aforementioned skills (Ruppar et al., 2011; Snell & Brown, 2011). The functional life skills curriculum model remained the predominant educational model throughout the 1980s and into the 1990s, giving rise to Community Living Domains (Falvey, 1989; Ford, Schnorr, Meyer, & Dempsey, 1997) and a focus on vocational and community goals (Falvey, 1989; Ford et al., 1997). This practical, life skills approach when paired with ecological assessments done within the context of an
individual’s environment was considered one of the best practices (Downing & Perino, 1992). However, while functional academics were addressed, they were restricted to reading and math skills focused on development of specific skills applicable to the domains of community living. For example, Ford et al. (1997) suggested that for a student with significant intellectual disabilities an appropriate reading goal would be, “While participating in English 8, Mary will listen to a small group of classmates as a story or passage is read orally” (Ford et al., 1997, p. 103). This suggested goal casts the student with severe disabilities as a passive recipient of literacy rather than as an active participant capable of full participation in the literacy learning opportunity.

Purported benefits of a functional life skills approach to education for students with severe and intellectual disabilities revolve around student quality of life as an adult through learning how to function independently in society postschool (Ayres, Lowrey, Douglas, & Sievers, 2011; Bouck & Joshi, 2012). Ayres et al. (2011) also suggest that individuals who have access to a functional skills approach to education are more likely to gain independence in the community and thusly improve the perceptions of mainstream community members regarding individuals with disabilities. Downing (2006) however argues that “although some might tout the need for the teaching of ‘functional life skills’ for these students, in this author’s mind, that’s exactly what reading is- a very functional life skill” (p. 39). Ruppar et al. (2011) concur that literacy meets the definition of a functional life skill.

In a review of literature on the effects of a functional life skills curriculum, Alwell and Cobb (2009) ultimately report that due to the limited number and wide variability of
reported interventions, there was nothing they could identify as best practices in teaching functional life skills to individuals with severe and intellectual disabilities. Likewise, in a secondary data analysis of results of the National Longitudinal Transition Study-2, where postschool outcomes of students with intellectual disabilities who had received a functional life skills education were compared to postschool outcomes of students with intellectual disabilities who had received a nonfunctional or traditionally academic education, no statistical difference could be reported for any postschool outcome (Bouck & Joshi, 2012).

**Barrier Three: The Readiness Model**

Yet another barrier to literacy instruction for students with severe and multiple disabilities is based on the socially entrenched belief in a sequential skill sequence inherent in literacy acquisition (Zascavage & Keefe, 2004). First defined by Chall in 1983, the skill sequence has guided literacy instruction by dividing literacy skills into a sequential set of building blocks which begin with the prereading stage, move into several learning to read stages, and eventually into the stages of reading to. In this developmental model, prerequisite skills must be learned and mastered before a student can move to the next stage or skill set (Collins, 2008). For example, students should be able (a) to write their name and the letters of the alphabet, (b) name the letters of the alphabet, and (c) retell a familiar story before moving on to such skills as understanding letter-sound/symbol relationships and learning sight words or basic decoding skills (Browder et al., 2011).
However, students with severe and multiple disabilities do not always follow typical patterns of acquisition, being able to master high level skills while being unable to acquire prerequisite skills. Thus, this traditional view does not provide educators with an accurate picture of a student’s literacy use or potential (Morgan et al., 2011). This anomaly can create difficulty for educators who fear moving on to higher levels before the predetermined lower level steps are mastered. That can also create difficulties for students who are not able to master those first steps and thus are subsequently deemed incapable of learning literacy skills and thus excluded from further literacy instruction (Agran, 2011; Downing, 2005; Keefe & Copeland, 2011; Kliwer et al., 2004). “The ‘readiness model’ of literacy instruction had a great impact on the nature of instruction provided to these students, who often have difficulty acquiring the numerous prerequisite skills, deemed essential for literacy development” (Mirenda, 2003, p. 271).

Barrier Four: Low Expectations

Maybe the biggest barrier that students with severe and multiple disabilities face is the low expectations for literacy acquisition. Copeland and Keefe (2007) note that a dangerous assumption made by many professionals is that students with severe disabilities cannot benefit from literacy instruction and thus no literacy instruction should be provided. This dangerous assumption becomes a self-fulfilling prophecy of circular logic. A student is perceived as being too disabled to acquire literacy or does not move beyond the prerequisite steps in the readiness model and as a result literacy instruction is put aside in favor of other more “functional” skills (Agran, 2011; Bailey et al., 2011; Browder et al., 2008; Copeland & Keefe, 2011; Downing, 2005; Erickson &
Koppenhaver, 1995; Forts & Luckasson, 2011; Keefe & Copeland, 2011; Mirenda, 2003). Kliewer (2008) describes this phenomenon as blaming the student:

> The literate participation of many children with significant disabilities in segregated settings was commonly limited to extremely brief, adult-designed expressions of bodily needs...the resulting lack of literacy is then blamed on what are considered to be the children’s intrinsic impairments rather than recognized as a manifestation of the stagnant settings in which children have been placed. (p. 33).

In a study done by Ainsworth (2014) parents of high school students with severe and multiple disabilities unanimously cited low expectations and teacher attitudes toward literacy education for students with severe disabilities as the primary barrier to their children’s literacy acquisition.

Browder et al. (2008) break the low expectations barrier down further into three potential areas of concern. The first area is the automaticity of a perceived cultural competence of a particular segment of the population, for example, those who have an IQ score below an arbitrary 55. Mirenda (2003) also identifies this arbitrary brush off of children with Autism whose interest in particular subjects or books on particular subjects is seen as ‘‘stimming’ and is discounted’’ (p. 271). The second area of low expectation revolves around the assumption that students with severe disabilities are only capable of learning certain skills such as functional sight words. Copeland et al. (2011) noted that if students with severe and multiple disabilities receive literacy instruction at all, it is most typically instruction in sight word recognition comprised of community or safety words.
The third identified potential area of low expectations is that of language and communication deficits as appearing to be preclusive to literacy instruction. This barrier is so prevalent that it affects all aspects of individual with CCN’s literacy experiences. While Light and Kent-Walsh (2003) denote the extreme importance of literacy for AAC users, they also note that “research suggests that children who use AAC have qualitatively different experiences that may affect their development of emergent literacy skills” (p. 5).

**Barrier Five: Lack and Focus of Research**

Yet another barrier is the general lack and focus of research supporting literacy acquisition for students with severe and multiple disabilities. Numerous authors cite a general lack of research in the area of literacy acquisition for students with severe disabilities in general and for those with CCN in particular (Bailey et al., 2011; Keefe & Copeland, 2011; Morgan et al., 2011). Browder et al. (2008) equate the void of published research with disinterest in the field saying, “the lack of research on teaching literacy and reading skills to students with significant cognitive disabilities illustrates the lack of interest in teaching such students to actively participate in literacy activities” (p. 129).

One of the potential issues with the research gap may have to do with the nature of the research itself and with a disputed definition of what constitutes literacy. The National Reading Panel described five components of literacy. So some researchers see empirical research to determine the effective instructional strategies, which lay the foundation of literacy acquisition in these five components, as a body of research needed (Agran, 2011; Allor, Champlin, et al., 2010; Erickson et al., 2010). Agran decries the
“scant attention paid to the components recommended by the National Reading Panel (2000); specifically, phonemic awareness, phonics, reading fluency, vocabulary development and comprehension strategies” (2011, p. 89). Bailey et al. (2011) call for more research into the effectiveness of interventions specifically for teaching literacy skills to students with CCN. Erickson et al. (2010) defend the need for research into the identified and accepted components of literacy as the foundational skills that will ultimately result in literacy acquisition for this population of students.

Conversely, however, some researchers see the need for the definition of literacy to be broadened beyond the five identified components and thus, the research methods used to study them. Morgan et al. (2011) argue against a strictly skill-based definition of literacy and call for more qualitative research to be done as a more accurate reflection of how individuals with severe and multiple disabilities acquire and use literacy. Kliewer (2008), whose research is based in ethnography, describes how teachers in one school rejected the definition of reading as an end-element to a sequence of isolated subskills requiring student conformity [instead they] defined literacy as an evolving, symbolic dimension intrinsic to each strand of the web of shifting relationships that made up the classroom community. (p. 33)

Even Downing (2005) warns of the dangers of a too narrow definition of literacy as a means to exclude students from literacy. However, Keefe and Copeland (2011) caution that broadening the definition of literacy beyond the five NRP identified components in order to allow for the unique learning needs of individuals with severe and multiple disabilities should not be seen as justification for denying these individuals access to
literacy opportunities. Regardless of the definition of literacy, additional research is needed to define and demonstrate the literacy capabilities of individuals with severe and multiple disabilities and to highlight effective instructional strategies for helping them develop literacy.

**Research Questions**

Therefore, the purpose of the current study was to determine if the ALL Curriculum is an effective intervention for improving the accuracy of letter-sound correspondence and sight word acquisition by middle school students with severe and multiple disabilities including CCN, physical and moderate to severe intellectual disabilities, and autism when instructed in small groups in a school setting. This study aimed to add to the empirical research base on effective instructional strategies for students with severe and multiple disabilities including those with CCN. This study also extended previous research conducted by Light and McNaughton (2009) in the development of the ALL Curriculum. While the original research by Light and McNaughton utilized case studies, the current study used a rigorous single-subject, multiple-baseline design across participants design and replicated across two skill sets. Additionally, the original study included individual instructional sessions. The current study employed group instruction which allowed for a more authentic classroom experience. The current study also extended and replicated the results of a pilot study (Ainsworth, 2014) described in more detail in Chapter 2 by focusing on the group instruction in authentic classrooms.

The specific research questions are as follows:
1. Is there a functional relation between the use of the ALL Curriculum and increased accuracy of letter-sound correspondence by middle school students with severe disabilities and complex communication needs?

2. Is there a functional relation between the use of the ALL Curriculum and improved acquisition of sight words by middle school students with severe disabilities and complex communication needs?

3. Is there a functional relation between the use of the ALL Curriculum and increased level of performance in treatment phases for letter-sound correspondence and sight word recognition by middle school students with severe disabilities and complex communication needs when the intervention is conducted in small groups?

**Definition of Terms**

In order to provide consistency and transparent understanding, key terms used in this study are defined below.

*Severe Disability:* individuals who require extensive and ongoing support in one or more major activities of daily living such as for mobility, communication, self-care, and learning (Giangreco, 2011).

*Multiple Disabilities:* simultaneous impairments of which the combination causes such severity of impairment an educational setting which addresses only one of the impairments is insufficient (such as intellectual disability with orthopedic impairment) (Virginia Department of Education, 2012b).
**Intellectual Disability**: significantly sub average general intellectual functioning existing concurrently with deficits in adaptive behavior (Virginia Department of Education, 2012a).

**Moderate to Severe Intellectual Disability**: refers to individuals who meet the definition for intellectual disability but require substantially more pervasive and extensive supports (Browder & Spooner, 2011).

**Nonverbal**: use of nonsymbolic communication.

**Nonsymbolic Communication**: communication that is contextually bound and unique to a given individual such as eye gaze, body gestures, facial gestures, or nonspecific sounds (Browder & Spooner, 2011).

**Symbolic Communication**: the use of any widely recognized symbol set which are not contextually bound such as spoken language, written language, manual sign language, pictures, or recognizable parts of items (Snell & Brown, 2011).

**Student with Complex Communication Needs**: individual who may rely on nonsymbolic communication or AAC for expressive communication. This may include physical or sensory or intellectual disabilities as well (Beukelman & Mirenda, 2005).

**Direct Select**: use of fingers, hands, head stick, adapted pointer, or other body part to access all possible symbol choices presented at one time (Glennen & DeCoste, 1997).
Scanning: Indirect selection method in which symbol choices are systematically presented to the viewer who uses an adapted access method of selection such as a switch (Glennen & DeCoste, 1997).

Eye Gaze: direct select access facilitated by an eye gaze at the desired symbol or object (Glennen & DeCoste, 1997).

Manual Scanning: physically moving hand or finger over all possible symbol choices presented at one time prior to making a selection.

Visual Scanning: visually moving eyes over all possible symbol choices presented at one time prior to making a selection.

Phonics: understanding that letter-sounds represented graphically by symbols (letters of the alphabet) and can be blended together to form words (National Reading Panel, 2000).

Sight Words: words memorized and recognized on sight (Light & McNaughton, 2009).
CHAPTER TWO

Chapter 2 is divided into four major sections. The first section presents the literature search procedures. The second section covers characteristics of the participants involved in this study including those individuals with intellectual disabilities, those with physical disabilities, those who have comorbid autism and intellectual disabilities and those who require use of augmentative and alternative communication systems. The third major section addresses instructional strategies and literacy skills targeted during the current study. Specifically, the instructional strategies applicable to the research procedures in the current study include direct instruction, systematic instruction, and constant time delay. This section also presents a review of the literature on teaching phonics and sight words specifically to the target population involved in the current study. The fourth major section presents a review of research in the area of literacy skills acquisition for the target population including results of the pilot study, a discussion of the original research for the ALL Curriculum, and a discussion of the challenges researchers face in researching the target population.

Literature Search Procedures

The literature search was performed using the following data bases: Academic Complete, Health Source: Nursing/Academic Edition, Humanities Full Text, OmniFile Full Text Mega, Education Full Text, Social Sciences Full Text, Teacher Reference
Center, ERIC, Psych-Info, and JSTOR. There were no publication year limitations. The following keywords were used: literacy and severe disabilities, AAC and literacy, augmentative and alternative communication and literacy, severe disabilities and literacy, AAC and literacy and ID and MR, mental retardation and phonics, mental retardation and sight words, intellectual disabilities and literacy, group instruction and severe disabilities, intellectual disabilities and group instruction, variability and intellectual disabilities, severe disabilities and variability. The descendant search was conducted using the names of prominent scholars in this research topic to identify any additional sources (e.g. Browder, Spooner). A hand search was performed using table of contents in such journals as Research and Practice for Persons with Severe Disabilities and Education and Training in Autism and Developmental Disabilities from 2010 through 2013 in order to identify any other relevant articles. Another means of searching included examining websites or relevant organizations including TASH.org, CEC.org, IRA.org, AAIDD.org, Center for Disease Control, and the US Department of Education. Finally, an ancestry search was conducted using the reference list of key articles (e.g. Agran, 2011; Keefe & Copeland, 2011) identified by the database search and relevant text books.

Criteria for inclusion and Exclusion

All of these search procedures identified 180 sources including 17 books or chapters in books, 9 websites, and 5 other sources such as seminars and published curricula. First, the identified literature was examined for relevancy to teaching literacy to students with severe disabilities at all ages and grade levels. Next, the topic was delimited
to studies on the targeted literacy component of phonics and sight words which are those skills used in the current study. Those articles pertaining to other elements of literacy such as phonemic awareness, fluency, and comprehension were not included. The pool was further delimited to address only those sources pertaining to the teaching strategies of direct instruction, systematic instruction and constant time-delay as those were the teaching strategies used in the current study. Additionally, those sources published prior to 2000 were not used unless considered seminal works or unless more current relevant articles could not be found.

**Characteristics of Individuals With Severe and Multiple Disabilities**

Severe disabilities is a term that has been used to describe a heterogeneous group of individuals whose disabilities cause them to require a pervasive and extensive support structure to participate in activities of daily living (ADLs) (Beirne-Smith, Patton, & Kim, 2006). These activities of daily living include self-care such as bathing, dressing, toileting, eating, and getting out of bed and to a chair (Rajan, Herbert, Scherr, Mendes de Leon, & Evans, 2013). Individuals considered to have severe disabilities are likely to have primary disabilities of autism, deaf-blindness, intellectual disabilities, multiple disabilities, and traumatic brain injury and are likely to have comorbid deficits in adaptive behaviors, sensory, orthopedic, functional skills, or behavioral concerns (Snell & Brown, 2011). The participants who took part in the current study were individuals with severe disabilities including intellectual disability, autism, physical disabilities, and complex communication needs. In the following sections each of these categories of severe disabilities pertaining to the participants in the current study is explored.
**Intellectual Disability**

In the current study, all of the participants had IQ scores below 50 indicating that they all had intellectual disabilities, regardless of other comorbid conditions such as autism and cerebral palsy. However, defining what intellectual disabilities entails has historically been a challenge. What constitutes an intellectual disability has been an amalgamation of an ever changing set of criterion.

**Important characteristics and definitions.** Throughout history, humans have struggled with defining what it means to be intelligent and thus conversely what it means to have an intellectual deficit (Sattler, 2001). In 1510 a test of mentality was proposed by Fitzbert that included being able to count 20 pence, tell one’s age, and identify one’s father. Then in 1610 Swinburne suggested requiring that before a person could be tried in a criminal case, they must be declared intellectually sound by measuring a yard of cloth and naming the days of the week (as cited in Sattler, 2001). Certainly by these standards, many of the individuals who today are considered to have intellectual disability would be proven intellectually sound. However, as society changed and became more complex, the need to better define what it means to be intelligent or to define intelligence continued to evolve. Binet in 1916 defined intelligence as “the tendency to take and maintain a definite direction; the capacity to make adaptations for the purpose of attaining a desired end; and the power of autociticism” (Sattler, 2001, n.p.). In 1958, Wechsler, a foundational author of the Wechsler-Bellevue Intelligence scale, defined intelligence as “the aggregate or global capacity of the individual to act purposefully, to think rationally, and to deal effectively with his environment” (Sattler, n.p.). These definitions of
intelligence, as well earlier tests of mentality, might result in those individuals who are considered to have mild intellectual disabilities today, to pass unnoticed unless they demonstrated physical manifestations of a disability.

However, it is important to note that historically speaking only more overt and severe forms of intellectual disability were ever recognized (Beirne-Smith et al., 2006). Prior to the 1700s, those individuals with pronounced intellectual or other forms of disability, were provided the basics of food and shelter in monasteries or in almshouses but were not provided with training, education, or other social opportunities (Beirne-Smith et al., 2006). It was not until Jean Marc Itard in 1799 began his work with the wild boy of Aveyron, whom he named Victor, that any systematic attempt was made to educate an individual who appeared to have an intellectual deficit (Beirne-Smith et al., 2006). Additionally it was not until 1837 that the first successful school for children with intellectual disabilities was established by Seguin who also created the Seguin Form Board which is currently used to assess visual discrimination and eye-hand coordination (Sattler, 2001).

Still, what defines an intellectual disability is hard to identify. Even the association dedicated to promoting effective research and practices, rights and policies for individuals with intellectual disabilities, the American Association on Intellectual and Developmental Disabilities (AAIDD formerly known as the American Association on Mental Retardation - AAMR) has seen the need to change their definition of intellectual disabilities 10 times since 1908 (Collins, 2008). The current definition of intellectual disabilities which appears on the AAIDD’s website is “a disability characterized by
significant limitations both in intellectual functioning and in adaptive behavior, which covers many everyday social and practical skills. The disability originates before age of 18” (2013). Besides denoting what constitutes a deficit in intellectual functioning, defined as intellectual disability, the website also provides a tentative definition of intelligence as “general mental capacity, such as learning, reasoning, problem solving, and so on” (2013). It also makes reference to the criterion of an IQ score falling below 70 or 75 as in indication of an intellectual disability.

Intellectual disability, however it is defined, encompasses a broad category of individuals with a wide range of abilities and support needs. Kopelman (1984) points out that individuals with intellectual disabilities “tend, unfairly, to be regarded as one group; or if distinguished, they are described as falling into one of four groups: mildly, moderately, severely, or profoundly retarded” (p. 65). It was not until 1838, however, that intellectual disability was seen as a series of levels rather than one defined category and that it was differentiated from mental illness (Sattler, 2001). Since then there have been many iterations of defining and segmenting the varying levels within intellectual disabilities. The most widely used criterion for assigning levels to an intellectual disability is the IQ score (intelligence quotient). Even before the IQ test was conceived, individuals with intellectual disabilities were cast into levels based upon their perceived inherent depth of deficits. For example, one such classification system grouped individuals with intellectual disabilities into the levels of moron, imbecile, and idiot while another iteration used the terms high grade, middle grade, and low grade. More recently the terms educable mentally retarded, trainable mentally retarded, and
severely/profoundly mentally retarded were used (Collins, 2007). Prior to the shift to the term intellectual disabilities, the most common level system denoted individuals as those with mild, moderate, or severe mental retardation. The passing of Rosa’s Law initiated the move to use the term intellectual disabilities in 2010, departing from the previously used term *mental retardation*. This was in part a move to a less-stigmatizing term for these individuals and simultaneously a move away from a classification system in an attempt to move beyond presumptive categorization of individuals.

Yet another classification system that has attempted to move beyond pejorative terminology urged the use of language directed toward individuals’ support needs. In one institutional setting described by Ignacy Goldberg, individuals were placed in one of the following categories,

(a) the retarded who were in need of constant care and attention, (b) the normal retarded who cared for themselves and functioned in a relatively independent fashion within the group and (c) the minimally gifted who were rewarded by staff for doing things they were paid to do. (as cited in Collins, p. 12, 2007)

In 1992 the AAMR (now known as AAIDD) proposed a support-based classification system using the terms (a) intermittent (support on an as-needed basis), (b) limited (support needs time limited), (c) extensive (regular support involvement), and (d) pervasive (constant, high intensity, provision of support across settings) as denotations of support needs (Beirne-Smith, 2006).
However, in defining, labeling and classifying individuals with intellectual disabilities there are inherent ramifications that can affect how those individuals are treated within a society.

That is, saying that someone is handicapped and signifying that quality with a label often places him or her in a double disadvantage: he or she happens to be disadvantaged and our attitudes and value judgments make him or her so… [Thus] how others evaluate a label that implies a handicap may also arbitrarily close off experiences for those labeled as handicapped. (McCullough, 1984, p. 103)

Indeed Braddock and Parish (2002) have gone so far as to define disability as a social construct that reflects the socially perceived impairments and limitations of individuals who carry the label of intellectual disability. Indeed the baggage that appears to come with a label of intellectual disability, particularly if it is further stratified into a presumptive category, indicating a disability of more span and depth, can and does impact the opportunities these individuals are presented with. Low expectations based upon disability labels, and thus upon perceived deficits, have hindered the educational opportunities presented to individuals with intellectual disabilities, particularly in the area of literacy education (Agran, 2011; Bailey et al., 2011; Browder et al., 2008; Copeland & Keefe, 2011; Downing, 2005; Erickson & Koppenhaver, 1995; Forts & Luckasson, 2011; Keefe & Copeland, 2011; Mirenda, 2003).

The argument can be made, however, that labels offer professionals a starting point or touch point for developing appropriate supports, programs, and treatments. Kopelman (1984) argues that labeling individuals, while often done pejoratively, can also
benefit these individuals in “signaling that they have important and unique needs…[and]
very useful in making special care, programs or funds available to them” (p. 67). Indeed
individuals with intellectual disabilities do require unique and specific educational
strategies in order to maximize their potential. It is the appropriateness of the services
delivered rather than an inherent educability on the part of that individual that determines
whether or not that potential can be achieved (Collins, 2007). To say, however, that there
are specific strategies proven effective in the education of individuals with intellectual
disabilities, is to say that there is a discrete set of characteristics that these individuals
possess, which presuppose them to benefiting from said strategies. It is here the concept
of levels of disability appears as many of the associated causes of intellectual disability
are manifested along a continuum. Individuals with Down syndrome, fragile X syndrome,
autism, cerebral palsy, and fetal alcohol spectrum disorder can demonstrate intellectual
disability that ranges from mild to severe, thus making it difficult to encapsulate a
discrete set of characteristics applicable to the whole population of individuals with
intellectual disabilities. The broad descriptive characteristics listed on the AAIDD
website include (a) limitations in functioning as compared to same age peers in similar
and various contexts and (b) a mix of limitations coexisting with strengths (as cited in
The Arc, n.d.). Beirne-Smith (2006) separates the population of individuals with
intellectual disabilities into those with mild and those with severe manifestations. For
those with a mild form, the characteristics include (a) an external locus of control, (b)
expectancy of failure, (c) outer-directedness, (d) difficulty making and maintaining
relationships with others, (e) a higher than average prevalence of sensory deficits.
including visual, auditory, and motor issues, and (f) lastly, a two to three times increased risk over the general population of having a mental health disorder. Those individuals with a more severe form of intellectual disability are also more likely to have additional deficits in communication skills and increased behavioral concerns, while exhibiting more pronounced versions of the characteristics of those with mild forms (Beirne-Smith, 2006).

**Literacy skills.** A growing body of research is beginning to define the capabilities of students with intellectual disabilities in general and in acquiring literacy specifically (Alberto, Waugh, Fredrick, & Davis, 2013; Allor, Mathes, Roberts, Jones, & Champlin, 2010; Beecher & Childre, 2012; Finnegan, 2012). Students with intellectual disabilities have demonstrated progress in both letter-sound correspondence (Allor, Mathes, et al., 2010; Finnegan, 2012) as well as sight word recognition (Alberto et al., 2013; Beecher & Childre, 2012). Participants in these studies have acquired phonics through systematic phonics and analogy phonics lessons (Finnegan, 2012), through published curricula (Fredrick, Davis, Alberto, & Waugh, 2013) and systematic instruction (Swinehart-Jones & Wolff Heller, 2009). Participants have also acquired sight word recognition through the use of computer assisted programs (Coleman-Martin, Wolff Heller, Cihak, & Irvine, 2005), simultaneous prompting with and without error correction (Waugh, Alberto & Fredrick, 2011), and through published curricula (Beecher & Childre, 2012). This body of research highlights the ability of students with intellectual disabilities to acquire the foundational literacy skills of letter-sound correspondence (phonics) and sight word recognition.
Physical Disabilities

Several of the participants in the current study had physical disabilities in addition to intellectual disabilities. There are many reasons and causes for the manifestation of a physical disability, although cerebral palsy is the most common cause of childhood physical disability with an estimated 764,000 Americans diagnosed as having some degree of cerebral palsy (Centers for Disease Control, 2013).

Important characteristics and definitions. Physical disabilities can be the result of pre-, peri-, or postnatal causes. Prenatal causes may be diseases contracted by the mother, genetic disorders, or other fetal accidents including in-utero strokes. Perinatal causes may include injuries at birth due to lack of oxygen, difficult delivery resulting in fetal stress, or prematurity. Postnatal causes include accidents, diseases, or child abuse such as shaken baby syndrome. While vision impairments are generally classified as a physical disability, for the purposes of this study, inclusion criteria for student participants indicated that they must have some degree of functional vision.

Students who have physical limitations present a unique set of challenges for teachers, especially when the physical limitations are significant and impact an individual’s ability to do typical school-related activities such as writing with a pencil, holding or turning pages in a book, or to communicating verbally. Limited movement and fatigue may also present challenges to educators and barriers for students (Swinehart-Jones & Wolff Heller, 2009).

Literacy skills. There is considerable evidence that individuals with physical disabilities exhibit literacy skills significantly below those of their same-age peers.
(Carpenter & Readman, 2006; Erickson et al., 2010; Machalick et al., 2010). In a study
conducted by Carpenter and Readman (2006), 27 adults with physical disabilities were
interviewed to gain insight into the barriers they faced in acquisition of literacy skills. Of
the 27 individuals interviewed only 2 were employed. While the authors expected the
primary barriers indicated by the participants to be physical or support in nature it
became evident to them that the most significant barriers experienced by these
individuals were “primarily psychosocial in nature and could be interpreted as
representing the compounding effect of having decreased literacy skills and being
physically disabled” (p. 141). The barriers expressed by these individuals revolved
around the negative emotional responses they encountered, difficult experiences at
school, and low expectations of others which resulted in difficulties with remaining
motivated to acquire literacy skills. Unfortunately, low literacy expectations for students
with severe and multiple disabilities, even among professionals in the field of special
education, have historically been pointed out as the beginning of a cycle of a self-
fulfilling prophecy in which opportunities are not presented thereby making literacy
acquisition an impossible dream (Agran, 2011; Allor, Champlin, et al., 2010; Browder et
al., 2008; Erickson & Koppenhaver, 1995; Joseph & Seery, 2004; Keefe & Copeland,

Other barriers may include professionals being unfamiliar with or having access
to assistive technology (Zascavage & Keefe, 2004). Many individuals with physical
disabilities require the use of assistive technology (AT) to access literacy opportunities
and yet there remains an absence of information pertaining to the use of assistive
technology to support literacy acquisition for students with intellectual and physical disabilities (Erickson et al., 2010). Additionally the placement of individuals with multiple disabilities in stagnant environments, which focus on alternative curriculums lacking in literacy opportunities is another barrier students face. These segregated environments “commonly lack thoughtful or even recognizable academic opportunities” (Kliewer & Landis, 1999, p. 2582).

For many individuals with physical disabilities who came to be of schooling age prior to PL-194-142, literacy education was something that eluded them. In her autobiography, Ruth Sienkiewicz-Mercer was able to tell her story because of the dedication of one man, Stephen Kaplan, who was willing to spend 12 years of painstaking detective work in helping her to tell that story (Sienkiewicz-Mercer & Kaplan, 1989). Ruth Sienkiewicz-Mercer herself had “never spoken a word, typed a sentence…had little formal education and reads, at best, at a first-grade level, recognizing only simple words placed before her in a familiar context” (p. vii). Because of Kaplan’s dedication to the project, Sienkiewicz-Mercer was able to, as she put it, “I. FEEL. TALKING” (p. xvii). However, Kaplan was quick to point out that although the story belonged to Sienkiewicz-Mercer, he provided the words. Had she been given literacy instruction, she might have been able to tell her story in her own words.

At the national TASH conference in December 2013, Jerry Wooliver, an individual with physical disabilities, related his own life story from institutionalization to ultimate independence through a narrated PowerPoint show with the help of his attendants and family. In his presentation he noted that of all the opportunities lost to him
throughout his life of living in institutions, it was his lack of literacy that bothered him most. He had in later life reunited with family members lost to him when he was institutionalized and enjoyed keeping up with them on Facebook. However, he was dependent on his care attendants and others to facilitate this mode of communication and information exchange (Wooliver, 2013).

Individuals with physical disabilities who are coming into schooling age in the 2010s have more educational rights afforded to them than those individuals who came into schooling age in the 1960s and early 1970s. Yet there are still very real barriers keeping literacy education just out of reach of many of these individuals.

**Autism**

Four of the eight participants in this study had a diagnosis of autism which can be one of the contributing factors in determining an individual as someone with a severe disability. Autism is a spectrum disorder meaning that individuals diagnosed with autism can present with a wide range of ability levels and support needs, much as individuals with cerebral palsy (Autism Society, 2014, para. 1).

**Important characteristics and definitions.** According to Autism and Developmental Disabilities Monitoring (ADDM), 38% of children with ASD also have some level of intellectual disability (Center for Disease Control, 2014). In a report by the Department of Education, it is noted that of all children ages 6–21 who have disabilities, 7.2% of them have a diagnosis of autism and of these individuals diagnosed with autism 41.9% receive the majority of their special education services in separate special
education classes, separate schools or in residential facilities (U.S. Department of Education, 2014).

One of the major components of an autism diagnosis is its effect on communication. The DSM-V defines this aspect as persistent deficits in social communication and social interaction across multiple contexts, as manifested by the following, currently or by history:

- Deficits in social-emotional reciprocity, ranging, for example, from abnormal social approach and failure of normal back-and-forth conversation; to reduced sharing of interests, emotions, or affect; to failure to initiate or respond to social interactions.
- Deficits in nonverbal communicative behaviors used for social interaction, ranging for example from poorly integrated verbal and nonverbal communication; to abnormalities in eye contact and body language or deficits in understanding and use of gestures; to a total lack of facial expressions and nonverbal communication.
- Deficits in developing, maintain and understanding relationships, ranging for example, from difficulties adjusting behavior to suit various social contexts to difficulty in sharing imaginative play or in making friends; to absence of interest in peers. (American Psychiatric Association [APA], 2013, p. 50)

All of the participants with autism in the current study demonstrated communication difficulties.
Another aspect of autism is that of repetitive and ritualized behaviors. All of the participants with autism in the current study had a level of ritualized behaviors, which to some degree impacted their performances in the intervention. The DSM-V defines this by aspect as

Restricted, repetitive patterns of behavior, interests or activities as manifested by at least two of the following…

- Stereotyped or repetitive motor movements, use of objects or speech
  (simple motor stereotypies, lining up toys or flipping objects, echolalia, idiosyncratic phrases)
- Insistence on sameness, inflexible adherence to routines, or ritualized patterns of verbal or nonverbal behavior (e.g. extreme distress at small changes, difficulties with transitions, rigid thinking patterns, greeting rituals, need to take some route or eat same food every day).
- Highly restricted, fixated interests that are abnormal in intensity focus (e.g. strong attachment to or preoccupation with unusual objects, excessively circumscribed or preservative interests).
- Hyper- or hyporeactivity to sensory input or unusual interest in sensory aspects of the environment (e.g., apparent indifference to pain/temperature, adverse response to specific sounds or textures, excessive smelling or touching of objects visual fascination with lights or movement). (APA, 2013, p. 50)
All of the participants in this study demonstrated aspects of ritualized and repetitive patterns of behavior.

**Literacy skills.** Individuals with autism often demonstrate the ability to learn code or rule-oriented aspects of literacy such as phonics and decoding (Frith, 2003; Sigman, Dissanayake, Arbelle, & Ruskin, 1997; Whalon, Otaibi, & Delano, 2009) but have more difficulty with comprehension aspects of literacy (Mayes & Calhoun, 2003a, 2003b; Nation, Clarke, Wright, & Williams, 2006; Whalon et al., 2009). Whalon et al. (2009) recommended that students with autism participate in all of the five identified areas of literacy according to the National Reading Panel (2000) as previously delineated.

In a review of literature on evidenced-based practices in teaching sight words to individuals with autism, Spector (2011) found only nine intervention studies in which data from participants with autism were disaggregated by disability category from other participants. In the reviewed studies, the participants with autism all learned to read targeted sight words. However, the author notes that there were not enough studies addressing any one of the instructional strategies (e.g., massed trials, systematic prompting, constant time delay, stimulus prompts) to determine evidence-based practices.

In another review of literature on the broader topic of literacy acquisition for students with autism, Whalon et al. (2009) examined 11 studies which included 61 participants with autism ranging in age from 4 years to 17 years old. Of the 11 studies examined, 4 targeted skills that were rule oriented such as phonics. Results from these studies indicate that for students with ASD this was a relative strength as compared to comprehension-based literacy skills that were addressed in 5 of the 11 studies. This is
consistent with the findings in the current study in which participants with autism had slightly higher mean increases in letter-sound correspondence than in sight word recognition. This is further discussed in Chapter 4.

The use of computer software packages to teaching literacy skills to students with autism were reported in studies conducted by Basil and Reyes (2003) and Coleman-Martin et al. (2005). In the first study all six participants used a computer program (Delta Messages) to create increasingly complex sentences based upon 70 words. The two participants with autism in this study did as well as their peers with other disabilities. In Basil and Reyes’ study, participants were taught across three conditions: (a) teacher only, (b) teaching plus computer assisted software, and (c) computer assisted software only. All three of the participants, including one participant with autism, were able to reach criterion on target sight word recognition across all of the conditions. The authors note that while individual participants’ rates of learning differed, as did their baseline reading levels, they all made progress toward and reached criterion. Basil and Reyes echo this sentiment stating that, “One major implication of the present results is that poor reading skills cannot be explained by cognitive deficits and impaired underlying processes alone” (p. 42).

**Complex Communication Needs**

The ability to communicate with other people is a vital skill not only for expressing wants and needs (Stephenson, 2009), but also for social and academic functions (Crestani, Clendon, & Hemsley, 2010; Valiquette, Sutton, & Ska, 2010). In the current study, all of the participants had complex communication needs resulting in the
need for an alternative or augmented communication system aside from verbal communication. Participants in this study used a variety of augmented communication strategies including (a) Pictures Exchange Communication (PECs), (b) voice output devices with specialized programs such as iPads, and (c) nonsymbolic communication strategies such as gestures, head nods, nonspecific vocalizations, and eye gaze.

**Important characteristics and definitions.** Communication, especially narrative communication, influences literacy acquisition, academic achievement, development of friendships, social interaction, and classroom participation (Crestani et al., 2010). For individuals with intellectual disabilities and complex communication needs who require speech generating devices (SGD) or other forms of augmentative and alternative communication (AAC), the development of communication skills is often a function of access to a range of vocabulary provided by another individual such as a teacher, parent, or therapist (Crestani et al., 2010; Valiquette et al., 2010).

AAC can be limited to the use of pictures and line drawing in isolation (Stephenson, 2009) or in combination with an SGD which are also known as voice output communication devices (VOCs). Speech generating devices range in their message capacity from those that allow only one recorded message to devices where messages are written by users creating unlimited vocabulary. However, for most individuals with intellectual disabilities, the SGDs selected for them provide a limited range of vocabulary (Valiquette et al., 2010) In addition, individuals with intellectual disabilities often have limited control over vocabulary programmed into their SDGs (Crestani et al., 2010). Discerning vocabulary for use with individuals with intellectual disabilities and complex
communication is of upmost importance. In a synthesis of three studies aimed at discerning appropriate vocabulary for individuals with complex communication needs, the three research teams employed three different approaches. Due to a lack of evidence-based practices established for selecting vocabulary to program into SGDs for individuals with intellectual disabilities, the authors of the following studies approached the subject from different angles. These authors looked at vocabulary selection for SGDs for individuals with intellectual disabilities by (a) studying competent SGD uses, (b) by studying beginning SGD uses, and (c) by studying what vocabulary is used by typically developing students as a means of determining appropriate vocabulary for SGD users. Valiquette et al. (2010) limited participants in their study to individuals who had SGDs with at least 32 symbols. The rationale for this decision was based on the fact that individuals using SGDs with fewer symbol options would be considered beginning communicators and thus might not be able to participate fully in the study. Conversely, Stephenson (2009) selected participants with severe intellectual disabilities who had no functional speech and whose AAC was limited to use of pictures for his study into vocabulary development. Meanwhile, Crestani et al. (2010) took an entirely different approach to their research by studying students without any disabilities in order to discern the vocabulary used by typically developing individuals in the context of narrative discourse.

Findings across these studies highlight vocabulary selection as both a limitation for individuals with intellectual disabilities and complex communication needs (Crestani et al., 2010; Valiquette et al., 2010) as well as indicators of the individual’s own
limitations (Stephenson, 2009). Crestani et al. (2010) report that the most common vocabulary used in narrative discourse by typically developing individuals without any communication needs were *I, and, the, it, was, then, got, had, and went*. For individuals with complex communication needs, access to these words is imperative to their ability to develop personal narratives and to reflect upon their own experiences and events. Valiquette et al. (2010) found that most of the participants in their study used their SGD in limited settings and relied on parental interpretation and nonsymbolic communication means such as gestures, vocalizations, and facial expressions to communicate in the community or at home.

**Literacy skills.** For individuals with intellectual disabilities and complex communication needs, access to a range of vocabulary designed to promote narrative discourse is a critical component of academic and social skills acquisition (Crestani et al., 2010; Valiquette et al., 2010). For individuals responsible for selecting vocabulary for SGD or AAC, it is important to remember (a) the desires and priorities of those who will use the vocabulary (Valiquette et al., 2010), (b) the vocabulary commonly used in narrative discourse by typically developing individuals (Crestani et al., 2010), as well as (c) the intellectual and developmental level of the individuals for whom the vocabulary is being designed (Stephenson, 2009). However, acquisition of literacy for individuals with complex communication needs could enhance independence in communication and render the need for third party selection of available vocabulary unnecessary.

Unfortunately, literacy acquisition for individuals who use AAC has disproportionately lagged behind that of their peers in reading and spelling (Dahlgren
Sandberg, Smith, & Larsson, 2010). One explanation for this is the assumption that an individual’s difficulty with and deficits in symbolic communication and language may preclude reading instruction (Browder, Ahlgrim-Delzell, Spooner, Mims, & Baker, 2009). This is a most unfortunate assumption because for individuals with limited or no speech, writing may be the easiest and most autonomous means of communicating with others (Myers, 2007). While research indicates the importance for individuals with severe disabilities to have choice options (Guess, Benson, & Siegel-Causey, 2009; Sigafoos & Dempsey, 1992; Stafford, 2005) the ability of individuals with severe intellectual and comorbid physical and communication disabilities to make selections may inhibit their participation in choice making activities where they are visually presented with a set of options and expected to select an activity, tangible, or person from the given set of options (Sigafoos & Dempsey, 1992). Kliewer (2008) also notes that one barrier students who rely on AAC may face is that they are often presented with SGDs with messages to communicate bodily functions such as bathroom or eat but not much more. “The expectation was that a child with significant disabilities had nothing to say beyond those few expressions of bodily function” (Kliewer, 2008, p. 33).

Additionally the focus on acquisition of sight words as the sole literacy education for students with CCN and severe disabilities is a roadblock that stems from a seeming dichotomous relationship between being a “nonverbal” individual and phonics instruction (Swinehart-Jones & Wolff Heller, 2009). For many practitioners in the field of severe disabilities the primary roadblock to teaching phonics is that students who are essentially nonverbal cannot produce, blend, or segment phonetic skills orally. In a study conducted
by Hart, Scherz, Apel, and Hodson (2007), four students with physical disabilities and complex communication needs, ages 9, 12, 19, and 23, were matched up to four students of the same gender and spelling ability who did not have disabilities. During the study, when the students who did not have communication needs were given a spelling test, they orally sounded out the words, rehearsing each sound as they were spelling. The students who had CCN were unable to demonstrate this type of rehearsal. Results from the study indicate that participants with complex communication needs were outperformed by their peers without disabilities on the assessments used.

Further complicating literacy instruction for students with complex communication needs is the fact that the majority of teachers do not believe that students who have complex communication needs and severe disabilities are capable of learning phonetic and word attack strategies. Thus, these students are rarely taught phonetic-based literacy strategies (Copeland & Keefe, 2007). Students with CCN present a challenge to teachers since it is hard for teachers to know what their students are learning when they cannot easily repeat back in order for the teacher to check for comprehension and retention. For many students who have both intellectual disabilities and complex communication needs, AAC does not necessarily lesson or eliminate barriers to literacy acquisition since many individuals will continue learning to use their AAC strategies over many years (Browder et al., 2008). Additionally, the use of AAC to facilitate literacy lessons provided inadequate or inefficient responses (Erickson et al., 2008). This is especially true when students are using an SGD that has a dynamic display where they must manipulate multiple pages and understand how they link together in order to find
the response they are looking for. The operation of a dynamic display device can be a lengthy process, especially if students are accessing their device with switches or scanning software. That means that they have to multitask in order to participate in the lesson. As noted in the Hart et al. (2007) study, it is not uncommon for early spellers to sound out the words they are attempting to spell so that they can hear the sounds the word makes and then encode those sounds in the orthographic representations known as letters. For students who are nonverbal, the skill of encoding words can be more difficult because they do have the ability to say and hear the sounds as they manipulate them into letters. This skill requires participants to hear a sound either because they produced it orally or in their head, then to visualize the representative symbol, then hold both of those representations in their head long enough to record it. This process can be much longer for a student using an AAC device. Thus, one participant in Hart et al.’s study had to

first activate the scan feature of his device, wait for the column that the sound was in to become highlighted, activate his head switch, watch as the row was scanned vertically, and then activate his head switch again to choose the letter. If he made an error, he had to start the process again. His comparison participant, in contrast, looked at the keyboard of the computer and then pressed the letter of his choice, all the while rehearsing the sounds of the word out loud. (2007, p. 26)

While most of the participants in the current study had access to SGDs for use during the school day, none of the students used their devices spontaneously or consistently. Hence, the case against participants using an SGD as a response tool for the intervention is clear. Participants needed to be able to focus on acquisition of the content
rather than on the mechanics of using a SGD. Therefore, and in light of the research presented, the participants in the current study used the multiple choice method of participation in assessment and instruction as provided by the ALL Curriculum by selecting one of four answer selections using direct select (eye or hand).

**Variability in Performance by Target Population**

One of the challenges in research involving individuals with severe disabilities and complex communication needs is the variability seen in the results and in the data and across participants. This trend of inconsistency has been identified as a characteristic of individuals with moderate to severe intellectual disabilities and autism (Sherer & Shreibman, 2005). High variability in performance by the target population affects the selection of the research methods. Thus, traditional analyses supplementing visual inspection in single-subject research such as calculation of Percentages of Nonoverlap Data (PNDs) may not be problematic. In a study conducted by Bailey et al. (2011), there was high variability in the data. Mean PND calculations for letter-sound correspondence matching across the four participants were 35%, 56%, 25%, and 22% respectively indicating no effectiveness (< 50%) or questionable effectiveness (50-70%) of the intervention. Variability was high in both baseline and treatment phases. However, while acknowledging that there was little evidence of a functional relation, they pointed out that each of the participants made overall gains in their letter-sound correspondence skills. Similar conclusions were mad in the pilot study conducted by Ainsworth (2014). While overall level and trend showed increases, variability was high across both baseline and treatment phases across participants.
In a longitudinal study conducted by Allor, Mathes, et al. (2010), the authors also noted high variability across participants. In this randomized quasi-experimental study, participants were verbal elementary aged with IQ scores between 40 and 69. Participants were randomly assigned to either a control group or an intervention group. The control groups received the traditional literacy instruction available in their classrooms which was typical of special education instruction. Participants in the intervention group received daily instruction delivered in small groups by highly trained teachers, which included instruction in concepts of print, phonological and phonemic awareness, oral language, letter knowledge, word recognition, vocabulary, fluency, and comprehension using a published curriculum. Results indicated that after three years of intensive instruction in comprehensive literacy instruction, participants reached criterion associated with end-of-first grade levels. Additionally the authors note that IQ did not appear to be a predictor of performance. The authors conclude that variability across participants is to be expected. They also noted that when students with intellectual disabilities are provided with intensive and long-term instruction in literacy, they can reach criterion (Allor, Mathes, et al.).

Variability of response was also noted in a studies conducted by Baylis and Snowling (2012) as well as by Boudreau (2002) involving participants with Down syndrome. Baylis and Snowling examined the efficacy of phonologically based literacy program in teaching individuals with intellectual disabilities was evaluated. Results indicated that use of a systematic phonics-based program increased the literacy skills for individuals with intellectual disabilities despite the variability of responses. For example,
the authors note that there was considerable variability in scores between children as well as in the aggregate means of acquired skills. They maintain however, that although variability was high, statistically significant changes between baseline and treatment scores were measured. Boudreau examined a broad scope of individuals with Down syndrome to examine the difference between literacy acquisition skills and individuals with similar developmental abilities. Results provided findings consistent with other research findings showing that individuals with Down syndrome demonstrate a relative strength in word identification. Additionally, the author reports “broad variability in levels of literacy acquisition achieved by” participants (Boudreau, 2002, p. 516).

**Instructional Components of the Intervention Study**

In the following subsections the specific instructional strategies and targeted literacy skills addressed in the current study are discussed. The instructional strategies used in the current study and subsequently discussed in this section are direct instruction, systematic instruction, constant time delay, and group instruction. The literacy skills targeted for intervention in the current study are and phonics (letter-sound correspondence) and sight word recognition.

**Specific Instructional Strategies Used in the Current Study**

In typically developing children, learning to read is a multilayered task involving all five components of literacy along with writing in an iterative process. This interconnectedness of the components makes it important for a comprehensive reading program to cover simultaneously all of the components (National Reading Panel, 2000). Instructional strategies found to be effective in teaching a variety of skills, including
literacy, to individuals with severe disabilities are direct instruction, systematic instruction, and constant time delay which are also strategies used in the current intervention. Direct instruction and systematic and explicit instruction have been specifically identified as effective strategies in teaching the components of literacy for all students (Learning Points Associates, 2004; National Reading Panel, 2000). In a comprehensive review of research on reading instruction for individuals with intellectual disabilities, Browder, Wakeman, Spooner, Ahlgrim-Delzell, and Algozzine (2006) identified 128 studies covering sight word acquisition, picture identification, comprehension, phonics, phonemic awareness, and fluency. Within these studies, the researchers identified use of time delay as it pertains to errorless learning as the only evidence-based strategy to come from their analysis of the included studies. Below are detailed descriptions of studies that explicitly specified use of direct instruction, systematic and explicit instruction, and constant time delay to teach literacy skills to individuals with severe disabilities.

**Direct instruction.** Direct instruction has been defined as the presentation of instruction in small steps with ongoing monitoring of student understanding, while eliciting active and successful participation from all students (Rosenshine, 1986). In the current study, direct instruction was the key element of the intervention curriculum where the script for each lesson presented small steps toward the final task of letter-sound correspondence, and the instructor was guided to continually check for student understanding through active participation in the lesson. Direct instruction has been
shown in existing research to be an effective strategy for presenting new information to students with severe disabilities.

In a study conducted by Fallon, Light, McNaughton, Drager, and Hammer (2004), direct instruction was used to teach single words to five students who demonstrated less than 30% speech intelligibility with comorbid diagnosis of physical and/or intellectual disabilities. During each session, participants were presented with five words from a pregenerated list. Participants were first asked to watch as the instructor modeled reading the word while running a finger under the word (tracking) as it was read, then to practice the skill along with the instructor, and finally to independently perform the word tracking and to select the corresponding picture. This study’s procedures did not require participants to repeat or otherwise orally produce sounds or words. Results of the study indicate that four of the five participants achieved 100% PNDs while one participant reached 88% PNDs in recognition of targeted sight words.

Direct instruction was also used in studies conducted by Ruwe, McLaughlin, Derby, and Johnson (2011) as well as by Crowley, McLaughlin, and Kahn (2013) in which a direct instruction flash card system was used to teach sight words students with autism and intellectual disabilities. Ruwe et al. worked with three middle school students with intellectual disabilities while Crowley et al. worked with two elementary students with autism. All participants across both studies relied completely on natural speech as their primary mode of communication. The youngest participant, a kindergartner in the Crowley et al. study, was learning to use AAC to facilitate and to augment verbal communication. However, all participants used oral pronunciation of presented sight
words within the context of the studies. In the Ruwe et al. study participants were shown a set of sight word flash cards one at a time. If the participant could identify the sight word presented on an individual flash card within 2 seconds, then the flash card was put at the back of the stack. If the participant was unable to identify the sight word within 2 seconds or identified it incorrectly, then the instructor modeled pronouncing the word and the participant repeated it. The incorrectly identified card was then placed two to three cards back in the deck, so that it would appear again quickly in the lineup. A very similar procedure was used in the Crowley et al. study with the additional use of a reading racetrack implemented after the direct instruction flash cards were presented.

Results from the Ruwe et al. (2010) study provided strong evidence of the effectiveness of direct instruction flash card systems for teaching sight words in isolation. The three participants in this study correctly identified 92.25 %, 94.39%, and 96.75% of the sight words across all three sets respectively. However, the authors were unable to attribute the direct instruction flash card system to any gains made in the passage-reading probes as the results were unclear.

In the Crowley et al. (2013) study, results also indicated a functional relation between the use of the direct instruction flash cards plus the use of the Reading Racetrack in teaching sight words to two participants with autism. One of the participants reached 100% PND across all five word sets. The second participant showed more variability in data, however, still reaching 100% PNDs for five word sets and 75% PNDs for one more word set.
**Systematic and explicit instruction.** Another recommended teaching strategy is systematic and explicit instruction (National Reading Panel, 2000). The hallmarks of systematic instruction involve lessons that are carefully constructed and sequenced in a logically progressive manner. Explicit instruction, very much like direct instruction, involves the instructor specifically identifying the skills for students to be taught in the lesson and then directly modeling the skill (Learning Points Associates, 2004). According to the National Reading Panel (2000), the most effective strategy for teaching phonics is through systematic instruction. The current intervention study made use of systematic and explicit instruction through progressively scaffolded lessons which allowed for systematically moving from exposure to the concept, modeling of the concept, guided practice, and eventually to independence with the presented concept. In the following studies, the use of systematic and explicit instruction is shown to be an effective strategy in teaching literacy to individuals with severe disabilities.

Systematic and explicit instruction was used in a study by Hanser and Erickson (2007) where they explored the intersection between sight word acquisition and use of AAC through the Literacy Through Unity: Word Study program (Hanser & Erickson, 2007). This integrated communication, spelling, and word study program was designed to be used in conjunction with Prentke Romich dynamic display AAC devices including the Vanguard, Vantage, and Pathfinder. Three participants between the chronological ages of 7 and 13 were studied (a) who used dynamic display AAC devices at home and school, (b) were able to communicate two messages per minute on their AAC devices, and (c) demonstrated age equivalents of at least five years on a standardized vocabulary test.
Data were collected using pre- and posttesting as well as a nonconcurrent multiple-baseline design. Pre- and posttesting captured the change in participant communication over time. The multiple-baseline design was used to capture the frequency of participant usage of letters and icon sequences. Results of the study indicated that participants had an average gain of 5 words or 20% increase in word identification, an increase of 14 words or a 56% increase in icon sequencing, and an average gain of 3 additional words in the word generation skill. However, one participant demonstrated a 5% decrease in the word generation skill.

Constant time delay. Constant time delay is the process of inserting a fixed amount of time between the presentation of the stimulus and the presentation of the controlling prompt (Snell & Brown, 2011). The use of time delay is intended to ensure that students are not making errors since the correct answer is provided to them after the time delay (Browder & Spooner, 2011). In the current study, constant time delay was used in order to decrease student error during instructional sessions. It was also used in the study described below.

Using constant time delay in an alternating treatment design, Coleman, Hurley, and Cihak (2012) compared teacher directed and computer assisted methods of teaching students with moderate intellectual disabilities functional sight words. Participants in that study were three elementary-aged students identified as having moderate intellectual disabilities. Eleven functional sight words were selected for each instructional condition (teacher directed or computer assisted) and the conditions were counter-balanced to avoid possible carryover. During the teacher directed intervention, flash cards were used.
depicting both the orthographic representation and logographic (picture) representation of the sight word. The teacher presented the card and asked the student to identify the word. If they did not know the word, students were instructed to wait for the correct answer provided by the teacher. During computer assisted intervention, a PowerPoint presentation set on an automatic slide transition at the fixed time delay mirrored the teacher directed procedures. An orthographic representation of the word combined with a logographic representation of the word was presented on a slide. The voiceover asked the students to identify the word and to wait for the correct answer if they did not know the word. Thus the slide would automatically change at the designated time delay and the voiceover would give the participant the correct answer. Results from the study indicate that both methods were effective in teaching sight word acquisition to students with intellectual disabilities and autism. Participants attained 78.11% sight word accuracy in the teacher directed sessions and 77% sight word accuracy in the computer assisted sessions. Two of the three participants however achieved acquisition of their sight words more efficiently during the teacher directed intervention sessions. One student with autism acquired his sight words more efficiently through the computer assisted intervention sessions.

**Group instruction.** For the current intervention study, use of small groups for instructional sessions was implemented in order to replicate authentic classroom conditions. Grouping students for instruction is a long-held educational practice in general education classes. While the idea of individualized instruction being delivered individually to students with severe disabilities is still a popular notion (Collins, 2007).
there are many benefits to instructing students in groups (Collins, 2007; Collins, Gast, Ault, & Wolery, 1991; Collins, Hendricks, Fetko, & Land, 2002). “Some confuse the notion of individualized instruction for students with individual instruction, but they are not synonymous” (Snell & Brown, 2011, p. 135). One of the benefits of group instruction is efficient use of teacher time since the reality of the classroom is that teacher time is limited (Alberto et al., 2013; Cihak, Alberto, Taber-Doughty, & Gama, 2006). Teaching students in groups not only maximizes teacher time, but also decreases noninstructional time for students (Browder & Spooner, 2011; Snell & Brown, 2011).

Additionally, when students receive instruction in groups, they have the opportunity to learn through observation from the other students. This observational learning is an additional benefit of group instruction. Cihak et al. (2006) also noted the benefits of increased opportunities for observational learning as well as increased opportunities for active participation.

Another benefit of group instruction that also increases student opportunities is to respond to and to observe choral responses (Cihak et al., 2006). Choral responding is defined as the group responding together to answer a question or repeat a concept when the teacher gives a signal (Wolery & Ault, 1992). In a study conducted by Wolery and Ault (1992), the authors compared the effectiveness of choral and individual responses in teaching four students with moderate intellectual disabilities to learn community-sign words. Across three experiments, the authors manipulated the number of opportunities to respond and the number of exposures to the stimuli. In the first experiment the number of exposures to the stimuli remained the same across the two conditions (individual
response and choral response). However, the number of opportunities to respond was higher in the choral response condition. In the second experiment, the number of opportunities to respond was the same across conditions, but the exposure to the stimuli was higher in the choral response condition. In the third experiment, participants in the choral response condition were exposed four times to each stimulus word and had the opportunity to respond four times to each stimulus word. In the individual response condition of experiment three, the participants were exposed to each stimulus word eight times with two opportunities to respond per word. Results from the first experiment indicated the choral response condition was slightly more beneficial to 75% of the participants. Results from the second experiment indicated that the individual response condition was more effective than the choral response condition for 75% of the participants. Results from the third experiment indicated that the choral response condition under the given parameters of experiment three was only slightly more effective than the individual response condition parameter of experiment three.

**Literacy Skills Addressed in the Current Study**

The National Reading Panel described five components of literacy, including phonemic awareness, phonics, fluency, vocabulary, comprehension (National Reading Panel, 2000). While some empirical research exists to determine effective instructional strategies, more studies in these five components are needed (Agran, 2011; Allor, Mathes, et al., 2010; Erickson et al., 2010). For the current intervention, two of the five components were targeted for the purposes of this study.
**Sight words.** Sight word acquisition refers to the skill of automatic word recognition which occurs when a reader instantly recognizes a whole word as an orthographic and phonological unit (Ehri, 1992; Erickson et al., 2008). Basic word recall or sight word recognition is the most often taught literacy skill for students who have severe disabilities (Browder et al., 2011; Alberto, Waugh, & Fredrick, 2010; Erickson et al., 2008; McDonnell & Copeland, 2011). The ability to recall words automatically is an important tool in being independently literate (Alberto et al., 2013; Light & McNaughton, 2009; Schloss et al., 1995). Acquisition of sight words is a key element in obtaining fluency, one of the identified components of literacy. Fluency, which is the ability to read text smoothly without errors, relies on sight word identification. When less energy is spent decoding individual words, comprehension of the text read increases (National Reading Panel, n.d.). Due to the importance of sight word acquisition as a means to increase fluency, it was selected as one of the target skills for the current intervention study. The following studies also support sight word acquisition as a viable means for teaching literacy skills to individuals with severe disabilities.

Basic sight word recognition is the aspect of literacy instruction that receives the most attention both in the research and in classrooms (Alberto et al., 2010; Browder et al., 2011; Erickson et al., 2008; McDonnell & Copeland, 2011). However, concerns about the memory load required for storing and retrieving sight words has prompted many researchers and teachers to focus on limited single words or multiword phrases which are deemed functional for the student. The result of this practice is that students end up with limited and usually overly specific phrases (Alberto et al., 2010). Such words do not lend
themselves to the ultimate goal of literacy which is reading in connected text (Alberto et al., 2013; Browder et al., 2011). Yet, the automaticity that comes with sight word recognition is vital to being independently literate (Alberto et al., 2013; Light & McNaughton, 2009; Schloss et al., 1995). Research suggests that direct instruction involving modeling, guided practice, and/or flash cards is an effective means of teaching sight words to students with severe disabilities (Crowley et al., 2013; Fallon et al., 2004; Ruwe et al., 2011; Schloss et al., 1995). In addition to direct instruction, an important aspect of literacy acquisition is moving from reading isolated sight words to reading words in connected text (Duffy, 2009).

Fallon et al. (2004) targeted five students between the ages of 9 and 14 with physical and intellectual disabilities as well as significantly limited speech intelligibility for a study investigating the use of direct instruction in teaching sight word acquisition and generalization. Using a single-subject multiple-probe-across-subjects design, the researchers measured the number of vowel-consonant (VC) and consonant-vowel-consonant (CVC) words read correctly from a group of pretaught letter-sounds. Measures were taken for target words read correctly in isolation, target words read in connected text, and novel words comprised of the pretaught letter-sounds. During intervention sessions, participants were instructed on 15 different sight words broken into sets of three to represent the three components addressed by the authors as follows: “(a) matching single sounds to the initial sound of words, (b) telescoping sounds into words and (c) reading single VC and CVC words” (Fallon et al., 2004, p. 1428). To measure generalization of the skills, participants were asked to read novel words comprised of the
pretaught letters. All five of the participants were able to achieve the criterion of 80% accuracy over two consecutive sessions for target words read in isolation. Four of the participants achieved PNDs of 100%, while the one participant achieved PNDs of 88%. However, the number of sessions required for participants to achieve criterion varied from 10 sessions to 34 sessions. Only one of the participants achieved criterion for reading novel words created from the prelearned letter set. Two other participants demonstrated evidence of generalization to novel words, but failed to reach criterion. Likewise, while demonstrating evidence of generalization from reading isolated target words to reading those target words in connected text, none of the participants were able to reach the 80% criterion.

Using a changing criterion design within a nonconcurrent multiple-baseline-across-groups design, Alberto et al. (2010) taught five middle school students with intellectual disabilities to read targeted sight words within connected text. Participants were (a) 12-15 years old, (b) had moderate levels of intellectual disability, (c) received special education services in self-contained settings, and (d) had the verbal capability to orally produce words. Participants were divided into two groups and were taught words both in isolation with the criterion change of four word increases during each phase of the instruction. Sessions were continued until criterion was met. Once assessment probes reached a criterion of 80% for two of the last three sessions, then the generalization phase began in which participants were asked to read the words learned in isolation within the connected text and demonstrate comprehension by completing the requested action (e.g. put the red ball in the blue cup or push to open). Both groups met the criterion for
acquisition of individual sight words with group one reaching criterion in 60 sessions and group two in 33 sessions. For generalization to connected text, group one met criterion in 29 sessions and group two in 16 sessions.

In a group experimental study using a pretest/posttest design conducted by Van der Bijl, Alant, and Lloyd (2006), participants were placed in one of three groups where they were taught 10 sight words using one of the three methods for teaching sight words. Participants were 33 school-aged individuals with moderate to severe levels of intellectual disability. Participants in the control group were taught sight words using a traditional orthography method, where sight words were paired with picture cues which faded as the participant learned the orthographic representation of the word. Participants in the first experimental group were taught sight words using a modified orthography method, in which the orthographic representation of the word is embedded in the picture cue. The picture cue is gradually faded out until only the orthographic representation remains. Participants in the second experimental group were taught sight words using a combination of traditional orthographic representation and modified orthographic representation. Flash cards were used during instruction in all three groups with the control having only an orthographic representation of the word on both sides of the flash card, the first control group having the modified orthographic representation with embedded picture on both sides of the flash cards, and the second experimental group having the modified orthographic representation on one side of the card and the traditional orthographic representation on the other. Results indicated that while no significant difference was shown between groups, the group exposed to the modified
orthography with the orthographic representation of the word embedded in a picture cue, was the least effective in order ranking. The authors speculated that modifying the orthographic representation of the word by embedding it in a picture might have interfered with participants learning the orthography itself. They noted, however, that participants in this group demonstrated better retention after a three-week withdrawal.

In a similar study, Didden, Prinsen, and Sigafoos (2000) issued an alternating treatment design to demonstrate that the use of pictures in sight word acquisition lessons not only appeared ineffective, it may have interfered with sight word acquisition. In that study, six elementary-aged students with moderate levels of intellectual disabilities were individually presented with 20 sight words divided into five experimental conditions of four words each during each intervention session. In the first experimental condition a picture was presented to the participant followed by a word and picture combination. In the second experimental condition the word was presented alone. In the third experimental condition the word alone was presented in an enlarged font. In the fourth condition the word was presented alone followed by word and a picture combined. In the fifth condition the word was presented alone and the picture was presented only after the participant produced a response whether correct or incorrect. Results indicated that participants had greater correct responses during posttests in the condition where words were presented alone with 56% correct responses. In the condition where words were first presented alone and then pictures were presented as feedback participants demonstrated 47% correct answers. Finally, in the condition where words were presented with pictures the demonstrated correct response rate was 43%. The authors concluded that presentation
of words alone appeared to be the most efficient means for sight word acquisition. However, if pictures were used, their use as feedback appeared to be their most beneficial use.

Waugh et al. (2011) used an alternating treatments design embedded in a multiple-baseline across word sets design to determine if there was a functional relation between error correction and a decrease in error rates. In this study three participants had a documented IQ in the moderate range of intellectual disabilities, received their special education services in a special education classroom, had visual and auditory acuity to participate in the lessons, as well as were able to orally pronounce words and verbally imitate teacher models. Dependent variables included the number and length of probe sessions and errors to criterion, the number of instructional errors, and length of instructional sessions to criterion and maintenance over a two- to four-week period. The two conditions involved simultaneous prompting with and without error correction. Six words sets were used and participants were assigned to four of the six so that each word set was used with two students and were counterbalanced across conditions, time of day, and students. The multiple-baseline design allowed demonstrating a functional relation between sight word acquisition and simultaneous prompting for all three participants. Using the alternating treatment design, a functional relation was demonstrated for two of the three students for error corrections.

**Literacy Curricula for Target Population**

As literacy has become an expected component in the education of students with severe disabilities as directed by No Child Left Behind (2001) and as measured by state
alternative tests, there are now more published curricula available to teach some or all literacy components to individuals with intellectual disabilities. Below are discussions of studies in which a published literacy curriculum was used in whole or in part to teach sight word acquisition.

Beecher and Childre (2012) conducted a study in which a published curriculum was used to teach sight words, but was also embedded in teacher directed literacy activities to incorporate the other strands of literacy including concepts of print, phonemic and phonological awareness, vocabulary, oral language, and comprehension. Additionally, sign language was paired with the targeted sight words to provide a visual cue. Data were collected using an A-B time series design combined with pre- and posttests. The three participants all received their special education services in self-contained settings for students with mild to moderate intellectual disabilities and autism. They ranged in age from 7 to 10 years; had some expressive communication disabilities; but did have the ability to orally pronounce words, letters, and sounds. During the intervention, participants received one-to-one instruction in sight word recognition using the packaged literacy program *PCI Reading Program: Level One*. During the one-to-one instruction time, participants not receiving the instruction rotated through literacy center activities designed by the teacher to facilitate acquisition of the other components of literacy. After each participant received their one-to-one instruction, the teacher engaged the participants in a small group read aloud. During this time, concepts of print, decoding, and comprehension were the focus of the literacy instruction. The small group portion of the lesson lasted for approximately 10 minutes. All three participants in this study made
gains in all areas of literacy. Participants increased their knowledge of the upper and lower case orthographic letters by 29, 31, and 35 letter respectively. Participants increased their letter-sound correspondence knowledge by 17, 22, and 18 letter-sounds respectively. Participants increased their sight word vocabulary by 23, 35, and 156 words respectively over the course of the 45 sessions. The authors reported immediate changes in level and accelerating trends across participants upon the implementation of the intervention. Thus, the authors concluded that this study provided additional evidence to the research base of the abilities of individuals with mild to moderate intellectual disabilities and autism to make progress in literacy skills when taught using a comprehensive literacy approach.

Another study, in which a published curriculum was used to teach components of literacy, was conducted by Alberto et al. (2013). While a larger study funded by the Institute of Education Services (IES) was conducted to include all the components of literacy covered by the published curriculum *Integrated Literacy Curriculum for Students with Moderate to Severe Disabilities (ILC)*, this publication covered only the sight word acquisition component. The authors used a changing criterion design embedded in a multiple-baseline design in order to show the functional relation between use of the ILC and participant sight word acquisition. During intervention sessions, the seven participants ages 8 to 15 were taught in small groups of two to three participants. At the beginning of each session, the teacher handed each participant cards with the target word or connected text for the session. The teacher then instructed participants to touch their individual cards, while one student was asked to read the card. The group was asked to
repeat the correct word on their card and then to select an object representing the word from an array of objects presented to the group. A changing criterion design was used because the criterion for mastery increased by four words per phase. It was noted that the ILC curriculum could be adapted for use by students who could not orally pronounce words, but none of the participants in the study required modifications.

In this section a review of the literature on teaching sight words to students with intellectual disabilities and autism has been presented. In summary, those strategies that demonstrated increased efficacy were (a) the use of the orthographic representation of a word without picture symbol association, (b) teacher directed constant time delay intervention, and (c) simultaneous prompting with error correction.

**Phonics/letter-sound correspondence.** Phonics instruction is the study of the sounds of our language and the orthographic representation of those sounds, also referred to as letter-sound relationships (Browder et al., 2006; Copeland & Keefe, 2007). The ability to manipulate sounds is the basis of decoding and encoding which are the skills that allow readers to read novel words and to spell. According to Ehri, Nunes, Stahl, and Willows (2001), systematic phonics instruction has been shown effective in helping struggling readers as well as being beneficial for all early readers.

The panel [National Reading Panel] also concluded that the research literature provides solid evidence that phonics instruction produces significant benefits for children from kindergarten through 6th grade and for children having difficulties learning to read. The greatest improvements in reading were seen from **systematic phonics instruction.** This type of phonics instruction consists of
teaching a planned sequence of phonics elements, rather than highlighting elements as they happen to appear in a text. Here again, the evidence was so strong that the panel concluded that systematic phonics instruction is appropriate for routine classroom instruction. (US DHHS, NIH, 2000, para 11)

Letter-sound correspondence is one of the foundational building blocks of functional literacy (Finnegan, 2012) and identified as one of the components of literacy by the National Reading Panel (2000). Indeed research has shown that knowledge of letter-sound correspondence and phonemic awareness are the two primary predictors in how well typically developing children will learn to read (Ball & Blachman, 1991; Bentin & Leshem, 1993; Hoien, Lundberg, Stanovich, & Bjaalid, 1995).

In a longitudinal study conducted by Allor, Mathes, et al. (2010), 59 individuals with IQs between 40 and 69 were assigned to either a group receiving direct reading instruction in small groups lead by the researchers or a control group receiving “typical special education instruction” (p. 447). After two to three years of intervention, students in the treatment group made statistically significant and educationally meaningful progress in all areas of literacy, including letter-sound correspondence, as demonstrated by standardized measures. In a study done by Finnegan (2012), students with a mean IQ of 55 who were placed in a treatment group and received systematic instruction in phonics and sight words, made significant progress, and outperformed students in the control group.

Despite the small research base (Allor, Mathes, et al., 2010; Finnegan, 2012), there is emerging research into the acquisition of letter-sound correspondence for
individuals who use AAC and who have severe disabilities (e.g. Johnston, Buchanan, & Davenport, 2009; Johnston et al., 2009; Truxler & O’Keefe, 2007). However, since most phonics interventions require verbal output from participants such as verbally making the sound when presented with an orthographic representation, the student who is unable to do so may be excluded from participation in this element of literacy. Indeed, research demonstrated that students who use AAC or aided communication were presented with fewer opportunities to learn these basic literacy skills (Downing, 2005; Kent-Walsh & Light, 2003; Kliewer & Biklen, 2001; Machalicek et al., 2010).

Explicit phonics instruction has received minimal attention in the research base on literacy acquisition for individuals with intellectual disabilities (Browder et al., 2006; Finnegan, 2012; Joseph & Seery, 2004). Many reasons for the dearth of research on phonics as well as the lack of opportunities for phonics instruction in the classroom have been cited. Examples of barriers are (a) an institutional belief that students with severe disabilities cannot learn literacy in general and phonics in particular (Finnegan, 2012), (b) the reliance on traditional means of teaching and assessing acquisition of phonics is through oral rehearsal and imitation (Browder et al., 2006), and (c) segregation of students with severe disabilities into separate classrooms where comprehensive literacy education is eschewed for functional activities (Kliwer, 1998; Zascavage & Keefe, 2004).

Due to the foundational importance of phonics to the acquisition of independent literacy skills, it was selected as one of the target skills for the current intervention study.
Phonics acquisition for individuals with severe disabilities was also investigated in the following research.

In a study by Finnegan (2012), a group experimental pretest/posttest one-way ANOVA design was used to compare two systematic methods of phonics instruction for students with intellectual disabilities. Participants were 52 students ages 5 to 12 who participated in the state’s alternative testing. Seven of the participants were considered nonverbal. The participants were randomly placed in one of three groups with the control group continuing their typical literacy program without any additional instruction. The first experimental group was instructed using synthetic phonics where participants learned individual letter-sounds and how to blend them to make words. The second experimental group was instructed using analogy phonics where participants learned common consonants and then were taught spelling patterns using visual rimes (e.g., hat, sat, fat). Both experimental groups received their phonics instruction in addition to the already occurring literacy instruction in their respective classrooms. While results of the study did not indicate significant differences in effect between the two experimental groups, there was a significant difference in effect between the control group and the two experimental groups. The author notes that results indicate students who received the systematic approach to phonics acquisition outperformed those participants who did not. Additionally the author suggests that results of the study indicate that students with significant intellectual disabilities were capable of learning phonics.

Fredrick et al. (2013) studied specific word-analysis skills and the generalization of those skills into decoding of novel words. The researchers used a changing criterion.
embedded in a multiple-baseline design across sound and word sets. In this study the five participants were between the ages of 7 and 15. All of the participants had (a) moderate levels of intellectual disabilities, (b) were already successfully participating in a reading program, (c) had no interfering behavior issues, and (d) were all verbal. For this study the researcher developed a two-part phonics component with the two parts being called Initial Phonics and Functional Phonics. During the Initial Phonics portion of the intervention, letter-sound was divided into three sets resulting in three tiers of a multiple baseline. For the Functional Phonics portion of the intervention, four letter/sound sets and two word sets were used to form a six-tier multiple-baseline across letter and word sets design. During intervention, teachers conducted probes individually to each participant at the beginning of every session. Following the probes there was the teaching portion of the session, in which the teachers worked with participants either individually or in small groups using simultaneous prompting. The two older participants of middle school age were instructed in groups throughout the intervention. The younger three participants of elementary school age were instructed individually for the Initial Phonics portion of the intervention and for the first two tiers of the Functional Phonics portion of the intervention.

The results of this study added to the growing research evidence demonstrating the ability of individuals with intellectual disabilities to acquire word analysis skills including phonics. Additionally, the results indicated that individuals with moderate levels of intellectual disabilities appeared to need more opportunities to generalize word analysis skills to the decoding of novel words. When one of the participants was given
those extended opportunities, he was able to make the jump from word analysis skills in isolation to functional use of them. These findings concur with the findings from a study in which Allor, Mathes, et al. (2010) noted that while participants in their longitudinal study made statistically significant gains in literacy, the amount of time required for gains was longer than anticipated. Those authors noted that they saw little to no gains on the standardized or ongoing measures during the first year of intervention, and the participants actually required three years of intensive instruction in comprehensive literacy to reach minimum criterion levels for end of first grade level.

In a study conducted by Johnston et al. (2009), both of the participants were of preschool age, had a primary disability of cerebral palsy, were identified as having mild intellectual disabilities, had limited communication skills defined as fewer than 10 verbal intelligible words, and used AAC. Both had some letter identification in their preintervention baseline. The authors used a within-subject, multiple-baseline probe design, which was repeated across participants in order to examine the effects of a phonics teaching intervention. During the intervention, all sessions took place during free choice time in the preschool classroom with the researcher positioning herself in the literacy center. Participants were given time to select the literacy center on their own, but if the participants had not selected to come to the literacy center after 30 minutes, the researcher solicited them and asked them to invite the other participant as well. During intervention sessions, classroom peers were invited to participate in the lessons if they expressed an interest. During the first step of the intervention, participants were encouraged to select one of the researcher-enhanced literacy activities as a contingency
reward for correct answers given during step two. During step two, the researcher presented a visual array of letters on a page and asked the participant to touch a specific letter by making the sound the orthographic letter represented. (e.g., “Touch the letter that says /s/”). If the participant responded correctly they had the opportunity to engage with the selected literacy activity. If the participant’s response was incorrect, the researcher said “no” and repeated the task stimuli. At the onset of the intervention, simultaneous prompting was used to ensure and facilitate correct responses. Results from the study indicate a functional relation between the intervention and participant acquisition and generalization of the three introduced letter-sounds. This finding is important because it adds to the body of research into phonics instruction and spelling for individuals who use AAC and on effective literacy interventions for AAC users as well (e.g. Fallon et al., 2004; Truxler & O’Keefe, 2007).

In the study by Truxler and O’Keefe (2007), the four participants were all elementary school aged with a mean age of 9 years, all had a primary disability of cerebral palsy, and all had unspecified IQ levels. Additionally all the participants had complex communication needs with verbal communication limited to one to two utterances that were intelligible to familiar people. All of the participants were also able to point accurately and independently. Half of the participants had some letter/sound identification skills prior to the intervention and half of the participants had all letter/sound identification skills prior to the intervention. Using a multiple-baseline across subjects design, the researchers examined the phonemic awareness and letter-sound correspondence acquisition in the first of two experiments. In the second experiment the
researchers examined whether the participants could functionally use the phonics acquired in the first experiment in order to apply them to print-to-sound translation, word recognition, and spelling. While participants earned a mean of 84% PNDs, this is not an accurate reflection of the effectiveness of the intervention, since overall participants were unable to generalize the skills from experiment one into the criterion for experiment two. The authors hypothesized that participants might have needed more and additional instruction in phonemic awareness and phonics in order to make progress toward the second experiment criterion.

**Original Research on ALL Curriculum and a Pilot Study**

This section of the literature review focuses on the original research by Janice Light and David McNaughton upon which the ALL Curriculum was founded. This section also discusses the results and implications of the pilot study guiding the current intervention research.

**Original Research on ALL Curriculum**

The research base underlying the ALL Curriculum (Light & McNaughton, 2009) consists of a series of four case studies targeting individual participants. Light and McNaughton provide an overview and summary of the ongoing research project (at the time of publication) in which nine participants received intervention instruction in the curriculum. Of these nine participants, seven were of preschool or early elementary ages, one participant was of later elementary age, and one participant was age 14. All participants had complex communication needs and used some form of AAC. Participants had a variety of primary disabilities including cerebral palsy, autism,
multiple disabilities, Down syndrome, and developmental apraxia. Light and McNaughton reported that at the time of publication, most participants had been receiving intervention instruction for at least one year. At this point in time case studies have been published on four of the nine participants which will be discussed in detail here. Results of the ongoing research indicated that all of the participants had demonstrated acquisition of letter-sound correspondence, phonological awareness and decoding of regular cvc, vc, and cv words. In addition, all of the participants were able to generalize these skills to application in shared book activities. Participants who had had more time in the intervention demonstrated the ability to decode longer and more complex words. The four published case studies from this research are discussed in further detail below.

In the first case example (Light, McNaughton, Birmingham & Pendergast, 2009), the literacy acquisition of Gareth, a preschool aged boy with cerebral palsy, is outlined. Gareth was considered to have severe cerebral palsy with low muscle tone. He also required a G-tube for feeding and a ventilator for breathing. However, on tests of receptive language, Gareth scored within normal limits for his age. The authors first began working with Gareth before he entered preschool. As a result of his young age, the researchers initially began to work on emergent skills such as vocabulary development and phonological development. Since Gareth had no ability to orally produce sounds, the authors also used oral scaffolding where his communication partner would pronounce the sounds of letters out loud and encourage Gareth to say them subvocally in his head. It was not until he began preschool at the age of three that more conventional aspects of
literacy were introduced, including letter-sound correspondence, phoneme segmentation, and sound blending. At this point he also began receiving instruction in single word decoding. Gareth made quick progress through the intervention and was decoding two and three letter regular words with 90% accuracy within four to five months. As Gareth’s decoding skills increased, the authors began to work on reading and comprehension of whole sentences though the use of silly pictures. Gareth was instructed to read a sentence and then select the picture that represented that sentence. It was only by reading every word in the sentence that he would be able to select the correct picture. Gareth moved on to short story books and the authors focused on comprehension of more complex and longer text. At the age of four and around the time he began comprehending longer texts, Gareth was also introduced to conventional writing using adaptive software. “By the time that Gareth entered kindergarten at age 5, he was a reader and a writer. His conventional literacy skills exceeded those of most of his peers” (Light et al., 2009, p. 201).

The second case study example (Light, McNaughton, Birmingham & Case, 2009) involved Jackson, a four-year-old boy with Down syndrome. While Jackson’s parents were able to understand much of his verbal speech, he was unintelligible to unfamiliar communication partners. Jackson received one-on-one intervention instruction in his home once a week for approximately 45 minutes per session. In the interval between sessions, his parents continued reading books with him, which helped him in increasing his vocabulary. For Jackson, his literacy intervention began with building letter-sound correspondence fluency, blending sounds, and decoding regular cvc, vc, and cv words. During decoding practice, Jackson was given the visual cue of the orthographic
representation of the word, so that he could follow along with the letters. Jackson was able to demonstrate 90% accuracy on letter-sound correspondence and 80% accuracy in decoding regular cvc, cv, and vc, words after nine months, or about 20–25 hours of intervention instruction. As Jackson’s literacy skills improved, he was introduced to the additional literacy skills of sight words, comprehension of simple sentences and stories, typing words and simple stories, and reading shared stories with increasing numbers of target words per sentence. After 16 months in the intervention, Jackson’s literacy skills exceeded those of most of his peers.

In the third case study, Light, McNaughton, Karg, and Weaver (2009) worked on literacy skill acquisition with Michael, a three-year-old boy with autism. Michael used a limited number of individual signs or picture symbols to express his wants and needs. Michael attended a preschool program that integrated typically developing peers into special education classrooms. At baseline, Michael had rudimentary skills in phonological awareness, sound blending, and phoneme segmentation. He also knew the names of some letters, but not the sounds, which were more important in decoding. Early in the intervention phase, the focus was on building Michael’s vocabulary. The authors also wrote all instructions and communications with Michael down, so that he could begin to pair the functional communicative purpose of written language. During the first phase of conventional literacy instruction, Michael was taught letter-sound correspondence, sound blending, phoneme segmentation, as well as continued vocabulary development. In the second phase the focus was on decoding regular cvc, cv, and vc words, fluency in phonological skills, generalization of learned skills to other
communication partners, and other activities. In the final phase of the intervention, Michael was taught to decode longer and more complex words, sight words, keyboarding, and comprehension of simple sentence and stories. At the conclusion of the year of intervention, Michael, now aged four, was reading texts at the first and second grade level, he demonstrated comprehension of the texts, and wrote simple stories which included beginnings, middles, and ends. Additionally, over the course of the intervention, as his literacy skills increased, his oral speech improved and his challenging behaviors decreased. As was the case with the participants in the other case studies, when Michael entered kindergarten, his literacy skills exceeded those of his typically developing peers.

In the fourth case study, Light, McNaughton, Karg, and Weyer (2009) provided literacy skill acquisition instruction to Krista, an eight-year-old girl with multiple disabilities. Krista had a genetic disorder, significant motor impairments, hearing loss, cortical vision impairments, a tracheotomy for breath support, and a g-tube for feeding. She relied on adapted signs, facial expressions, gestures, and an AAC voice output device for communication. At baseline, Krista demonstrated 35% accuracy in letter-sound correspondence, had not yet acquired any sound blending or phoneme segmentation skills, nor had she acquired any decoding skills. Her sight word vocabulary consisted of her name, Krista, mom, and dad. In adapting the intervention for Krista’s unique needs, the authors made the following accommodations: (a) instructors used augmented input when presenting instructions, (b) large font was used, (c) visual support in the form of orthographic representations of letters were used in phonological awareness skills, (d) care was given to the sequence of letter introduced in the letter-sound correspondence.
instruction, including earlier introduction of sight words than in other cases, and (e) the use of highly personalized books were used. By seven months into the intervention, Krista had acquired nine letter-sound correspondence pairs and demonstrated 90%+ accuracy in identifying those letters. She had also acquired approximately 30 sight words at 90%+ accuracy in both isolation and in shared stores. By 16 months into the study, Krista had increased her knowledge of letter-sound correspondence to 20 letters and increased her sight word vocabulary to 60 words. Krista also began writing instruction using a portable speech generating device, an onscreen keyboard, and a standard computer. Simultaneously Krista was learning comprehension strategies in both her reading and her writing. Krista’s gains in literacy resulted in raised expectations at school and greater opportunities to participate in the general education curriculum.

**Pilot Study**

The pilot study was conducted in the fall/winter of 2014. There were a few differences between the pilot and the current study including the number and age of participants, the setting, and skills sets. Differences between the studies are detailed in Table 1. For the pilot study, the purpose of the research was to determine if there was a functional relation between use of the ALL Curriculum and improved accuracy of letter-sound correspondence for three high school-aged students who had physical disabilities, intellectual disabilities, and communication disorders. The participants in the pilot were three high school-aged students who all had primary disabilities of cerebral palsy and intellectual disabilities. Baseline and treatment sessions were all conducted in a one-to-
one setting in the participants’ homes, where the researcher worked with and tested each participant individually.

The pilot study employed a single-subject, multiple-baseline across letter sets design and was replicated across the three participants. Participants were taught 15 letter-sound pairs divided into three groups of five letters each. Regulated randomization was used to randomly determine the entrance into treatment phases for each randomly assigned set of letters.

The dependent variable in the pilot study was letter-sound correspondence. For each participant, 15 letter-sound pairs were selected based upon prior knowledge of letter-sound pairs. Any letter-sound associations a participant already knew were deleted from the pool of potential letter-sounds for the study. Once a pool was established for each participant, the researcher followed the suggested sequence of letter-sound correspondence introduction presented in the ALL Curriculum to create a set of 15 letter-sounds for each participant.

Baseline in the pilot study was collected for 5 data points for the first set of letters in tier one, 8 to 9 data points for the second set of letters in tier two, and 10 to 11 data points for the third set of letters in tier three. There was high variability of data in baseline across all participants which may be attributed to the use of multiple choice response options. The use of multiple choice as a selection method provides for a 1 in 4 chance of getting a correct answer for each data point regardless of participant knowledge. However, use of multiple choice is a standard response adaptation for individuals who are functionally nonverbal (Alberto et al., 2011; Johnston et al., 2009;
Across all participants there was a low to moderate overall change in level as students were introduce to the ALL Curriculum (See Appendix A for pilot study graphs).

The first participant, Cathy, demonstrated an increase in means from baseline phases (tier one: $M = 2.2, SD = 1.09$; tier two: $M = 1.12, SD = 1.12$; tier three: $M = 2.0, SD = 0.81$) over treatment phases (tier one: $M = 3.86, SD = 0.91$; tier two: $M = 3.0, SD = 1.04$; tier three: $M = 3.4, SD = 1.26$) across all tiers. She also demonstrated immediacy of effect across all three tiers upon introduction of the intervention with a steep upward trend in tier two and a flat trend in tiers one and three. Variability in treatment phases across tiers remained high at 51%, 75%, and 40% respectively with an increase in stability in tier one, no change in tier two, and an increased variability in tier three.

Percentages of Data Points Exceeding Median PEMs (described in more detail in Chapter 3) were calculated at 0.6 in tier one, 1.0 in tier two, and 0.7 in tier three for an overall PEM score of 0.7, which indicated that the intervention was moderately effective (Ma, 2006; Wendt, 2007).

Participant two, Dylan, also demonstrated an increase in means from baseline phases (tier one: $M = 2.0, SD = 0.70$; tier two: $M = 1.37, SD = 1.06$; tier three: $M = 1.67, SD = 1.12$) over treatment phases (tier one: $M = 4.0, SD = 0.96$; tier two: $M = 3.69, SD = 0.94$; tier three: $M = 3.5, SD = 0.84$) across all tiers. He demonstrated high and rapid immediacy of effect across all three tiers upon introduction of the intervention with a low positive trend in tier one, a steep upward trend in tier two, and a downward trend in tier three. Variability in treatment phases across tiers remained high at 50%, 47%, and 67%
respectively with an increase in variability in tier one, a decrease in variability in tier two, and an increase in variability in tier three over baseline. PEMs were calculated at 0.8 in tier one, 1.0 in tier two, and 1.0 in tier three for an overall PEM score of 0.9, which indicated that the intervention was highly effective for this participant (Ma, 2006; Wendt, 2007).

Participant three, Kate, also demonstrated an increase in means from baseline phases (tier one: \( M = 1.2, SD = 0.44 \); tier two: \( M = 0.77, SD = 0.83 \); tier three: \( M = 1.45, SD = 1.21 \)) over treatment phases (tier one: \( M = 3.87, SD = 1.47 \); tier two: \( M = 4.08, SD = 0.79 \); tier three: \( M = 3.6, SD = 1.07 \)) across all tiers. She demonstrated high and rapid immediacy of effect across tiers one and two and a low immediacy of effect in tier three upon introduction of the intervention with low upward trends in tiers one and two and a flat trend in tier three. Variability in treatment phases across tiers remained high at 57\%, 59\%, and 40\% respectively with an increase in variability in tier one, and decreases in variability in tiers two three over baseline. PEMs were calculated at 0.9 in tier one, 1.0 in tier two, and 1.0 in tier three for an overall PEM score of 0.9 which indicated that the intervention was highly effective for this participant (Ma, 2006; Wendt, 2007).

Results from the pilot study added to the emerging body of research in the area of instruction on phonetic skills such as letter-sound correspondence for individuals with severe disabilities. Although variability remained high throughout the study for each of the participants, there were several demonstrations across participants and across letter sets of decreased variability. Additionally all participants demonstrated a mean increase in levels between baseline and intervention for each of the tiers. Despite demonstrated
increases in level, however, the rate of acquisition of the letter-sounds was slow as demonstrated by the flat or low upward trends. This is in line with other research that shows individuals with intellectual disabilities acquire literacy skills at a slower rate than peers without disabilities (Beecher & Childre, 2012).

In the current study many changes to the research procedures were incorporated as detailed in Table 1. Participants included middle school students who had a range of disabilities, including participants with autism, participants with physical and intellectual disabilities, and participants with strictly intellectual disabilities. The common denominator between participants in the pilot study and those in the current study was that all participants had limited verbal communication and literacy skills at the prekindergarten level. Additionally, in the current study, participants received the intervention in a school environment. While the participants were tested and instructed individually in the pilot study, the students in the current study received treatment intervention instruction in small groups but were still tested individually. Thus, the feasibility of the ALL Curriculum to be used in a more authentic school environment was examined.

In the current study, a single-subject, multiple-baseline design was used across groups and replicated across two skill sets (letter-sound correspondence and sight word recognition). The independent variable in the pilot study was the same as the current study with the addition of the sight word component of the ALL Curriculum being administered in the current study.
Table 1

Comparison Between a Pilot Study and a Current Study

<table>
<thead>
<tr>
<th>Research components</th>
<th>Pilot study</th>
<th>Current study</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Participants</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Age of Participants</td>
<td>High School (16-20 years)</td>
<td>Middle school (11-16 years)</td>
</tr>
<tr>
<td>Participants’ Disabilities</td>
<td>All had cerebral palsy and intellectual disabilities</td>
<td>Intellectual disabilities, Rett syndrome, cerebral palsy, autism, Down syndrome</td>
</tr>
<tr>
<td>Settings</td>
<td>One-to-one in participants’ homes</td>
<td>Small groups in a school</td>
</tr>
<tr>
<td>Dependent Variables</td>
<td>Letter-sound correspondence</td>
<td>Letter-sound correspondence and sight word recognition</td>
</tr>
<tr>
<td>Independent Variables</td>
<td>ALL Curriculum</td>
<td>ALL Curriculum</td>
</tr>
</tbody>
</table>

Summary

In this chapter a review of literature on key elements targeted by for the current study was presented. Direct instruction, systematic and explicit instruction, and constant time delay were the instructional strategies incorporated in the current study. Evidence from the literature suggests that these are the effective strategies for instructing students with severe disabilities. Additionally, literature on the use of group instruction to present new content to individuals with severe disabilities suggested that group instruction was also an effective strategy. Thus, the intervention was introduced in small groups in the current study. The two key skill sets examined in the current intervention study are letter-sound correspondence and sight word acquisition. The aforementioned body of research
on these target skills reflected the importance of these skills in the overall literacy acquisition for individuals with and without disabilities. Furthermore, existing studies suggested that individuals with severe disabilities were capable of acquiring such skills as letter-sound correspondence and sight words. A discussion of the literature on the variability inherent in working with individuals with severe disabilities was also presented. The foundational case studies underlying the ALL Curriculum as well as the results of a pilot study guiding the current study were discussed. Comparisons of the research components in the pilot study and in the current study demonstrated how the research decisions remained the same or were refined based on the learning experiences from the pilot study. In the following chapter, the methods for the current study, which were arrived upon through careful inspection of the literature and experience obtained through the pilot study, are presented.
CHAPTER THREE

In this chapter the research methods used to study a functional relation between the ALL Curriculum and acquisition of the basic literacy concepts of letter-sound correspondence and sight word recognition by middle school students with severe and multiple disabilities are discussed. This chapter describes the research design; human subject protections; research participants, including sample demographics and individual descriptions; dependent and independent variables; explicit procedures for the different phases of the study; data collection and scoring procedures; interassessor agreement, fidelity of implementation, social validity; and data analysis.

Research Design

This study employed a single-subject, multiple-baseline across groups and participants design and was replicated across two skill sets. Thus, there were two simultaneously conducted single-subject experiments: one targeting letter-sound correspondence and another one focusing on the acquisition of sight words. In a single-subject design, the functional relation between the independent and dependent variables can be evaluated through systematic introduction of treatment (Horner et al., 2005). Single-subject research designs are most appropriate when working with small \( n \) populations or when finding a homogenous sample large enough for group experimental designs is not feasible. This is often the case when conducting research with individuals
with severe disabilities, who appear at a low incidence in the general population and for whom the nature and severity of disability make it difficult to find homogeneity (Gast, 2010). In single-subject designs each participant serves as their own control (Horner et al., 2005). For the population of individuals with severe and profound disabilities, a single-subject design, which relies on detailed (or extensive) participant descriptions, allows for research consumers to generalize individual responses to intervention and to account for variability between participants through individual characteristics, including the characteristics of nonresponders. The call for evidence- and research-based strategies in education means that empirical data is needed on how best to address educational needs of all students. Single-subject designs use rigorous, scientific methods that result in establishing evidence-based practices (Horner et al., 2005) by complying with accepted criteria for empirical validity through assessing internal and external validity (Koehler & Levin, 1998).

**Multiple-Baseline Design**

A multiple-baseline design requires the establishment of three or more concurrent baselines and the subsequent sequential introduction of the independent variable across the baselines. The systematically and sequentially administered independent variable across different tiers or baselines allows the researcher to analyze different patterns of behavior simultaneously throughout the duration of the intervention (Kennedy, 2005). In a multiple-baseline design, experimental control is established through the simultaneous collection of baseline data across multiple tiers (Gast, 2010). These tiers can be comprised of behaviors, people, settings, stimuli or times (Kennedy, 2005). In the current
study, conditions were defined as groups of participants and baseline data collection began across all participants within the same week. When working with participants in a multiple-baseline design, the researcher needs to make the predictions that the participants will all respond to the independent variable and that the response will be independent of other participants’ responses (Gast, 2010).

The systematic and staggered introduction of the independent variable allows for observation of the interaction between dependent and independent variables across multiple conditions. In other words, the first group/participant begins the treatment phase of the intervention while the other groups/participants remain in baseline. The treatment phase begins for the remaining groups in a staggered fashion. This allows for the functional relation between the dependent and independent variables to be seen clearly, when the performance of the group/participant improves, as they enter the treatment phase; while the performance of those in baseline remain at the same baseline levels. The multiple-baseline design is also a logical choice for interventions in which the target behavior is irreversible or learned (such as in academics), since this design does not require the return to baseline phase (Gast, 2010). Therefore, a multiple-baseline design was selected for this study for the following reasons:

- The intervention involves an academic task that cannot be unlearned (identification of letter-sound correspondence and sight word recognition) and a multiple-baseline design does not require a return to baseline.
- A multiple-baseline design allows the researcher to provide intervention in a closer approximation to the authentic classroom experience (Gast, 2010).
A multiple-baseline design is also an appropriate tool for measuring the behavior of a group of participants while still tracking and evaluating individual behavior. Gast (2010) recommends keeping data charts on individual participants as well as the group chart, so that individual variability is not masked. For this reason, individual data were plotted for each participant in each group. Participants were individually assessed but instruction was delivered in four small groups. Due to the unique nature of each individual’s range of abilities and limitations, it was important to be able to continuously track each participant’s progress throughout the intervention so that variability across participants even in the same group could be analyzed. This also allows consumers of research to identify the progress of individuals who most closely match students they may be working with, and thus, determine the effectiveness of the intervention with a participant who exhibits specific characteristics.

**Regulated Randomization**

Randomization is a conjectural assignment of a sequence of events which is removed from an actual sequence of events (Kennedy, 2005). Randomly assigning entrance into treatment can offset validity threats such as history and maturation (Dugard, File, & Todman, 2011). Additionally, Gast (2010) states that randomized entrance into the treatment phase may be considered if it is anticipated that participants in early tiers may take so long to reach stabilization that later tier participants spend an exceedingly long time in baseline. Randomization was chosen for the investigation based on the evidence from the pilot study, which demonstrated the lack of stability in baseline phases due to the use of multiple-choice options for participants’ input as well as due to the
unique characteristics of the target population. Additionally, regulated randomization allowed for the intervention to proceed without frustrating the participants by remaining in baseline too long.

Regulated randomization as described by Koehler and Levin (1998) involves two phases of randomization, namely (1) the random assignment of tiers to the order in which they will enter the treatment phase of the intervention, and (2) the random assignment of the points at which intervention is to be introduced to each tier. Entrance points to the treatment phases in the current study were randomly selected from two possible entry points for each experiment. Entrance into the treatment phase for the first tier of letter-sound correspondence was randomly selected from one of two possible sessions (Session 6 or 7). Subsequent tiers in letter-sound correspondence were likewise randomly selected from one of two possible data points as follows: tier two (Session 9 or 10), tier three (Session 12 or 13), and tier four (Session 14 or 15) respectively. Entrance into the treatment phase for the first tier of sight word recognition was randomly selected from one of two possible sessions (Session 6 or 7). Subsequent tiers in sight word recognition were likewise randomly selected from one of two possible data points as follows: tier two (Session 8 or 9), tier three (Session 10 or 11), and tier four (Session 12 or 13) respectively. This two-part regulated randomization process supports the systematic and staggered entrance into treatment phase of the intervention which is a key element of multiple-baseline design (Koehler & Levin, 1998). In the current study, regulated randomization was used to determine both the order in which groups of participants were
introduced to the treatment as well as the entrance point for introduction of the treatment for each group.

**Design Standards for Single-Subject Research**

In a report developed by Kratochwill et al. (2010) it was determined that the following design criteria must be met in order for a study to be considered as meeting evidence standards:

a. “The independent variable (i.e., the intervention) must be systematically manipulated, with the researcher determining when and how the independent variable conditions change.” (p. 14)

b. “Each outcome variable must be measured systematically over time by more than one assessor, and the study needs to collect inter-assessor agreement in each phase and on at least twenty percent of the data points in each condition (e.g., baseline, intervention) and the inter-assessor agreement must meet minimal thresholds.” (p. 15)

c. “The study must include at least three attempts to demonstrate an intervention effect at three different points in time or with three different phase repetitions.” (p. 15)

d. “For a phase to qualify as an attempt to demonstrate an effect, the phase must have a minimum of three data points.” (p. 15).

The current study meets these outlined design standards. First, the researcher systematically determined when and how the intervention was introduced using regulated randomization procedures. As described in detail later in this chapter, interassessor
reliability was taken for at least 30% of baseline and 30% of treatment sessions and interassessor agreement coefficient was determined to average at 99% (98-100% range). The study also met the design standard of demonstration of intervention effect at four different points in time during the first experiment targeting the letter-sound correspondence by introducing the treatment phase to the first tier of letter-sound correspondence during Session six, and to the subsequent three tiers in letter-sound correspondence in Session 9 for tier two, Session 13 for tier three, and Session 14 for tier four. In the second experiment focusing on sight word recognition, demonstration of intervention effect was also measured at four different points in time by introducing the treatment phase to the first tier in Session 7, the second tier in Session 8, the third tier in Session 11, and the fourth tier in Session 13. Thus in the current study the intervention effect was demonstrated at each point that the four groups were introduced to the intervention (both for letter-sound correspondence and also for sight words) for a total of four different points in time, in which the intervention effect could be demonstrated in each experiment. Lastly, in this study all phases had more than the minimum of five data points as designated in the design standards, thus meeting this criterion as well.

Participants and Settings

In this section human subject protection procedures and approvals are discussed. Additionally descriptions of the target population in general as well as detailed descriptions of individual student participants are presented. In this study the teachers of the students selected for the intervention were also considered participants since they took part in post-intervention interviews. For this reason the middle school students who
participated in the intervention will be referred to as student participants and the teachers who participated in the postintervention interviews will be referred to as teacher participants.

Human Participants’ Protections and Informed Consent

This research study was carefully and thoroughly screened by the Institutional Review Boards at George Mason University (protocol 479383-1) and at Southern County (pseudonym) Public Schools (project number 2014-01) (Appendix B). The study was approved by both IRBs. In order to obtain consent and assent for participation in the study the following procedures were followed. To gain consent from parents of student participants, an introduction letter with attached consent form was sent home with each child either via backpack or mail as determined by the student’s teacher to be the best means of contacting the parents (see Appendix B). The signed consent form could be sent back to the researcher via self-addressed, stamped letter, or sent back to the school via the student’s backpack.

Once parental consent was gained for all potential student participants, then students were approached to gain assent. An assent form prepared in the visual software Boardmaker by Mayer Johnson was used (see Appendix B). The researcher went line by line over the assent form with each student, while the teacher was present, to make sure that the student understood the content. A pair of “yes” and “no” cards (Appendix C) were presented to the students to indicate their agreement to or dissention from participating in the intervention. If the students agreed to participate in the study then
they wrote their name on the assent form. If they were unable to write their name, then the teacher or researcher wrote it for them and indicated that it was dictated.

Teachers of identified student participants were sent an email with information regarding the intervention and a request for their participation in a postintervention interview. They were invited to an information session conducted by the researcher and the principal, where they could ask questions and view the curriculum. Consent forms were attached to the email and were available at the information session as well. Confidentiality was maintained by assigning the county, school, student, and teacher participants pseudonyms. All personally identifiable information was removed so that individuals or schools could not be identified.

**Participant Recruitment**

Once approval was received from Southern County Public Schools (pseudonym), the researcher worked with the principal of the school to identify potential student participants. The inclusion and exclusion criteria for student participants, which is described below in the next section, were given to the principal as well as the teachers of the target population in the identified school. With recommendations from the teachers, potential student participants were identified and the researcher then contacted parents of the students to gain consent. After parental consent was attained, the researcher approached the potential student participants to gain assent. Once assent was received, student participant groups were formed based upon teacher recommendations.
Criterion for Participation

In order to be eligible for participation in this study, participants were expected to meet the following inclusion criteria: (a) participants must be between the ages of 11 and 16; (b) participants must be functionally nonverbal, defined as having two or fewer verbal word approximations used for functional communication; (c) participants must have prekindergarten literacy skills as measured by scores on the Brigance Early Childhood Inventory and on researcher-made assessments; and (d) participants must be assessed using the state’s alternative testing as defined by the No Child Left Behind Act (2001). The procedures for using the researcher-made assessment are described later in the chapter. A copy of the researcher-made assessment is available in Appendix D.

Student Participants

Student participants were eight middle school students between the ages of 11 and 16 who attended public school in a large urban county outside a mid-Atlantic metropolitan area. The selected student participants were all served in self-contained classrooms for students with intellectual disabilities or autism and all participated in the alternative state test. All of the students received services for intellectual disabilities as well as speech and language services. Student participants demonstrated limited verbal capacity or were considered functionally nonverbal. To be considered functionally nonverbal for the purpose of this study, the student had to demonstrate that readily recognizable words were not their primary communication mode. Limited verbal capacity, for the purposes of this study, was defined as utterances of no more than two to three readily recognized words. Additionally, selected student participants demonstrated
prekindergarten literacy skills as determined by the Brigance Comprehensive Inventory of Basic Skills-Revised (Brigance, 1999) section A Readiness subsections A8-15, section D Word Recognition Grade Placement, and section G Word Analysis subsections G1-3.

Student demographic information was gathered from the students’ teachers and from records reviews and is presented in a series of tables following this section. Table 2 presents basic student demographic information, including disability categories and information about standardized test scores. Most student participants had multiple disabilities aside from the primary disability, on which their eligibility was based. It should be noted that while Anna was the only one of the participants tested using the Bayley Scale of Infant Development 3, it was the only standardized test used to determine her cognitive level. Thus it was important to include those test scores in Table 2.
<table>
<thead>
<tr>
<th>Student</th>
<th>Age</th>
<th>Gender</th>
<th>Primary disability</th>
<th>Secondary disability</th>
<th>Tertiary disability</th>
<th>IQ</th>
<th>Vineland scale</th>
<th>Bailey scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jo</td>
<td>13</td>
<td>F</td>
<td>CP</td>
<td>Moderate ID</td>
<td>Seizures; ME Seizures</td>
<td>42</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Anna</td>
<td>14</td>
<td>F</td>
<td>Rett</td>
<td>Severe ID</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>3 mos.</td>
</tr>
<tr>
<td>Sam</td>
<td>12</td>
<td>M</td>
<td>Unknown Genetic Origin Autism</td>
<td>Moderate ID</td>
<td>Heart condition</td>
<td>40</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>Dean</td>
<td>15</td>
<td>M</td>
<td>Autism</td>
<td>Moderate ID</td>
<td>Grave’s Disease</td>
<td>45</td>
<td>53</td>
<td></td>
</tr>
<tr>
<td>Bobby</td>
<td>11</td>
<td>M</td>
<td>Autism</td>
<td>Moderate ID</td>
<td>NA</td>
<td>NA</td>
<td>49</td>
<td></td>
</tr>
<tr>
<td>Garth</td>
<td>16</td>
<td>M</td>
<td>Down Syndrome Autism</td>
<td>Moderate ID</td>
<td>Asthma</td>
<td>42</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Ash</td>
<td>12</td>
<td>M</td>
<td>Autism</td>
<td>Severe ID</td>
<td>NA</td>
<td>NA</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>Chuck</td>
<td>15</td>
<td>M</td>
<td>Autism</td>
<td>Moderate ID</td>
<td>NA</td>
<td>42</td>
<td>45</td>
<td></td>
</tr>
</tbody>
</table>

*Note. IQ = IQ score on Stanford Binet; Vineland Scale = score on the Vineland Adaptive Behavior Scales; Bailey Scale = score on the Bailey Scale of Infant Development 3; F = Female; M = Male; CP = Cerebral Palsy; ID = Intellectual Disabilities; Seizures = Seizure Disorder; ME = Microphalic Encephalopathy; Rett = Rett Syndrome; N/A = untestable or unavailable; mos. = months.*

Due to the diverse nature of the student populations in the study school, it was important to consider whether student participant English proficiency and/or spoken home language impacted the effectiveness of the intervention. Since all of the student participants had limited to no verbal language, information about proficiency was based upon the language spoken in the home and the number of years the student has been in public schools in the United States. This information gathered from the student participants’ teachers or from school records is presented in Table 3.
Table 3
Student Participant Ethnicity and Home Language

<table>
<thead>
<tr>
<th>Student</th>
<th>Ethnicity</th>
<th>Birth language</th>
<th>Home language</th>
<th># of Years in US schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jo</td>
<td>H</td>
<td>Spanish</td>
<td>Spanish</td>
<td>12</td>
</tr>
<tr>
<td>Anna</td>
<td>C</td>
<td>English</td>
<td>English</td>
<td>12</td>
</tr>
<tr>
<td>Sam</td>
<td>C</td>
<td>English</td>
<td>English</td>
<td>10</td>
</tr>
<tr>
<td>Dean</td>
<td>C</td>
<td>Russian</td>
<td>English</td>
<td>13</td>
</tr>
<tr>
<td>Bobby</td>
<td>C</td>
<td>Spanish</td>
<td>Spanish</td>
<td>8</td>
</tr>
<tr>
<td>Garth</td>
<td>C</td>
<td>Bengali</td>
<td>Bengali</td>
<td>2½</td>
</tr>
<tr>
<td>Ash</td>
<td>C</td>
<td>Spanish</td>
<td>Spanish</td>
<td>8</td>
</tr>
<tr>
<td>Chuck</td>
<td>A</td>
<td>Amharic</td>
<td>Amharic</td>
<td>12</td>
</tr>
</tbody>
</table>

*Note. C = Caucasian, H = Hispanic, A = African American.*

Individual descriptions of each participant follows in the next section.

**Jo.** Jo was a petite 13-year-old seventh-grade student who had right side hemiplegic cerebral palsy. She was ambulatory with assistance. Jo required that someone walk with her holding her up under her right armpit for balance and stability. When walking she was unsteady and often crossed her feet. During the time of the intervention, Jo’s physical therapist tried several walking supports including a cane and a gait trainer. Jo was unsuccessful with the cane because she tended to forget to use it for stability and support. She would let it drag behind her which became a hazard. Jo sat in an adapted chair in her regular classroom with lateral supports. However, during the intervention sessions, Jo did not use her adaptive chair which remained in her classroom. During
intervention sessions, Jo sat in a chair with arms to help with her stability and was placed close to a wall or table for additional support. Jo had no functional use of her right hand but would often use her left hand to support the right one in activities. She seemed to prefer pointing with her nonfunctional right hand, which she would swing from the shoulder in order to position the hand in proximity to where she wanted it. The researcher had to remind her to use her left hand to point to her selections during the intervention. She could hold a pencil in her left hand. Jo received occupational and physical therapy at school.

Jo had significant visual issues in the form of a retinal detachment. She wore goggle-like glasses with a strap to secure them to her head. She had functional vision in her right eye but not even light perception in her left. She appeared to see ¾ inch letters using high contrast. She received services from a teacher of the visually impaired.

Jo was G-tube fed and had extremely limited vocal output. The only sound the researcher heard Jo make was a breathy laugh. Jo’s main form of communication was smiling, head nodding, and gesturing. She could make an approximation of the American Sign Language (ASL) sign for bathroom and for girl which she used to ask about her group mates. She had access to a speech generating application (app) on her school issued iPad but needed reminders and prompting to use it in structured activities.

According to testing done in the Brigance Diagnostic Comprehensive Inventory of Basic Skills Revised (Brigance, 1994), Jo was able to match uppercase letters at the 2.0 level, point to uppercase letters at the 1.6 level, and match lowercase letters at the 2.0 level. In the classroom her teacher noted that Jo used a name stamp and could complete
one- to two-step vocational tasks with prompts and redirection. She demonstrated knowledge of a few basic sight words, which were not identified, and she could identify numbers 1–7 and four 2-dimensional shapes.

Jo was a very social and pleasant girl who enjoyed peer and adult interactions. She came willingly with the researcher for intervention sessions and eagerly looked forward to seeing the other girls in her group who were not in her regular classroom. When one of the other girls was absent during a session, Jo would inquire immediately about the girl’s whereabouts by turning her left hand up and pointing to an empty space at the table and then making the ASL sign for girl. She also enjoyed helping her group mate during the sessions by moving Anna’s wheelchair or encouraging her to participate through physical prompts. Although Jo seemed to enjoy the intervention sessions, she was hard to focus most days as she preferred to interact with Anna and exhibit behaviors which distracted from the sessions (e.g., sliding under the table). She would often pop up from her chair to a standing position during sessions requiring the researcher to stop the intervention and get her reseated for safety reasons. She also liked to take the letters and words and hide them under her leg or under the table. Jo responded to social praise for correct answers by laughing and shaking her head “no.”

Jo’s current classroom was a self-contained classroom for students with moderate to severe intellectual disabilities. There were eight other students in her classroom including Sam. There was one classroom teacher and four teaching assistants assigned to her classroom.
Anna. Anna was a 14-year-old ninth-grade student with a diagnosis of Rett Syndrome, which, according to the International Rett Syndrome Foundation (n.d.), is a postnatal neurologic disorder. Rett Syndrome is characterized by typical development up to approximately nine months, followed by early loss of eye contact and of functional use of hands due to hand wringing (Batshaw, Roizen, & Lotrecchiano, 2013). She also had a seizure disorder. Anna was a petite girl who used a manual wheelchair for mobility. She had limited functional use of her hands due to symptoms associated with Rett Syndrome and was unable to propel her wheelchair herself. Also due to limited use of her hands, she was unable to feed herself or to manipulate objects. If one of her hands was gently held down or restrained in an arm brace, she was able to make an approximate reach toward objects. She wore bilateral AFOs (ankle foot orthotics). Anna received physical and occupational therapies to help with the symptoms of Rett Syndrome.

Anna was a nonverbal student who did not have a formally established communication system. She gained adult attention by crying or whining. Anna was observed making lunch selections from two enlarged pictures of food items presented on a triangular black form. One adult would gently hold down her right hand so that she could reach toward the picture of her lunch selection with her left hand, which appeared to be her more dominant hand. Anna could chew solid foods and drink from a straw. She could hold her head erect and sit with support.

The only formal standardized testing conducted with Anna was the Bayley Scales of Infant Development 3 on which she scored an age equivalent of three months pacing her in the severe range of intellectual disabilities. However, due to Anna’s verbal and
motor limitations, caution must be used in interpretation of scores on standardized tests. Anna was unable to match letters or sight words to pictures.

Anna spent a lot of time during the school day sleeping and was almost always awoken from a nap of up to two hours just prior to intervention sessions. Thus, it often took Anna halfway into the session to fully wake up and participate. Anna had spinal surgery during baseline of the intervention. As a result she was absent from school for several weeks during baseline. However, she returned to school prior to the onset of intervention for her group. Anna appeared interested in Jo, her group mate who was not in her regular classroom, but never initiated any contact. Anna usually appeared very serious and rarely smiled; although she worked hard during the intervention sessions once fully awake. When awake, Anna paid close attention to what was going on in her classroom, including tracking favorite adults as they moved around the room, and in visually attending to objects, tasks, or activities. Anna presented a strong and steady eye gaze which she used to make selections and to communicate wants and desires such as gazing steadily at her plate of food for lunch and then pointedly at the adult feeding her when she wanted another bite. She did not respond to social praise in the form of words, smiles or tactile input such as a pat on the hand or arm.

Anna lived at home with both her parents and two siblings. Anna had been in the public school system and receiving special education services since preschool. Anna was currently being educated in a self-contained classroom for students with severe disabilities. There were five other students in the classroom including Garth. There was one classroom teacher, four teacher assistants, and two dedicated nurses in her classroom.
Sam. Sam was a 13-year-old eighth grader with a diagnosis of multiple disabilities of unknown genetic origin. Sam had a history of feeding and heart issues, for which he underwent multiple surgeries. Sam wore glasses. He was ambulatory, although due to his heart condition, his physical development was delayed as was his independent ambulation. Sam had functional use of his hands and could grasp and manipulate objects, hold a pencil, and type using two fingers. During intervention sessions, Sam pointed to his selections by placing his whole hand with fingers splayed on his answer. He had to be reminded by the researcher to use his index finger as a more refined selection method.

Sam was a nonverbal student who used gestures, head nodding, nonspecific vocalizations, an approximation of the word “no,” and an ASL sign approximation of bathroom. Sam also used a communication app on his school issued iPad although he needed reminders and modeling to use it during structured activities. Sam could also make approximate imitations of individual words but did not use them functionally or seem to generalize them beyond the initial imitation.

In Brigance Early Childhood Inventory Sam’s overall scores fell between 1.6 years of age and 7 years depending on the tasks. Sam was able to match uppercase letters, point to uppercase letters at the 5.6 level, and match lowercase letters at the 5.3 level. In the classroom his teacher noted that Sam could print his name with a visual model, could complete one- to two-step vocational tasks, and could stay on task for 30 to 45 minutes. He had demonstrated knowledge of a few basic sight words, which were not identified. When given a field of two choices, his teacher reported that he was inconsistently able to point to a letter requested by name.
Sam was a very social and friendly boy who came eagerly with the researcher for intervention sessions and who enjoyed interacting with his group mate. He actively sought out high fives from both the researcher and his group mate and helped out when his group mate hesitated in selecting an answer. Sam enjoyed social praise and was clearly pleased with himself when he answering correctly. Sam lived at home with his parents and two siblings. He had received special education services since the age of six months. Sam was currently being educated in a self-contained classroom for students with moderate to severe disabilities, including Jo. There was one classroom teacher and four teacher assistants assigned to his classroom.

Dean. Dean was a 15-year-old eighth-grade student with a diagnosis of autism. He was ambulatory and had good fine and gross motor skills. If given the option, Dean would skip or lope down the hallways of the school rather than walk. Dean clapped his hands repeatedly and vocalized loudly when happy or excited. Dean made good eye contact when an adult was speaking to him. He answered questions with a nonsymbolic “yes” vocalization or a slight headshake for “no.”

Dean was a nonverbal student who primarily communicated through pointing, gesturing, his “yes” approximation and head nodding. He had access to a communication app on his school issued iPad which he used with reminders. Dean attended both visually and auditorily when an adult was speaking to him, and attempted to answer questions. He followed directions and was cooperative. Dean came willingly with the researcher for intervention sessions and appeared to look forward to seeing his group mate who was in another classroom regularly. Dean would smile, clap and vocalize, when we would reach
his group mate’s classroom door to pick him up for sessions. Dean would respond to his group mate’s requests for high fives, but did not initiate them himself.

On the Gilliam Autism Rating scale he showed autistic traits in communication, socialization and stereotyped behaviors with relative strengths in daily living skills. Dean was attentive to his environment. He noticed when his shoe was untied and was able to tie it himself. He had good visual spatial skills. On the Brigance Early Childhood Inventory Dean demonstrated good auditory discrimination skills at the five-year level and visual discrimination skills at the four-year level. He was unable to identify letters or match beginning sounds with letters or pictures. In the classroom he was able to type his full name and phone number from memory. His teacher reported that he was inconsistent in answering comprehension questions about a story that had been read to him.

Although Dean was born in the US, his first language was Russian. Dean was adopted in 2012 and lived with his adoptive mother and biological siblings during the time of the intervention. Prior to adoption, Dean lived in a residential facility for approximately five years, where English was spoken as it was in his adoptive home. Dean was currently being educated in a self-contained classroom for students with autism. There were four other students in the class, including Chuck. There was one classroom teacher and three teacher assistants assigned to the classroom.

**Bobby.** Bobby was an 11-year-old sixth grader who had a diagnosis of autism. Bobby was ambulatory and had good fine and gross motor skills. Bobby had difficulty staying seated for extended periods of time, especially if he was being asked to focus on something. He usually carried a small manipulative such as a rubber “p” shaped object
for chewing on, or small plastic rectangles that he fiddled with. Bobby was much attuned to smells and liked to smell people. During intervention sessions Bobby would get up and run around the room if there was space to do so. If there was not space to run around, he would often slide down in his seat until he was under the table. Bobby was also an eloper and would take any available opportunity to run out of the room. In his classroom, Bobby required an adult to sit next to him to keep him focused and on-task during activities. He would also lie on the ground and refuse to get up. It often took two of his teachers to get him off the floor. When seated Bobby would cross his arms out in front of himself and then repeatedly slap his opposite elbows while swaying back and forth and looking at the ceiling or closing his eyes.

Bobby was a nonverbal student who used multimodal communication. He had a Picture Exchange Communication (PEC) book that he carried with him. However, he used it inconsistently and required reminders to use it. He primarily communicated through the use of the ASL sign for “more,” gestures, pointing, and leading people to what he wanted. Bobby vocalized with giggles and squeals when he was overstimulated. He did not make any word approximations or attempt to use vocalizations with communicative intent. Bobby was very difficult to focus during intervention sessions. On average out of a 45-minute session, he was focused for approximately 10 to 15 minutes of a good session. Bobby was always accompanied to intervention sessions by one of the assistant teachers from his classroom due to his behaviors, which included running out of the room (elopement). Bobby did not interact with his group mate, unless specifically
prompted to, and then it was fleeting contact. He would accept high fives or fist bumps as social praise but did not seek them out.

On the Childhood Autism Rating Scale Bobby scored in the mild to moderate range of Autism. When using the Brigance Early Childhood Inventory Bobby was able to match letters, numbers, and pictures. He was able to compare bigger and smaller amounts and showed a relative strength in visual spatial skills. He could hold a pencil but did not write functionally. Bobby received speech and occupational therapy services.

Bobby lived at home with his mother, grandmother, and sibling. He began receiving special education services in 2006 when he was in preschool. Bobby was being educated in a self-contained classroom for students with autism including Ash. There were one teacher and three teacher assistants in his classroom.

Garth. Garth was 16-year-old ninth grader who had a diagnosis of Down Syndrome. Garth immigrated to the United States in 2011 from Bangladesh with his mother and sisters in order to receive treatment for tetralogy of Fallot, a congenital heart anomaly. He had open heart surgery at the age of 14. Prior to surgery, Garth used a wheelchair for ambulation due to difficulty with oxygen saturation caused by his heart condition. He also suffered from malnutrition also due to his heart condition and difficulty with eating. A G-tube was surgically implanted to help with nutrition. Postheart surgery Garth was able to ambulate independently and gained weight. He remained G-tube fed at home, but ate solid food for lunch at school. Garth wore glasses to correct his vision. He was able to pick up and manipulate objects such as a fork, pieces of food, or other objects. He used a whole hand grasp on smaller or paper objects. He would grab
instructional materials or other objects within his reach and throw them on the floor while smiling. He could use his index finger to make a pointer, but did not use it functionally. When interacting with intervention materials he used the whole hand grasp or a hand swipe despite modeling and repeated attempts to get him to point to selections.

Garth was a nonverbal student who did not have a formal communication system. He primarily communicated through gestures and pointing and smiling. However, he did use the ASL sign for *bathroom*. Garth was a friendly boy and waved and smiled at adults in the hallway. He also made a point of waving goodbye to all of the adults in the room when leaving with the researcher for intervention sessions. However, Garth did not acknowledge his classmates and only engaged with his group mate when specifically directed to. Garth came willing with the researcher for intervention sessions and sat patiently at the table. In his classroom he tended to stay where he was placed, whether that was at a table, in a chair, or in a beanbag. He moved willingly when asked to by an adult but did not initiate movement on his own. Garth enjoyed social praise in the form of high fives, fist bumps, pats on the arm and verbal praise.

The only formal testing done on Garth was the Vineland Adaptive Behavior Scales, on which he earned a score of 33, putting him in the moderate to severe range of adaptive behaviors. In informal classroom testing he demonstrated knowledge of common object functions such as tableware. He could match shapes from a field of two, followed routine commands and demonstrated understanding of cause and effect. He was right hand dominant but used both hands equally when reaching for objects. No letters or sight word testing was reported in his files.
Garth lived at home with his parents and two siblings. Bengali was the language spoken at home. Prior to immigration the United States, Garth had never attended any kind of school. Garth was currently being educated in a self-contained classroom for students with severe disabilities. There were five other students in the classroom including Anna. There were one classroom teacher, four teacher assistants, and two dedicated nurses in his classroom.

Ash. Ash was a 12-year-old sixth grader who was diagnosed with autism. Ash was ambulatory with a wide slow gait. He had good fine and gross motor skills and enjoyed coloring, playing with water, and doing simple puzzles. He could hold a pencil and scribble but did not make any recognizable marks. He exhibited many of the Obsessive Compulsive Disorder (OCD) characteristics associated with autism, including the need to touch everything he encountered in the hallways. Such need made his gait seem even slower, as the hallways of his school were full of equipment used by various students. Additionally he needed to touch each corner of any paper, picture, or visual display presented to him as well as the table ledge with both hands prior to otherwise engaging with them. Once each corner was touched, Ash would use both his index fingers to brush the paper or picture repeatedly before otherwise engaging with the material. Ash attended all intervention sessions with an assistant teacher from his room due to behavioral issues. His teacher’s main concern for behavior was his tendency to hit people. He did reach out and chuck the researcher under the chin a few times, but not hard. It appeared to be more of a response to excitement rather than the desire to hit
someone. He was easily redirected back to the task and appropriate forms of receiving social praise.

Ash was a nonverbal student who used multimodal communication. He had a PECs book which he used only with prompts and modeling. His primary mode of communication was through gestures, head nodding, nonspecific vocalizations, and leading people to what he wanted. He also used the ASL sign for *more*. Ash vocalized often during intervention sessions and found it amusing when the letter-sound *mmm* was introduced, as that is one of his constant vocalizations. Ash never attempted to imitate the letter-sounds or words but would watch the researcher carefully when letter-sounds were made.

Although an attempt was made to administer the Stanford Binet Nonverbal Intelligence Scales to Ash, the attempt was discontinued. He was unable to answer enough items to achieve even a basal score and unable to respond to enough items to earn a standardized score. Therefore his IQ was estimated to be below a standard score of 40, which is in the severe range of intellectual disability. In testing done with the Brigance Early Childhood Inventory, Ash scored between the age equivalents of zero and four years. In the classroom his teacher reported that he recognized his name in print, he could sometimes follow one- to two-step directions and try new vocational activities. However, easily became frustrated. He demonstrated limited ability to match pictures and letters.

Part of the difficulty in assessing Ash was that he did not have an established and reliable means of making a selection. Every time he was presented with choices (pictures, objects, words) he used both hands to touch all of the choices simultaneously. This
proved to be an obstacle during the intervention as well. The researcher struggled to find a mean for Ash to demonstrate his knowledge of the letter-sounds and words he was being taught. No matter what visual array was used to present the choice, he would begin at the outer edges of the display with both hands and work his way in touching every choice. Eventually a method of choice selection was found and Ash was able to demonstrate that he was learning the letter-sounds and words being presented during the intervention sessions. A full description of that process and the ultimate choice selection is presented later in the section dedicated to all students’ choice selection.

Ash came willingly with the researcher for intervention sessions and appeared to enjoy the sessions. At the beginning of the intervention, he enjoyed the picture cards the most, but as the sessions went on, and as he began to learn the letter-sounds and words, he enjoyed demonstrating his knowledge and wanted to spend less time looking at the picture cards. Ash liked social praise in the form of verbal praise and in the form of having his extended hand pressed and clapped between both of the researcher’s hands. He would actively seek this form of reinforcement after each selection. When he got the answers correct he would smile and rock. He appeared to be very pleased with himself when he got answers correct. Ash was unwilling to leave the table as long as the teaching materials were visible, which proved to be a problem during a fire drill. The researcher had to stop and put all the materials away before he would get up to leave.

Ash was diagnosed with autism at 18 months and received special education services in the public schools since preschool. In addition to special education services, he received speech and occupational therapy services at school. Ash was currently
educated in a self-contained classroom for students with autism including Bobby. There were one teacher and three teacher assistants in his classroom. He lived at home with his mother, stepfather, and a sibling.

Chuck. Chuck was 15-year-old ninth-grade student diagnosed with Autism. He was ambulatory and had good fine and gross motor skills. Chuck had a teacher assistant assigned specifically to him due to extreme behaviors. Maladaptive behaviors included hitting, biting, grabbing, and refusing. However, his teaching assistant only attended the first intervention session and after that Chuck did not display the above-mentioned maladaptive behaviors with the researcher. In the first few sessions of the intervention, Chuck was wary and easily became overwhelmed. He cried during one of the sessions and sat sideways in his seat refusing to interact with the materials at all. During another session he became agitated by activity in the hallway on the way to the intervention site and subsequently would not engage in the intervention activities. If Chuck was in a specials class, such as gym or art, prior to the intervention session, he needed to go all the way back to his classroom and check his schedule before coming with the researcher for an intervention session. If the researcher tried to pick Chuck up directly from a specials class to save time, he would become agitated and refuse to engage in the intervention activities. However, after a few sessions Chuck became comfortable with the researcher and with the intervention protocol and then became enthusiastically engaged.

Chuck was a nonverbal student who used multimodal communication. He had access to a communication app on his school issued iPad which he used for communication purposes with prompts. His primary mode of communication was
through gestures, nonspecific vocalizations, facial expressions, and leading people to what he wanted. During the course of the intervention Chuck began spontaneously imitating the letter-sounds and the sight words presented in the intervention. By the end of the intervention he could verbally approximate four of the five words and all five letter-sounds. Chuck’s teacher and personal assistant both told the researcher that during the course of the intervention Chuck began vocalizing more in class and that his parents had reported more word approximations at home.

Chuck scored in severe range of Autism on the Childhood Autism Rating Scale. His externalized maladaptive behaviors were more than two standard deviations above the average range for nonverbal students with autism, and thus, were considered not typical for autism and therefore clinically significant. In informal classroom testing he demonstrated the ability to match spoken words to pictures. He could write and type his personal information using a visual. His teacher reported that he was inconsistent in answering questions about a story that was read to him. He was able to match spoken words to pictures.

After the first few sessions, Chuck came willingly with the researcher for intervention sessions. At first Chuck hesitantly accepted social praise in the form of a fist bump. However, after repeatedly observing his group mate, Ash, receiving social praise in the form of having his outstretched hand pressed and clapped between both of the researcher’s hands, Chuck began to request the same social praise. He sometimes even sought the praise after Ash gave a correct answer. By the last few intervention sessions, Chuck was reading the letters and words upside down during Ash’s turns, producing the
correct answer before Ash, so that he could get the social praise from the researcher. In the early intervention sessions, Chuck would avoid eye contact with the researcher and become agitated if the researcher looked at him for too long. By the last few sessions, Chuck would seek out eye contact with the researcher and often spent most of the sessions holding onto the researcher’s arm that was closest to him.

Chuck was currently being educated in a self-contained classroom for students with autism. There were four other students with autism in the class including Dean. There was one classroom teacher and three teacher assistants in the classroom. Chuck had received special education services in the public schools since preschool first with an eligibility of developmental disability and then in 2005 his eligibility was changed to autism. He lived at home with his parents.

**Teacher Participants**

Teachers who had the selected student participants in class either full day or for reading instruction were asked to participate in postintervention interviews. Teacher assistants who were present during the intervention sessions were also asked to participate in the postintervention interviews. There were four teacher participants and four teacher assistants queried for interviews in total. The teachers and teacher assistants were all female. Two of the teachers were Caucasian, one teacher was African American, and one was Asian. Two of the teacher assistants were Caucasian and two were Hispanic. Although all of the student participants were considered to have severe disabilities, all of the teachers had received their primary certification in mild disability categories. Teacher and Assistant demographics are presented in Table 4.
### Table 4

**Demographic Information for Teacher and Assistant Information**

<table>
<thead>
<tr>
<th>Name</th>
<th>Teaching placement</th>
<th>Years in field</th>
<th>Position/certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lisa</td>
<td>Autism</td>
<td>5 - 9</td>
<td>T: MD</td>
</tr>
<tr>
<td>Ruby</td>
<td>Autism</td>
<td>1 - 4</td>
<td>T: MD</td>
</tr>
<tr>
<td>Becky</td>
<td>Life Skills (Severe Disabilities)</td>
<td>10+</td>
<td>T: LD/ED</td>
</tr>
<tr>
<td>Mary</td>
<td>Life Skills (Severe Disabilities)</td>
<td>1 - 4</td>
<td>T: MD</td>
</tr>
<tr>
<td>Ellen</td>
<td>Autism</td>
<td>1 - 5</td>
<td>A</td>
</tr>
<tr>
<td>Jody</td>
<td>Autism</td>
<td>5 - 10</td>
<td>A</td>
</tr>
<tr>
<td>Gwen</td>
<td>Autism</td>
<td>5 - 10</td>
<td>A</td>
</tr>
<tr>
<td>Jessica</td>
<td>Life Skills (Severe Disabilities)</td>
<td>10+</td>
<td>A</td>
</tr>
</tbody>
</table>

*Note. T = teacher, A= assistant, MD = mild disabilities, LD/ED = learning disabilities, emotional disabilities.*

### Settings

All student participants attended public school in Southern County Public Schools. Southern county was a diverse, urban county with student enrollment in the 2013-14 school year under 25,000 with students coming from 111 different countries and speaking 88 different languages. The high diversity of the county could also be illustrated by the large range of free and reduced-priced lunch eligibility across the county. For example, in one school the rate of free and reduced-price lunch was as high as 86.32%, and in another school it was as low as 2.04%. The Hartford Program (pseudonym), where
all of the student participants attended school, was collocated with another school building called Study School (pseudonym). The Hartford Program was its own entity with its own principal, despite sharing space with the larger Study school. The Hartford Program was a small but complete school with a staff of 41 full-time teachers, assistants, and staff and an additional 10 itinerant staff shared with other schools. There were less than 75 students who attended the Hartford Program in the 2013-2014 school year. The Hartford Program mirrors the diversity of Southern County with 67% of students having a home language other than English and a 56% rate of free and reduced-price lunches.

The student participants were placed in four groups for the intervention, which were defined as Group A, Group B, Group C, and Group D. Student participants were primarily assigned to groups based upon their schedules. However, when student schedules matched, the researcher randomly assigned those students to one of the groups as described in the procedures section below. Group A consisted of Jo and Anna. A third student, Ruby, participated in the lessons during the teaching portion of each lesson but data were not collected on her in testing. Group B was comprised of Bobby and Garth. Group C consisted of Sam and Dean. Finally, Group D contained Ash and Chuck.

Due to a lack of consistently available space, the intervention sessions took place in a variety of rooms within the Hartford Program’s building. In coordination with the librarian, therapists, and teachers, the researcher devised a schedule of room rotations for the groups. However, it was not uncommon for a designated space to be unavailable at a regularly scheduled time due to other more pressing needs. For example, the library, which was usually available to the researcher all day on Fridays and on Wednesday
afternoons, was sometimes used for IEP meetings, requiring the researcher to seek out alternate locations for that day for the groups originally schedule to meet in the library. Listed below are descriptions of the various spaces used for sessions. See Table 5 for a list of the rooms each group used for sessions.

**Library.** The library was the most often used space for the intervention, since it was usually available to the researcher all day on Fridays and on Wednesday afternoons. The library was situated near the front of the building across from the Occupational Therapy/Physical Therapy (OT/PT) room and next to the clinic. The entrance was a long hallway with shelves of books on either side. The main part of the library was one long room approximately 30 x 18 feet. Along one wall in the main room were floor-to-ceiling storage cabinets. Along the opposite wall were a sink and counter that ran the length of the room with undercounter storage cabinets and overcounter cabinets hung on the wall. There was a microwave and a computer on the counter, which were used by the entire school. There were three long tables running down the middle of the room which were configured in a T-design. Cushioned and armed chairs were pulled up around the tables. At the far end of the room, opposite from the librarian’s desk, was a large desk where the English as a Second Language (ESL) teacher sat. There was also a student desk with a computer on it behind a pillar, which was used by an itinerant technology teacher when she was in the building. Teachers and assistants often came into the library to go to the supply closet in the back of the room. There were no windows in the library and the floor was carpeted.
The librarian only worked part time, which is why the library was available to the researcher to use. However, during intervention sessions the ESL teacher was often present, and it was not uncommon for other teachers and teacher assistants to come in to use the microwave or shared computer. Also, throughout the day teachers and teacher assistants came into the library and checked out work boxes from the supply cabinet. For some of the participants, the sporadic appearance of other teachers and staff in the library proved to be a distraction (Bobby, Sam, Jo, and sometimes Dean), while other participants did not even seem to notice (Ash, Chuck, Garth, and Anna).

All of the groups met in this room. For Group B, Bobby sat with his back to the counter because there was less space between the table and counters so it was easier for the researcher to keep him at the table. Garth was seated directly across from him with the researcher between them at the end of the table. Group D, Chuck and Ash, sat in the same configuration with Chuck seated with his back to the counters. When Group C met in this space, Sam and Dean sat on the same side of the table facing the counters with the researcher directly across from them. For Group A the researcher tried many different configurations in an attempt to keep Jo in her seat. The best configuration in this space was with the girls forming a circle with Jo’s chair turned with its back against the table and Anna’s wheelchair on the other and the research completing the circle directly across from Jo. In this configuration, Jo could still pop up out of her chair but could not go anywhere, so she would just sit back down. While this configuration worked best at containing Jo, it made taking data and manipulating intervention materials challenging for the researcher who had to balance everything on her lap.
OT/PT room. The OT/PT room was approximately 20 x 14 feet. It was located near the front of the school across from the library and next to the clinic. The room was crowded with furniture and all of the physical and occupational therapists who came in and out of the building used the space as a base. The room was also used for broadcasting the school’s morning news program. There were no windows in the room, and five overhead florescent light banks, two of which had blue material draped across them which were used to light them. At one end of the room adjacent to the door was a large desk which was shared by all of the therapists who used the room. A small round table with three cushioned armchairs positioned around it sat behind the shared desk. Adjacent to the round table was a computer cart with two computers on it. On the back wall a large bulletin board with a bright red background and a huge butterfly in the corner hung in the center of the wall. In front of the bulletin board was a square table, which was nearly the width of the room. There were usually four or five cushioned nonarmed chairs around the table. A camera mounted on a large wheeled metal frame sat in the middle of the room along with two gait trainers, a rocking chair, and a stack of chairs. The room was carpeted. It was not uncommon for other people to be in the room during intervention sessions. Usually OTs or PTs would be working at the desk with their backs to the group. However, they would sometimes talk on the phone or interact with other people who came in to talk with them. The presence of other people in this room proved to be distracting to the same participants as in the library.

Most often the researcher used the small round table during intervention sessions with the students sitting on the opposite sides of the table and the researcher sitting
between them. For Jo, and Anna in Group A, the researcher tried several different configurations in seating. Usually Anna’s wheelchair was placed next to Jo, both because Jo liked to interact with Anna and because it helped to keep Jo from trying to walk away from the group which was a safety concern. However, when Garth and Bobby from Group B were in this room, Bobby was placed at the larger square table with his back to the red bulletin board so that he was less likely to get up and run around. The table blocked easy access to the rest of the room and it was easier for the researcher and assistant teacher to block him in. When Ash and Chuck, Group D, met in this room they sat on opposite sides of the small round table with the researcher between them. Group C never met in this room.

**Speech room.** The speech room was a small, crowded room approximately 14 x 8 feet. Directly inside the door was a large metal desk which was shared by the speech therapist and teacher of the visually impaired. Behind the desk sat a small round table with two student chairs with tennis balls on their feet pulled up to it. There was also a student desk and one additional student chair in the room. There was one window toward the back of the room on the same wall as the small round table. A small white board hung above the round table but nothing else was on the wall and the floor was carpeted. This room was located at the back of the school at the end of the main hallway. Only once the speech therapist was in the room during an intervention session working at her desk with her back to the group.

This room was not often available to the researcher and was not scheduled into the regular room rotation, but was a preferred space when available, especially for Group
B. Because the room was very small, it was easier to place Bobby in a position where he could not get up and move around which helped to calm him down and focus on the task at hand. Sam and Dean, Group C, only met in this room once. They sat on opposite sides of the round table from each other with the researcher in the middle. Groups A and D never met in this room.

**Room 112.** This was Anna’s and Garth’s regular classroom and was used for intervention sessions while the students were away in a specials class (such as art or gym). Room 112 was a large classroom shaped in a wide T. The front portion of the room along the long arm of the T next to the door housed desks for the dedicated nurses, a computer table with two computers, and two tall file cabinets. Along the opposite wall was the door to a large handicapped accessible bathroom. The lights were almost always out in this part of the room. There were windows all along the back wall with wide cabinets under them, but the blinds were usually kept down and closed. In the main open space in the short arm of the T was a rectangle table with four or five student chairs around it. Several cushioned, armed chairs sat in an open space in front of the interactive white board. The main part of the room where the open space and table were located was carpeted. The front part of the room, where the computers and bathroom were located, had linoleum on the floor. During sessions, the teacher was always present and working at her desk. Also it was not uncommon for other people to come in and out of the room both to talk with the teacher and to retrieve supplies. In this room, the presence of people coming and going only proved distracting to Sam and Dean.
Interventions in this room took place primarily at the table. When Group C met in this room, Sam and Dean sat on one side of the table facing the wall of cabinets with the researcher across the table from them. When Group A met in this room two configurations were tried with varying success in both. In one configuration, the group met in the long arm of the T near the computers with Jo’s chair facing the door and up against the computer table for added stability. The researcher placed her chair next to Jo with Anna’s wheelchair directly beside her. In the other configuration Jo was placed at the end of the rectangle with Anna’s wheelchair at the corner. Once, the group met in this room because Anna was standing in her stander. While Anna worked well in her stander, it was more difficult for the group because she was at a different eye level than Jo. Thus, it made it difficult for the researcher to engage or even to keep an eye on both girls at one time. This provided opportunities for Jo to pop out of her seat and try to walk away.

**Room 124.** Room 124 was Chuck’s and Dean’s regular classroom and was used for intervention sessions, while the students were out at specials classes (such as art or gym). This room was a large rectangular interior space with no windows. In the middle of the space toward the back of the room, there was a bank of desks separated by carousels around each desk. To the right of the desks sat a square table, and along the front wall there was a sink with cabinets and a bathroom. The bathroom was located in the back right corner along the front wall. The bathroom door opened into a quiet/rest area. A half wall, beginning just to the right of the door and running 10 feet into the room separated this quiet rest/area from the door. In the quiet area there were cushioned rocking chairs and a book case. The front half of the room was carpeted. The back half of the room with
the desks had linoleum on the floor. Only half of the overhead florescent lights were ever
turned on. During sessions the teacher was always present and working at her desk. It
was not uncommon for other people to come into the room to talk with the teacher. In this
room the teacher’s presence did not disrupt the groups meeting in this space.

Intervention sessions in this room took place at the square table in the back half of
the room. The only group that ever met in this space was group B. During their
intervention sessions, Bobby sat at the square table with his back to the front wall,
bathroom and quiet/rest area. Garth sat opposite him facing the front wall, bathroom, and
quiet/rest area. This was not a particularly good space for intervention sessions with
Bobby, because he liked to go and lay on the cushioned rocking chairs in the quiet/rest
area.

Room 125. This room was Bobby’s and Ash’s regular classroom. It was a large,
slightly irregular square room with the door opening toward one end of the square.
Directly next to the door to the right in the corner of the room, there was a computer on a
desk and the teacher’s desk. In the open space in front of the teacher’s desk, a kidney-
shaped table was situated in front of an interactive whiteboard. A bank of desks, each
desk separated from the others by a carousel, sat in the open space in the left side of the
room. Two rectangular tables arranged into an L-shaped took up the space in front of the
desks. Along the front wall to the left of the door, there was a sink with cabinets and a
bathroom situated in the back left corner. There were cushioned rocking chairs along the
front wall of the room as well as in the center of the kidney table. The front half of the
room was carpeted and the back half of the room with the desks had a linoleum floor.
Only about one fourth of the overhead florescent lights were ever on in this room. During sessions in this room there were always other people in the room. Sometimes it was just one assistant, but at other times, it was the whole class or many adults talking. For Bobby and Jo these other people proved to be distracting, but the other participants who met in this room were not distracted by them.

Sessions in this space took place either at the kidney table or at the L-shaped tables; although Ash did one make-up session at his desk. When Group B met in this room, Bobby sat at the kidney table to the left of the researcher in his regular seat which was a cushioned chair with arms. Garth sat to the right of the researcher in a regular classroom chair. This was not a good space to conduct intervention sessions for Bobby. He displayed more out-of-seat behavior and was more difficult to focus in this space than in any of the others.

When Chuck and Ash from Group D met in this space, the researcher sat on the interior short arm of the L with Ash at the end of the L and Chuck directly across from the researcher. When Group A met in this space, Jo and Anna were placed on the outside short arm of the L with the researcher on the interior short arm of the L across from Jo and Anna. On the few occasions when group A met in this space, Jo was able to bring her adaptive classroom chair on small wheels since this room was located on the opposite end of the school from Jo’s regular classroom and was too far for her to walk within the timeframe available. For this reason, Jo sat nicely at the table and was not able to pop out of her seat. Group C never met in this space.
Conference room. The conference room was a 13 x 8 foot room located in the main hallway near the front of the school. It contained a large oblong conference table which was pushed into the corner and took up half of the room. The opposite end of the room contained mats and two therapy balls. While the original purpose of the conference room was for conducting meetings, it housed a student who was having behavioral difficulties and needed to be separated from his class during the time of the current study. As a result of his installment in the conference room, there were many educational materials housed on the table. This room was only available to the researcher when the student was absent. It was a preferred location, especially for Group A, since it was centrally located and required less of a walk for the two girls who required assistance while walking. The room had no windows but did have a floor-to-ceiling glass panel next to the door.

When Group A met in this space, Jo was placed at the end of the table up against the wall for stability with Ruby directly next to her and Anna’s wheelchair beside her. The researcher sat on the side of the table next to Anna and adjacent to Jo. While the table configuration was not ideal, the decreased transition time that it took to move the girls to one of the farther locations meant more time available during the sessions for the intervention. When Group C met in this space Sam and Dean sat side by side at the end of the table with the researcher seated adjacent on the long side of the table. This proved to be a difficult location for Group B as the mats and therapy balls were too tempting for Bobby. It was impossible to keep Bobby in his seat in this space and both times the group
met in this space he ended up on the balls or laying on the mats on the floor. Group D never met in this space.

Table 5  

<table>
<thead>
<tr>
<th>Group</th>
<th>Students</th>
<th>Mondays</th>
<th>Tuesdays</th>
<th>Wednesdays</th>
<th>Fridays</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Jo, Anna</td>
<td>10:30 Rooms 125, 112, OT/PT room or conference room</td>
<td>NA</td>
<td>1:00 Library Or room 112</td>
<td>2:15 Library</td>
</tr>
<tr>
<td>B</td>
<td>Bobby, Garth</td>
<td>12:30 Room 124, 125 or conference room</td>
<td>NA</td>
<td>9:30 Room 125, speech room or OT/PT room</td>
<td>9:30 Library</td>
</tr>
<tr>
<td>C</td>
<td>Sam, Dean</td>
<td>1:30 Room 112 or conference room</td>
<td>NA</td>
<td>10:30 Room 112</td>
<td>12:30 Library</td>
</tr>
<tr>
<td>D</td>
<td>Chuck, Ash</td>
<td>NA</td>
<td>10:30 OT/PT room</td>
<td>2:00 Library</td>
<td>10:30 Library</td>
</tr>
</tbody>
</table>

Note. OT/PT = Occupational Therapy/Physical Therapy.

Dependent Variables

There were two dependent variables in this study which were (a) letter-sound correspondence, and (b) sight word recognition.
**Letter-Sound Correspondence**

The first dependent variable was letter-sound correspondence. This refers to the ability of a student to match the sound that a letter makes *mmm* with its orthographic representation “m.” In order for readers to process all of the words they will encounter, they need skills to deconstruct and figure out novel words. These print-to-sound skills are called word attack strategies or decoding and focus on the relationship between orthographic letters and their corresponding sounds (Truxler & O’Keefe, 2007).

In this study each group of participants was taught five letter-sounds. In order to determine the letter/sound pairs selected for each group, each participant was preassessed to determine if they had prior knowledge of any letter-sounds. Thus any already known letter-sounds were eliminated from the pool of potential letter-sounds for that participant’s group. Then based upon the preassessment results, each group was assigned a unique set of five letter-sound pairs based roughly on the suggested sequence from the ALL Curriculum and barring any already known letter-sounds. The letter-sounds selected for Group A were *a, m, p, t, c*. For Group B the selected letter-sounds were *a, m, p, t, o*. The letter-sounds selected for Group C were *d, n, f, s, c*. For Group D the letter-sounds selected were *a, m, p, t, o*.

**Sight Word Recognition**

The second dependent variable was sight word recognition which refers to the skill of automatic word recognition occurring when a reader instantly recognizes a whole word as an orthographic and phonological unit (Ehri, 1992; Erickson et al., 2008).
For the purposes of this study, a pool of potential sight words was generated for each group based upon recommendations of teachers, suggested sight words from other packaged curriculums, as well as based upon high interest as suggested in the ALL Curriculum (Light & McNaughton, 2009). Each participant was preassessed on their group’s pool of potential sight words to determine prior knowledge of any of the words. Any already known words were eliminated from that groups’ pool of potential sight words. After the preassessment, five words were selected for each group from their pool of unknown words. The sight word selected for Group A were bus, car, yellow, lunch, see. The sight words selected for Group B were bus, car, yellow, lunch, see. The sight words selected for Group C were bus, car, yellow, lunch, see. The sight words selected for Group D were happy, mad, home, yellow, and green.

Physical Display and Target Arrangement

For both dependent variables a correct response was considered a touch on the target letter or sight word as operationalized for each individual participant below. In order to determine the physical layout of the presented choices, the researcher observed each participant’s range of motion and patterns of touch. Prior to beginning intervention, the researcher met with each participant individually to assess range of motion and natural patterns of movement. In order to assess range of motion and movement patterns, the researcher presented each student participant individually with a variety of visual displays with the following pictures from Boardmaker software: pizza, ball, dog, bus, spoon, cup. The researcher pointed to each picture, stated what the picture represented, and used it in a sentence. For example, the researcher pointed to the picture of pizza and
said “Pizza. I like pepperoni on my pizza. Do you?” This was repeated for each picture. The researcher then asked the student participant several questions such as “Can you touch the dog?”; and “Do you like to eat pizza or would you like to eat a bus?”; and “I like to play ball. Can you touch the ball?” The goal of the questions was to observe as the student made a selection. The researcher was looking to see if the student participant visually scanned all of the choice options before making a selection. The researcher also was looking to see whether the student could reach each of the pictures on the visual array and subsequently, to assess where was the best physical location to place the visual array for each student participant. The visual arrays used were a clear Plexiglas stand, a laminated sentence strip, and a freestanding blue A-frame pocket chart. Additionally the researcher was watching for idiosyncratic movements that might be used or that might hinder a student participant in making selections.

For students using eye gaze the same sequence of assessment described above was used to determine the student participant’s patterns and strength of eye gaze. When assessing eye gaze, the researcher was interested in determining both the best layout to use for the student as well as to see the student participant’s natural selection signals. Thus, a freestanding A-frame pocket chart was used with the fixed array of letters or words arranged in a square pattern with two letters on opposite edges of the second row down of pockets and two letters on opposite edges of the fourth row down of pockets for Jo and Anna. Bobby, Garth, Sam, Dean, Chuck, and Ash all used a fixed array of letters or words arranged in a horizontal line on the laminated sentence strip.
Choice Selection Methods

In order to determine choice selection methods for the participants, the researcher watched natural patterns of selection, when known items were presented to the participants. For example, when a student was presented with four choices of pictures that his teacher confirmed he already knew, the researcher was able to observe how he selected the correct target. This method of watching a participant select from already known items or pictures was repeated for each participant to operationalize making a selection for them. Listed below and presented in Table 6 are the selection methods used by each participant.

Choice selection methods for participants in group A. For Jo choice selection was a touch with her index finger or sometimes she elected to take the letters/words out of the pocket and hand them to the researcher. Anna primarily used eye gaze as her choice selection, but would make reaching approximations using her left hand combined with eye gaze, if her right hand was gently held down. Her eye gaze was very steady. She held her gaze on her identified target for up to two seconds and then returned her gaze to the researcher’s face to indicate a selection had been made. Therefore, a touch was considered direct eye gaze on a word/letter with or without a hand reaching approximation followed by redirection of her eye gaze to the researcher’s face.

Choice selection methods for participants in group B. For Bobby’s choice selection, he often touched more than one letter or word following a request. The researcher tried several different visual arrays to try to get Bobby to touch only one selection, but no matter what the visual array was, he seemed to need to touch his
selection and then one additional letter/word. Therefore, a touch for Bobby was defined as the first letter/word that he touched.

In choice selection Garth demonstrated difficulty with appropriately interacting with materials both in his classroom and during intervention sessions. He would grab materials and throw them on the ground. Garth was encouraged to use his index finger, which he was capable of isolating, to make his selections. Sometimes he would approach a target with his index finger, and at the last moment, open his hand and grab the target and throw it on the ground. For this reason, the visual array was often held just out of his reach in front of him. Therefore, a target selection for Garth was identified as the target word/letter for which he was grabbing or on occasion was able to grab.

**Choice selection methods for participants in group C.** Sam initially used a selection method of an open-handed slap on the target letter or word. While this method was usually successfully interpreted by the researcher, occasionally it was difficult to tell which of two letters/words Sam was intending as his target selection. When this occurred, the researcher would ask Sam to clarify his selection with a finger point. So as the intervention sessions continued, Sam was reminded to use his index finger in a point for target selection. A touch for Sam, therefore, was defined as a touch with his index finger.

For choice selection Dean had a very precise touch. He pulled all five fingers on his right hand into a single point and used that to make his selections. A touch for Dean was defined as a direct selection of the target using his five finger point.

**Choice selection methods for participants in group D.** For Ash choice selection was a challenge. Ash, like Bobby, tended to touch multiple targets upon each request,
when he responded at all. At the beginning of the intervention, the first target he touched in a series of touches was counted as the selection. If he simultaneously touched multiple targets, then the request was repeated. However, as the intervention continued and the researcher continued to search for means of getting Ash to touch only one target selection, Ash began using the researcher’s hand as a pointer to indicate his target selection. This began as hand-under-hand direction during the teaching portions of each session. Eventually Ash took over and would take the researcher by the wrist and direct her pointed finger to his target selection. Ash was able to demonstrate generalize this selection method by using other interveners’ (such as interrater observers) hands as pointers. This proved to be a reliable means of target selection. For Chuck choice selection was straight forward. He would take the requested letter/word off the sentence strip and hand it to the researcher.
Table 6

<table>
<thead>
<tr>
<th>Group</th>
<th>Student</th>
<th>Choice selection method</th>
<th>Group letter-sound pairs</th>
<th>Group sight words</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Jo</td>
<td>Touch with finger</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anna</td>
<td>Eye gaze with or without reach approximation</td>
<td>a m p t c</td>
<td>Lunch, bus, car, yellow, see</td>
</tr>
<tr>
<td>B</td>
<td>Bobby</td>
<td>First target touched</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Garth</td>
<td>Target reached for</td>
<td>a m p t o</td>
<td>Lunch, bus, car, yellow, see</td>
</tr>
<tr>
<td>C</td>
<td>Sam</td>
<td>Touch with finger or palm</td>
<td>d n f s c</td>
<td>Lunch, bus, car, yellow, see</td>
</tr>
<tr>
<td></td>
<td>Dean</td>
<td>Touch with five-finger point</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Ash</td>
<td>Touch with researcher’s finger</td>
<td>a m p t o</td>
<td>Mad, happy, yellow, green, home</td>
</tr>
<tr>
<td></td>
<td>Chuck</td>
<td>Target touched or handed to researcher</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Independent Variable**

The independent variable was the Accessible Literacy Learning (ALL) Curriculum by Mayer Johnson. This packaged curriculum is designed as a comprehensive literacy program for students who have a range of disabilities including cerebral palsy, autism and Down syndrome. It is also designed for students who have communication disorders or who use AAC (Light & McNaughton, 2009). The curriculum consists of the
following teaching components: phonological awareness skills, sound blending, phoneme segmentation, letter-sound correspondences, single word decoding, decoding during shared reading, sight word recognition, reading sentences and short stories, as well as reading comprehension skills. The components used in this study include letter-sound correspondents and sight word recognition. The curriculum is scripted and includes most teaching materials. The scripts are brief and repetitive. They include instructor responses for both correct and incorrect student responses. Additionally, the scripts lead the instructor through incrementally decreasingly scaffolded lessons. Each lesson in both letter-sound correspondence and sight word recognition was broken down into four steps.

During the first step, *Introduce the Task*, the instructor presents the task that the student is to learn during the lesson. In this step, the student is a passive participant; the only expectation of them is that they are paying attention to the instructor. In this step the instructor first introduces the larger task to be learned such as “learning to read words.” The instructor then presents the first discrete item such as a sight word or particular letter which is printed on a card. The instructor describes the item to the student, while physically tracing it with their finger and pointing to it as the item is repeated. During the introductory phase of the letter-sound lessons, it is important that the instructor does not say the name of the letter but use the sound that the letter makes. After presenting the item and describing it by either reading the sight word, or making the sound of the letter, the instructor is then directed to go further by either using the sight word in a sentence or by saying a word in which the presented letter is the initial sound. For example, if the sight word *car* were presented, the instructor would first say “car” while pointing to it
and tracing it with their finger. The instructor would then use the word *car* in a sentence such as, “I drove my car to school today.” If the letter *m* were presented, the instructor would first say the sound that the letter makes “mmmmmm” while pointing to and tracing the letter. Next the instructor would say a word in which the target letter produced the initial sound such as “man,” while exaggerating the initial sound.

During the next step, *Model*, the instructor is modeling for the student what will be required of them in the following step. The instructor selects the target item (word or letter) and then also selects a foil. Following the script, the instructor places the target item card and a foil card within vision or reach of the student and instructs them to listen as he/she pronounces the target word or letter-sound. Next, the instructor models for the student how to look at both choices presented and then point to the target while saying it. For example, the instructor would say the target word “car” and then model looking at the target word *car* as well as the foil word *horse*. The instructor then repeats the target word “car” and points to the card with the word *car* on it. The instructor then selects a new foil and repeats the modeling exercise again making sure that the foil is not placed in the same location. Once again, during this step, the student is a passive observer. Nothing is being expected of them at this time, except their attention.

During the third step, *Guided Practice*, the student is expected to be an active participant in the lesson. At this point the instructor selects a target word or letter and a foil and places them within vision or reach of the student. The instructor follows the same pattern as in the modeling step by saying the target word or letter-sound and then modeling how to look at both choices before pointing to the target item. During this step,
however, the student is encouraged to point to the target item as well. The instructor repeats this sequence building upon it by lengthening the time between oral presentation of the target item and pointing to the item to allow students to anticipate the action. The instructor should also begin increasing the number of foils up to four total choices including the target item and three foils. The *Guided Practice* step should be repeated until the student is consistently selecting the correct target.

During the final step, *Independent Practice*, the instructor visually presents the target item and three foils to the student. The instructor then asks the student to listen to the target item, as it is presented orally, and to point to the target item card.

**Materials**

This study used the materials provided in the curriculum including letter-sound response plates (see Appendix E), yellow letter cards on which one letter was printed in black ink on each, researcher-made yellow sight word cards with one sight word printed in black ink per card (see Appendix F), and data collection sheets (see Appendix G). Velcro dots were placed on the back of each letter card and each sight word card. Additional materials included a blue A frame table sized pocket chart (see Appendix H) and a laminated sentence strip with Velcro dots on it for placing letter cards on it (see Appendix I). On the sentence strip, each Velcro dot used is assigned a number 1 through 4 for recording purposes. Other materials included additional sight word response plates created by the researcher to supplement the provided words and pictures to correspond with the sight words (see Appendix J). The pictures were obtained from *Boardmaker*
software by Mayer-Johnson. The additional words were also printed in black ink on yellow
card stock paper so that they matched the curriculum provided words.

All letter cards were printed on the two inch yellow card stock with ½ inch black
lower case letters. The letter-sound response plates used during letter-sound lessons
consisted of the target letter presented in a yellow box at the mid-bottom center of the
page with four picture boxes presented in 2 x 2 square above. The pictures are Mayer-
Johnson BoardMaker symbols in color. Each picture represents something that begins
with the target letter. The word describing the picture is presented directly below the
picture within its box and the initial letter is highlighted in yellow. For example, on a
letter-response card, where the target letter is “y” the four pictures presented above are
yellow, yell, yawn, and yo-yo. In each case the first letter “y” is highlighted in yellow.

All sight word cards were created using 5½ by 1¾ inch rectangle yellow card
stock with ½ inch words printed in black lower case letters. The curriculum does not
provide accompanying picture cards for the sight words but recommends that if the sight
word can be easily represented by a picture, then one can be used. Therefore, for this
study picture cards printed on yellow backed card stock were used for the following
words: bus, yellow, car, lunch, see, happy, home, mad, green. Procedures for selection of
each groups’ sight words are explained in the research procedure section below. Pictures
were obtained from the BoardMaker software by Mayer-Johnson.

Data sheets used for collection of letter-sound correspondence and sight word
recognition came directly from the ALL Curriculum. A copy of the data sheet is available
in Appendix G. The data collection forms are the same for both letter-sound
correspondence and for sight word recognition. One data sheet was completed per student participant per session. The data sheets allowed collecting demographic and logistic information such as student name, date, target skill, and observer/instructor. Additionally for each response opportunity, the instructor recorded the target (letter-sound) and then the three foils used on the fixed array. The instructor circled the student selection (choice 1, 2, 3, or 4—one of which is the target and three of which are foils) and then marked in a separate column whether the student selection was correct (+) or incorrect (0). There were also areas for summary data, error analysis and for comments/anecdotal notes. A Flip video recorder was used to record most sessions to facilitate further analysis.

**Research Procedures**

In this section all the procedures for before, during, and after the intervention are presented. Prior to each intervention session, the researcher checked to ensure that all materials were ready and that the video camera had charged batteries and space available for recording. Additionally, the researcher conducted all the sessions and delivered all the instruction. The researcher is a middle-aged, White female with 28 years of experience in the education field with 15 years’ experience working directly with students with severe disabilities and complex communication disorders as both a classroom teacher and as an assistive technology specialist.

**Preassessment Procedures**

Prior to beginning intervention, the researcher met with each participant individually to assess their range of motion and natural patterns of movement. In order to assess range of motion and movement patterns, the researcher presented each student
participant individually with a visual display with the following pictures from BoardMaker software: pizza, banana, dog, bus, spoon, drink, and eat (see Appendix K). The specific procedure used was described in the previous section physical display and target arrangement. The purpose of this procedure was for the researcher to observe the student participant visually scanned all of the choice options before making a selection. The researcher also was looking to see whether the student could reach each of the pictures on the visual array and subsequently to assess where was the best physical location to place the visual array for each student participant. Additionally the researcher was watching for idiosyncratic movements that might be used or that might hinder a student participant in making selections such as Ash and Bobby’s tendency to touch multiple targets simultaneously. The researcher took anecdotal notes, which were then used to determine a scanning and choice-making teaching procedure for each participant as well as to determine the optimal positioning of choice options for participants. After meeting with the individual participants, the researcher spoke with their teachers in order to validate the findings during observation.

In order to generate a pool of potential sight words for each group, the researcher solicited suggestions of sight words that would be motivating and/or relevant for the student participants. Solicitation of sight words was conducted via email and/or face-to-face discussions with teachers and also with parents. In addition the researcher used sight word lists from other packaged curriculums and established and widely used sight word lists. Once a pool of potential words was generated, the researcher culled any words that
were potentially relevant to only certain student participants such as the names of pets or family members as well as words a participant had already mastered.

**Random Assignment of Groups to Tiers**

Student participants were primarily assigned to groups based upon their schedules. However, when student schedules matched, the researcher randomly assigned those students to one of the groups by writing each student’s name on an index card and placing the card in an unmarked envelope. The researcher then wrote the group options (A, B, C, or D) on separate cards. After mixing up the envelopes, the researcher placed one envelope at a time on alternating group cards, until all the potential student participant envelopes were assigned to a group card. Once formed, the researcher reviewed the groupings with the teachers to make sure that there were no concerns with the groupings due to behavioral concerns. The groups were then randomly assigned to the order in which they entered intervention phase (Gast, 2010). Randomization occurred by placing each group’s letter card (A-B-C-D) in individual unmarked envelopes. After shuffling the envelopes, they were placed on index cards marked one through four to indicate the order in which group would enter the intervention phase. This was done independently for each experiment resulting in groups entering each experiment in a different order.

Regulated randomization was used to determine the exact session entrance point for each tier in both experiments. To achieve randomization, a coin was tossed to determine in which of two preselected sessions (6 or 7) the introduction of the letter-sound intervention for the first group would begin based upon design standards of at least
five data points per phase before the next tier is added. Entrance into the treatment phase for the subsequent tiers of intervention in letter-sound correspondence were likewise randomly selected from one of two possible data points as follows: tier two (9 or 10), tier three (12 or 13), and tier four (14 or 15) respectively. Entrance into the treatment phase for the first tier of sight word recognition was randomly selected from one of two possible sessions (6 or 7). Subsequent tiers in sight word recognition were likewise randomly selected from one of two possible data points as follows: tier two (8 or 9), tier three (10 or 11), and tier four (12 or 13) respectively. As a result for the first experiment, letter-sound correspondence, introduction of the intervention began in the following sessions: tier one = Session 6, tier two = Session 9, tier three = Session 13 and tier four = Session 14. For the second experiment, sight word recognition, introduction of the intervention began in the following sessions: tier one = Session 7, tier two = Session 8, tier three = Session 11, and tier four = Session 13.

**Baseline Phase Procedures**

In the following two sections the specific procedures used during baseline testing across all participants and all groups are described. The operationally defined selection method for each participant is presented in Table 7.

**Letter-sound correspondence.** During baseline data collection each student participant was tested individually. The student participant was asked to listen to a letter-sound made by the researcher, for example, *mmmmmmmm*. The name of the letter “m” was not used. The researcher asked, “Show me the letter that makes the sound *mmmmmmmm.*” The student participant was presented with four letters on a visual
display including the target sound. On the recording sheet the researcher recorded the three foil letters chosen from the letter set and the target letter according to their numbered location on the visual display. The researcher then recorded the letter the student chose by circling the choice in the appropriate numbered position. This procedure was repeated for each letter selected for the group the individual student participant was assigned to. The researcher made no comments on the accuracy of student selections in baseline phase. The only comments the researcher made were continuing comments such as “OK” or “Thanks” or “Got it.”

The order in which the target letters were presented during baseline data collection was randomized between sessions. Additionally foils and target letters were randomized within numbered placements on the visual display between each trial.

During individual data collection, the student participants not tested were given books or other manipulatives to look through during testing. Once baseline data were collected for each participant the researcher read a book with the group in order to fill the allotted time that was eventually used for the intervention. The book reading time not only acquainted student participants to the length of time they would be spending with the researcher once treatment began, but also allowed the student participants to become more familiar with the researcher and with each other. The total time for data collection for a group was approximately 10 to 15 minutes at the beginning of each session (approximately 5 minutes per student) followed by 20 minutes of book reading for a total of approximately 35-45 minutes. These 45 minutes mirrors the amount of time that was
required during the treatment phase to complete individual testing as well as intervention teaching. Each session was video recorded to facilitate further analysis.

**Sight word acquisition.** During baseline data collection each student participant was tested individually on sight word recognition. The student participant was asked to listen to a word said by the researcher (e.g. *pizza*). The researcher then asked, “Show me the word *pizza.*” The student participant was presented with four words on a visual display including the target word. On the recording sheet the researcher recorded the three foil words chosen from the pool and the target word according to their numbered location on the visual display. The researcher then recorded the word the student chose by circling the choice in the appropriate numbered position. This procedure was repeated for each word selected for the group. The researcher made no comments on the accuracy of student selections. The only comments the researcher made were continuing comments such as “OK” or “Thanks” or “Got it.”

The order in which the target words were presented during baseline data collection was randomized between sessions. Additionally, foils and target words were randomized within numbered placements on the visual display between each trial.

Individual data collection procedures for sight word recognition were identical to those of individual data collection procedures for letter-sound correspondence as described above. Each session was video recorded to facilitate further analysis.
Table 7

*Operationalized Participant Selection Methods for All Procedures*

<table>
<thead>
<tr>
<th>Group</th>
<th>Student</th>
<th>Choice Selection Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Jo</td>
<td>Touch with finger</td>
</tr>
<tr>
<td></td>
<td>Anna</td>
<td>Eye gaze with or without reach approximation</td>
</tr>
<tr>
<td></td>
<td>Bobby</td>
<td>First target touched</td>
</tr>
<tr>
<td>B</td>
<td>Garth</td>
<td>Target reached for</td>
</tr>
<tr>
<td></td>
<td>Sam</td>
<td>Touch with finger or palm</td>
</tr>
<tr>
<td>C</td>
<td>Dean</td>
<td>Touch with five finger point</td>
</tr>
<tr>
<td></td>
<td>Ash</td>
<td>Touch with researcher’s finger</td>
</tr>
<tr>
<td>D</td>
<td>Chuck</td>
<td>Target touched or handed to researcher</td>
</tr>
</tbody>
</table>

**Treatment Phase Procedures**

In the case of this study, once a group entered a treatment phase whether for letter-sound correspondence or sight word recognition, student participants were individually assessed at the beginning of each session prior to the instructional portion of the session. This type of cold testing procedure involved collecting data at the beginning of a session prior to any review or intervention instruction. The final session of data
collection during baseline was followed by a teaching session. Therefore the first data point in the treatment phase is a cold test of information taught after the final baseline data was collected. In the following four subsections the specific procedures used for the testing portions of a session and the specific procedures used for the teaching portions of the treatment phase are described. The operationally defined selection method for each participant is presented in Table 7.

**Letter-sound correspondence cold testing procedures.** During the treatment phase, data collection was taken at the beginning of each session in cold probes. The cold probe data collection sessions were identical to baseline testing. Each participant was tested individually. The student participant was asked to listen to a letter-sound made by the researcher (e.g. *mmmmmmmm*). The name of the letter “m” was not used. The researcher asked, “Show me the letter that makes the sound *mmmmmmmm*.” The student participant was presented with four letters on a visual display including the target sound. On the recording sheet the researcher recorded the three foil letters chosen from the letter set and the target letter according to their numbered location on the visual display. The researcher then recorded the letter the student chose by circling the choice the in the appropriate numbered position.

During individual data collection, the remaining student participants were given books or other manipulatives to look through during testing. The total time for data collection for a group was approximately 15 minutes at the beginning of each session or about 5 minutes per student.
Letter-sound correspondence teaching procedures. After each student participant was tested, then the group engaged in an intervention lesson. At the beginning of each group session, the researcher presented the lesson as scripted in the ALL Curriculum for each of the five letters selected for intervention. During the lessons the researcher followed the script provided in the ALL Curriculum using the Velcro letters, visual displays, and letter-sound response plates. The lesson began with the researcher presenting a letter-sound response plate representing one of the target letters to the participants and showing the participants the orthographic representation of the letter while making the letter-sound. The researcher then pointed to each of the pictures on the card that began with the target sound, while emphasizing the target sound when saying the word. Student participants were encouraged to look at or touch the target letter and pictures on the response plate.

Once each of the student participants had an opportunity to interact with the response plate, then the researcher moved to guided practice using the letter cards. The letter card was placed on a visual display and the student participants were asked to touch the letter, while the researcher made the sound that is represented by that letter. Once the student participants did that, then more foil letters were placed on the visual display one at a time and the participants were asked to select the letter that corresponded to the sound of the target letter. This procedure was repeated for each of the four other letter-sounds targeted for intervention during each intervention session.

Sight word acquisition cold testing procedures. During the treatment phase, data collection was taken at the beginning of each session in cold probes. The cold probe
data collection sessions were identical to baseline testing. Each participant was tested individually. The student participant was asked to listen to a word said by the researcher (e.g. pizza). The researcher asked, “Show me the word pizza.” The student participant was presented with four words on a visual display including the target word. On the recording sheet the researcher recorded the three foil words chosen from the pool and the target word according to their numbered location on the visual display. The researcher then recorded the word the student chose by circling the choice in the appropriate numbered position.

During individual data collection, the remaining student participants were given books or other manipulatives to look through during testing. The total time for data collection for a group was approximately 15 minutes at the beginning of each session or about 5 minutes per student.

**Sight word acquisition teaching procedures.** After each student participant was tested, then the group engaged in an intervention lesson. At the beginning of each group session, the researcher presented the lesson as scripted in the ALL Curriculum for each of the five words selected for intervention. During the lessons the researcher followed the script provided in the ALL Curriculum using the Velcro word cards, visual displays, and any corresponding pictures selected to go with target words. The lesson began with the researcher holding up a target word card and the picture representing word to show the participants, while saying the word. The researcher then pointed to each of the word on the card and saying the word. Student participants were encouraged to touch and/or look at the word while the researcher said it repeatedly.
Once all of the student participants had an opportunity to interact with the word card and corresponding picture, then the researcher moved to guided practice. The word cards were presented in a scaffolded structure, where the target word was placed on a visual display, and the participants were asked to touch the word, while the researcher said the word. Once the participants did that, then more foil words were placed one at a time on the visual display along with the target word and the participants were asked to select the target word. This procedure was repeated for each of the four other words selected for intervention during each intervention session.

**Reliability and Validity**

This section presents information on the reliability of interassessor scoring and fidelity of implementation. Interassessor scoring was done across groups of students in both baseline and treatment phases on both dependent variables. Most sessions across the groups and dependent variables were videotaped using a Flip video recorder. Procedural fidelity is conducted in order to assure confidence that the findings can be attributed to the intervention (Gast, 2010).

**Interassessor Agreement**

Interrater observations were done to ensure reliability of scoring on student participant answer selections (Gast, 2010; Kennedy, 2005). There were seven interrater reliability observers (see Table 8). The first observer was an individual who had previously spent nine years volunteering in a special education classroom and working with students who have severe disabilities. Four other observers were teaching assistants who accompanied students to intervention sessions. One observer was one of the teachers
of one of the participants who occasionally accompanied the student to sessions for behavioral concerns. The final observer, Observer 7, was an individual with 20 years of working with individuals with disabilities. The final observer conducted interassessor agreement (IOA) through viewing randomly selected video sessions.

Table 8

*Interrater Observers, Number of Sessions Observed, and Interassessor Agreement (IOA) Coefficients*

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of observers</th>
<th>Observers</th>
<th># of Sessions observed by multiple observers</th>
<th>IOA Compared to researcher’s score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>3</td>
<td>Observer 1</td>
<td>10</td>
<td>98%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Observer 2</td>
<td>1</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Observer 6</td>
<td>4</td>
<td>100%</td>
</tr>
<tr>
<td>Group B</td>
<td>6</td>
<td>Observer 1</td>
<td>9</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Observer 2</td>
<td>2</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Observer 3</td>
<td>2</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Observer 4</td>
<td>4</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Observer 5</td>
<td>2</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Observer 7</td>
<td>2</td>
<td>100%</td>
</tr>
<tr>
<td>Group C</td>
<td>2</td>
<td>Observer 1</td>
<td>8</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Observer 2</td>
<td>5</td>
<td>100%</td>
</tr>
<tr>
<td>Group D</td>
<td>5</td>
<td>Observer 1</td>
<td>10</td>
<td>99.5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Observer 2</td>
<td>3</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Observer 3</td>
<td>4</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Observer 4</td>
<td>4</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Observer 5</td>
<td>5</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Interassessor training.** The observers were trained individually. During the training sessions they were shown how to fill out the recording sheet and were given
information detailing the definition for choice selection methods for each student participant as seen in Table 7. The interrater observers conducted two practice sessions with each group they observed in order to understand student choice making and to make sure that there was agreement between the researcher and observers on what constituted a choice selection for each participant before any interrater observational data were collected. Interrater reliability was taken across 30% or more of sessions in each condition for each participant during which one or multiple interrater observers accompanied the researcher to the schools and attended the data collection sessions. Reliability was calculated using point-by-point which entails calculating the number of agreements divided by the sum of agreements and disagreements and multiplying by 100. Interassessor reliability was calculated at 99% with a range of 98-100%. The detailed interassessor reliability across groups is provided in Table 8.

**Procedural Fidelity**

Procedural fidelity is conducted in order to assure confidence that the findings can be attributed to the intervention (Gast, 2010). Procedural reliability scoring was done across baseline and treatment phases on both dependent variables. Most sessions across both dependent variables were videotaped using a Flip video recorder. Procedural reliability was observed during 33% of baseline, 33% of conditions in accordance with quality indicators for multiple-baseline designs (Kratochwill et al., 2010). A fidelity checklist addressing implementation of baseline testing procedures as well as treatment phase testing procedures was developed. The fidelity of treatment checklist also included steps to be completed during the instructional portion of the sessions as defined by the
ALL Curriculum. The fidelity checklist is available in Appendix L. Procedural fidelity was calculated by dividing the number of completed steps by the total number of steps planned and multiplying by 100. Procedural fidelity was scored at 99%. A fidelity score of 100% was not reached because two sessions had to be ended early, before all steps were completed, due to behavioral issues.

**Procedural fidelity training.** The fidelity observers were teaching assistants and other staff from the Harford Program as well as one volunteer. The researcher trained the observers on the ALL Curriculum procedures individually, where the scripted ALL Curriculum and fidelity of treatment checklist were presented. All procedural fidelity observations were conducted on randomly selected sessions.

**Social Validity**

The importance of social validity lies in the demonstration of the importance and effectiveness of an intervention combined with its appropriateness and the satisfaction of the individuals involved (Kennedy, 2005). The quality indicators for social validity according to Horner et al. (2005) include social importance of the dependent variables, the magnitude of change for the dependent variables, practicality of implementation, and authenticity of the intervention conditions. Social validity for this study was addressed in the following ways: (a) interviews were conducted postintervention with the student participants to assess their level of enjoyment, engagement, and satisfaction with their progress in gaining literacy skills; (b) interviews were conducted with the teachers of the student participants to determine their satisfaction with the applicability of the ALL Curriculum, their perceptions on literacy education for their students and on the barriers
they perceive to literacy education for the student population; and (c) the intervention was conducted in classrooms and with small groups of students which are authentic classroom realities.

Teacher participant interviews were conducted via email at the request of the teachers due to end-of-the-year scheduling issues and timelines. Interview questions are available in Appendix M. Teacher participants were emailed a set of questions and were asked to reply to the researcher via email with their commentary on the questions. Teachers were asked about their perceptions of and experience with literacy instruction for their students. Teachers were also asked about how much training they have had in literacy instruction. Additionally teachers were asked to comment on anything related to the use of the ALL Curriculum during the intervention. Overall three teachers and three teacher assistants provided their input to the social validity of the intervention.

Student participants were also interviewed postintervention. Student participant interviews lasted approximately two minutes and focused on student engagement/enjoyment of the intervention and their feelings about literacy in general. Because all of the student participants did not verbalize, they were asked a few simple questions, which could be answered by pointing to a Yes or No card. Additional student participant responses were gleaned from the videos, anecdotal notes, and casual conversations with their teachers and teacher assistants. A copy of the student participant interview questions is available in Appendix N.
Data Analysis

During each data collection session, the researcher took data on the data sheets for all of the dependent variables. Immediately following each session, the researcher plotted the data on graphs, one line graph for each student participant. Additionally, the average score for the each group was calculated and plotted on separate graphs, one for each group (see Figure 3). The researcher also wrote down anecdotal information about the student participants specifically, the groups in general, or about any environmental events such as fire drills, or other interruptions, change in room, et cetera. Qualitative analysis procedures were conducted on interview transcripts and field notes.

Visual Analysis

Visual analysis includes a discussion of level, trend, variability, immediacy of change, overlap, and consistency for each participant in order to determine the magnitude of effect (Kratochwill et al., 2010). Visual analysis of graphs in single-subject research permits independent analysis which is the strength of this research method (Gast, 2010).

A visual analysis was conducted on the graph for each individual student participant, as well as on the graph for each group for each of the dependent variables. Thus, each student participant had a graph for letter-sound correspondence, and a graph for sight word recognition. Visual analysis was also conducted on the graph of aggregated group data for each of the dependent variables.

To conduct visual analysis the following data patterns between and within phases were examined: (a) level, which refers to “the average of the data within a condition and is typically calculated as the mean or median” (Kennedy, 2005, p. 197); (b) trend, which
refers to the “slope or best-fitting straight line for the data within a phase” (Kratochwill et al., 2010, p. 18); (c) variability, which refers to the stability of the individual data points within a phase; (d) immediacy of effect, which refers to the change between the last three data points of the baseline and the first three data points of the treatment phases; (e) overlap, which refers to percentage of data points in one phase that overlap with another (Kennedy, 2005); and (f) consistency, which refers to the extent to which data patterns are consistent within the same condition (Kratochwill et al., 2010).

**Percentage of Data Points Exceeding Median (PEM) Data Analysis**

Visual analysis was calculated using Percentage of Data Points Exceeding Median (PEM) in order to counter the effect of outliers in the calculation of effect size (Ma, 2006). PEM is calculated by drawing a line through the median in baseline and then computing the percentage of data points in treatment phase below (or above) the median. PEM are reported as scores of 0–1.0. PEM scores of 0.9 to 1.0 are considered highly effective, PEM scores of 0.7 to 0.9 are considered moderately effective, PEM scores less than 0.7 are considered to have questionable to no effect (Ma, 2006). PEM is a preferable visual analysis to use when there is considerable variability since PEM scores are not sensitive to trends and variability around the median. In the case of the current study, variability across all participants and phases in both experiments indicated that PEM would be a preferable visual analysis than more commonly used PNDs (percent of nonoverlapping data points). Additionally, PEM scores reduce the impact of ceiling/floor-level data point outliers, which were evident in the data presented in the current study.
In the current study, variability was compared to the median line in phases with no obvious or flat trend and was compared to the trend line in phases with obvious trend. The percentage of the data points that fell within 20% of the mean or trend line was calculated and reported. The level of variability was determined using the 80-20 rule. Thus, if 80% of data points fell within 20% of mean/median or trend line, the variability was considered low (Gast, 2010). The median line was chosen as the line running through the stability envelope because it is less sensitive to extreme values than the mean (Gast).

Due to the nature of using multiple choice, outliers are very likely since the participants may be guessing their responses. That leads to having a 1 in 4 chance in guessing the right answer. While the use of multiple choice increases the chance of variability in results, it remains the most viable way to assess the effects of an intervention with a population of students who have limited to absent verbal abilities, limited range of motion, and may have minimal competence with complex augmentative communication devices. The ALL Curriculum was specifically designed to “eliminate the need for oral or handwritten responses” (Light & McNaughton, 2009, p. 13). Even for student participants who have access to voice output AAC devices, the process of moving through the device to find answers, especially if the student is using auditory scanning, can increase student frustration and decrease opportunities for the student to participate in practicing target skills due to time constraints (Light & McNaughton, 2009).

**Randomization Tests**

According to Gast (2010), “randomization tests attempt to address the problem of autocorrelation by not relying on probability values generated from parametric tests, such
as $t$ and $F$ distributions” (p. 428). In small $n$ cases such as in single-subject designs, it can increase confidence in the causal relationship between independent and dependent variables (Dugard, File, & Todman, 2011). To this end, the intervention points of entry in this study were randomly determined given a preset range of entry points for each group and each experiment. In the current study, the actual intervention points within the potential intervals, specifically for letter-sound correspondence (experiment one) are Sessions 6 or 7 for tier one, Sessions 9 or 10 for tier two, Sessions 12 or 13 for tier three, and Session 14 or 15 for tier four. The actual intervention points within the potential intervals, specifically for sight word recognition (experiment two) are Sessions 6 or 7 for tier one, Session 8 or 9 for tier two, Session 10 or 11 for tier three, and Session 12 or 13 for tier four.

The null hypothesis for randomization tests is that there will be no differences in measurements regardless of the randomly assigned order or intervention starting point. The statistics of randomization tests are based on rearrangements of raw scores and the differences between the means that these arrangements produce. The statistic test is first computed for the actual data set followed by the statistic calculations for the randomly generated permutations of data. The proportion of data permutations with a test statistic greater or equal to a test statistic for the actual data is the $p$-value (Edgington & Onghena, 2007). If that probability is less than $\alpha = .05$, one can conclude that there is a statistical difference between the students’ performance with and without the intervention.

Thus, randomization tests were run in the current study to determine the probability of having a difference between the baseline and ALL Curriculum phases in
both letter-sound correspondence and sight words within and across the individual participants by chance. Randomization tests were conducted using the ExPRT (Excel Package of Randomization Tests) software for single-subject data analysis (Levin, Evmenova, & Gafurov, 2014). First, the calculations of statistical significance were based on the mean differences between baseline and treatment phases across eight participants for each dependent variable. In order to use the ExPRT software designed for multiple-baseline designs, the baseline and treatment averages across each group were calculated and entered into the program. In addition to investigating the statistical significance based on the group averages, participants’ individual data were entered into the ExPRT software in all possible combinations. For the letter-sound correspondence eight possible combinations included: Sam/Chuck/Bobby/Jo; Dean/Chuck/Bobby/Jo; Sam/Ash/Bobby/Jo; Dean/Ash/Bobby/Jo; Sam/Chuck/Garth/Jo; Dean/Chuck/Garth/Jo; Sam/Ash/Garth/Jo; Dean/Ash/Garth/Jo. For the sight words experiment eight possible combinations included: Bobby/Chuck/Jo/Sam; Garth/Chuck/Jo/Sam; Bobby/Ash/Jo/Sam; Garth/Ash/Jo/Sam; Bobby/Chuck/Jo/Dean; Garth/Chuck/Jo/Dean; Bobby/Ash/Jo/Dean; Garth/Ash/Jo/Dean. Anna’s data were not included into the individual randomization tests, since she had missing values. Average p-value across combinations was calculated for each experiment.

Qualitative Social Validity Analysis

Video files, anecdotal notes, teacher, assistant, and student interviews represented the sources of qualitative data. The teacher and student interviews were transcribed by the researcher. Memos were used (Maxwell, 2005) to help facilitate the analysis. Through the
memos the researcher came to see emerging concepts and categories and the relationships between them.

**Summary**

In this chapter, the research methods and procedures used for executing a rigorous single-subject, multiple-baseline design intervention are described. Independent and dependent variables are defined and operationalized. Procedures for data collection are described. Additionally, the issues of interassessor agreement and procedural fidelity are discussed. Finally the data analysis methods for two dependent variables and social validity interviews are explained. A summary table, Table 9, demonstrating how data collection methods are associated with the research questions is provided. In the following chapter, the results of the intervention are presented.
<table>
<thead>
<tr>
<th>Research question</th>
<th>Type of data collection</th>
<th>Analysis method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is there a functional relation between the use of the ALL Curriculum and increased accuracy of letter-sound correspondence by middle school students with severe disabilities and complex communication needs?</td>
<td>Baseline and treatment probes for letter-sound correspondence</td>
<td>Visual analysis; randomization tests</td>
</tr>
<tr>
<td>2. Is there a functional relation between the use of the ALL Curriculum and improved acquisition of sight words by middle school students with severe disabilities and complex communication needs?</td>
<td>Baseline and treatment probes for sight word acquisition</td>
<td>Visual analysis; randomization tests</td>
</tr>
<tr>
<td>3. Is there a functional relation between the use of the ALL Curriculum and increased level of performance in treatment phases for letter-sound correspondence and sight word recognition by middle school students with severe disabilities and complex communication needs when the intervention is conducted in small groups?</td>
<td>Aggregate group data for baseline and intervention probes; baseline and treatment probes for groups across dependent variables</td>
<td>Inspection for patterns using descriptive statistics with individual and group trends and visual analysis.</td>
</tr>
</tbody>
</table>
CHAPTER FOUR

This chapter presents the results of the multiple-baseline, single-subject research study determining the effectiveness of the ALL Curriculum to teach letter-sound correspondence and sight word recognition to students with moderate to severe intellectual disabilities, autism, and communication disabilities. Thus, the effects of direct instruction to small groups of students using the ALL Curriculum are reported on two dependent variables: letter-sound correspondence and sight word recognition.

As described in Chapter 3, eight participants with moderate to severe intellectual and communication disabilities participated in this multiple-baseline across groups/participants study, which was replicated across two dependent variables. Participants were randomly divided and assigned into four small groups for instructional purposes and groups were randomly assigned to tiers or to the order in which they entered the intervention. Furthermore, regulated randomization procedures were used to determine the starting point of the intervention for each tier. This was replicated for each of the experiments. Each experiment included baseline and intervention phases. In baseline, data were collected on each participant individually in a three- to five-minute testing session on each of the target letter-sounds and sight words. In intervention, data were collected on each participant individually in a three- to five-minute testing session
on each of the target letter-sounds and sight words prior to the instructional portion of the session.

**Letter-Sound Correspondence**

In the first experiment, participants were taught five letter-sounds through direct instruction using the ALL Curriculum. Letter-sound correspondence was measured as either correct or incorrect during testing portions at the beginning of each session. Overall findings from the study indicate that all participants demonstrated a mean increase between baseline and treatment (See Figure 1). In baseline participants demonstrated a mean of 1.19 ($SD = 0.71$) for letter-sound correspondence. In treatment participants demonstrated a mean of 3.22 ($SD = 0.48$) for letter-sound correspondence with a mean increase of 2.03 ($SD = 1.06$). Overall trend was positive with six out of eight participants demonstrating an upward trend in treatment phase, with one participant demonstrating a flat trend and one a slight downward trend. Across the participants variability was high in both baseline and treatment phases, although five out of eight participants decreased variability in treatment, especially in the last three treatment data points, over baseline. Seven out of eight participants demonstrated a relative immediacy of change upon the introduction of the intervention. The overlap between phases was measured using Percentage of Data Points Exceeding the Median (PEM; Ma, 2006). The PEM for all participants and across all phases of letter-sound correspondence was 0.89, which indicated that the treatment was moderately effective. In assessing consistency, at least five out of eight participants demonstrated an increased performance in the intervention phase, while high variability and several outliers in the baseline phase skewed the
functional relation for the other three participants. Thus, based on the visual inspection of
data presented in Figure 1, there is evidence of moderate effectiveness of the ALL
Curriculum on the letter-sound correspondence for middle school students with severe
disabilities and communication disorders (Kratochwill et al., 2010).
Figure 1. Letter-sound correspondence. The number of correctly identified letter-sounds for five target letters across baseline (●) and across intervention (■) across eight participants with autism, intellectual disabilities, and communication disabilities.
Individual results for each participant are described in detail below.

**Sam**

In response to research question one and as seen in Figure 1, Sam’s demonstration of letter-sound correspondence during baseline condition was low ($M = 0.6, SD = 0.89$) across all five baseline sessions. There was a slight downward trend with data presenting in a curvilinear U-shape pattern (Kennedy, 2005). Variability was high in baseline phase with only 40% of data points falling within 20% of the median line.

Upon introduction of the intervention Sam’s performance on letter-sound correspondence demonstrated a change in level from baseline ($M = 0.6, SD = 0.89$) to the intervention phase ($M = 3.8, SD = 1.14$). Due to variability in the data, the split-middle method of calculating an estimate of trend was used (Gast, 2010). The trend line was moderately upward in the intervention phase with a 13% decrease in variability from baseline to intervention phase where variability was moderate with 73% of data points falling within the 20% stability envelope. There was a slight immediacy of effect upon introduction of the intervention with a steadily increasing upward trend. Absolute level change between baseline (1) and treatment (2) indicates a +1 positive change in level. Sam reached mastery of the five letter-sounds during Session 15 and maintained that level across the remaining two sessions. There was a slight overlap between the phases due to one elevated data point in baseline. However, PEM was calculated at 1.0 indicating that the intervention was highly effective. Overall Sam’s performance was higher in intervention than it was in baseline.
Dean

Dean’s demonstration of letter-sound correspondence during baseline condition, as seen in Figure 1 (research question one), was low ($M = 0.6$, $SD = 0.89$) across all five baseline sessions. There was a slight upward trend with data presenting in a curvilinear U-shape pattern (Kennedy, 2005). Variability was high in baseline with only 40% of data points falling within the 20% stability envelope around the median line.

Upon introduction of the intervention Dean’s performance on letter-sound correspondence demonstrated a change in level from baseline ($M = 0.6$, $SD = 0.89$) to the intervention phase ($M = 2.73$, $SD = 1.48$). Due to variability in the data, the split-middle method of calculating an estimate of trend was used (Gast, 2010). The data presented a low upward trend in the intervention phase with a no change in variability from baseline to intervention phase. There was a moderate immediacy of change upon introduction of the intervention with a highly variable, low upward trend. Absolute level change between baseline (0) and treatment (2) indicates a +2 positive change in level. In the last four sessions, Dean’s level of performance reached its ceiling level with him correctly identifying 4/5 and 5/5 letter-sound associations. There was slight overlap between phases due to one elevated data point in baseline and one low outlier in treatment phase. However, PEM was calculated at 0.9 indicating that the intervention was highly effective. Overall, Dean’s performance was higher during intervention than in baseline.

Chuck

In response to research question one and as seen in Figure 1, Chuck’s demonstration of letter-sound correspondence during baseline condition was moderate ($M$
= 2.75, SD = 0.88) across six of nine baseline sessions at level 3.0 with outliers both above and below the median for three out of nine data points. The trend line was flat with high variability.

When the intervention was introduced, Chuck’s performance on letter-sound correspondence depicted a change in level from baseline (M = 2.75, SD = 0.88) to the intervention phase (M = 4.07, SD = 1.09). Due to variability in the data, the split-middle method of calculating an estimate of trend was used (Gast, 2010). The trend line was moderately upward in the intervention phase with a decrease in variability from baseline to intervention phase although it remained high. There was a slight immediacy of effect upon introduction of the intervention with high variability. Absolute level change between baseline (3) and treatment (4) indicates a +1 positive change in level. In Session 10 of the intervention phase data stabilized when Chuck reached mastery of the five letter-sounds. He maintained the level of mastery across the remaining five sessions. There was considerable overlap between phases due to moderately high baseline data and high variability of data in the first half of the treatment phase. Therefore, PEM was calculated at 0.6 indicating that the intervention had a questionable effect. However, Chuck’s overall performance was higher in the intervention phase than it was in baseline, reaching and maintaining the ceiling.

**Ash**

Ash’s demonstration of letter-sound correspondence during baseline condition, as seen in Figure 1 (research question one), was low (M = 0.62, SD = 0.74) across baseline sessions. There was a flat trend in baseline with data presenting in a curvilinear U-shape
pattern (Kennedy, 2005). Variability in baseline data was high in baseline with only 37% of data points falling within the 20% stability envelope.

Ash’s performance on letter-sound correspondence exhibited a change in level from baseline ($M = 0.62, SD = 0.74$) to the intervention phase ($M = 2.764, SD = 1.42$) upon introduction of the intervention. Due to high variability in the data, the split-middle method of calculating an estimate of trend was used (Gast, 2010). The data presented an upward trend in the intervention phase with an increase in variability from baseline to intervention phase where only 28% of data points fell within the stability envelope. There was a moderate immediacy of effect upon introduction of the intervention with a highly variable, and low upward trend noted in treatment data. Absolute level change between baseline (0) and treatment (2) indicates a +2 positive change in level.

PEM was calculated at 0.7 indicating that the intervention was moderately effective. Although Ash did not consistently demonstrate knowledge of all five letter-sound pairs during timeframe of this study, overall Ash’s performance was higher during intervention than in baseline.

**Bobby**

In response to research question one and as seen in Figure 1, Bobby’s demonstration of letter-sound correspondence during baseline condition was low ($M = 1.16, SD = 1.02$) with high variability across all baseline sessions. The trend line was positive with 80% variability.

Upon introduction of the intervention Bobby’s performance on letter-sound correspondence demonstrated a change in level from baseline ($M = 1.16, SD = 1.02$) to
the intervention phase ($M = 2.87, SD = 1.12$). Due to variability in the data, the split-middle method of calculating an estimate of trend was used (Gast, 2010). The trend line during the treatment phase was flat. As seen in Figure 1, during the intervention phase, Bobby’s performance visually decreased in variability. However, calculating the variability using the 80-20 rule above and below the trend line, variability remains high in treatment phase. There was no immediacy of effect upon introduction of the intervention with an absolute level change between baseline (2) and treatment (1) indicating a -1 downward change in level. There was slight overlap due to the first data point in treatment being a low outlier. However, PEM was calculated at 0.8 indicating that the intervention was moderately effective. Bobby demonstrated a consistently higher level of performance by the second intervention session. Although Bobby only demonstrated mastery of all five letter-sounds in the last session and was thus unable to repeat the performance, his overall performance was higher in treatment than in baseline.

**Garth**

Garth’s demonstration of letter-sound correspondence during baseline condition, as seen in Figure 1 (research question one), was low ($M = 1.25, SD = 1.21$) across all baseline sessions. There was a slight downward trend in baseline data with high variability.

When the intervention was introduced, Garth’s performance on letter-sound correspondence manifested a change in level from baseline ($M = 1.25, SD = 1.21$) to the intervention phase ($M = 3.14, SD = 0.69$). Due to variability in the data, the split-middle method of calculating an estimate of trend was used (Gast, 2010). The data presented a
low downward trend in the intervention phase. Although variability remained high across phases, there was a decrease in variability over baseline where 0% of data points fell within the 20% stability envelope, to intervention phase where 57% of data points fell within the stability envelope. There was immediacy of effect upon introduction of the intervention with data presenting in a curvilinear cyclical data pattern (Kennedy, 2005). Absolute level change between baseline (1) and treatment (3) indicates a +2 positive change in level. There was a slight overlap between the phases due to one elevated data point in baseline. However, PEM was calculated at 1.0 indicating that the intervention was highly effective. Although he did not demonstrate knowledge of all five letter-sound pairs within the timeframe of this study, overall Garth’s performance was higher during intervention than in baseline.

Jo

In response to research question one and as seen in Figure 1, Jo’s demonstration of letter-sound correspondence during baseline condition was low \(M = 1.46, SD = 1.05\) with high variability across all baseline sessions. The trend line was flat.

Upon introduction of the intervention Jo’s performance on letter-sound correspondence demonstrated a change in level from baseline \(M = 1.46, SD = 1.05\) to the intervention phase \(M = 3.25, SD = 0.46\). Due to variability in the data, the split-middle method of calculating an estimate of trend was used (Gast, 2010). The trend line was slightly upward in the intervention phase with decrease in variability from baseline where 38% of data points fell within the stability envelope, to intervention where 75% of data points fell within the stability envelope. Therefore high variability in baseline phase
decreased to moderate variability in treatment phase. There was a slight immediacy of effect upon introduction of the intervention with an absolute level change between baseline (2) and treatment (3) which was a +1 positive change in level. As seen in Figure 1, Jo’s performance in the treatment phase maintains a gradually increasing upward trend. While Jo did not reach mastery of the five letter-sounds during the course of this study, the increase in data stability and upward trend suggest Jo was making progress toward that end. There was a slight overlap between phases due to one elevated data point in baseline. However, PEM was calculated at 1.0 indicating that the intervention was highly effective. Overall Jo’s performance was higher in intervention than it was in baseline.

Anna

Anna’s demonstration of letter-sound correspondence during baseline condition, as seen in Figure 1 (research question one), was low ($M = 1.11$, $SD = 0.92$) with high variability across all baseline sessions. There was a slight upward trend in baseline data with high variability and a 0 data point in the last session of baseline. As seen in Figure 1, there was a five-session break in the middle of baseline data collection due to Anna’s extended absence for a surgical procedure.

Anna’s performance on letter-sound correspondence established a change in level from baseline ($M = 1.11$, $SD = 0.92$) to the intervention phase ($M = 3.37$, $SD = 0.91$) upon introduction of the treatment. Due to high variability in the data, the split-middle method of calculating an estimate of trend was used (Gast, 2010). The data presented an upward trend in the intervention phase with a decrease in variability from high baseline variability to moderate intervention phase variability. There was high immediacy of
effect upon introduction of the intervention with a highly variable, upward trend. Absolute level change between baseline (0) and treatment (3) indicated a +3 positive change in level.

There was a slight overlap between the phases due to one low data point in treatment. However, PEM was calculated at 1.0 indicating that the intervention was highly effective. Although Anna only demonstrated mastery of all five letter-sounds in the last session, her overall performance was higher in treatment than in baseline.

**Sight Word Recognition**

In the second experiment, participants were taught five sight words through direct instruction using the ALL Curriculum. Sight word recognition was measured as either correct or incorrect during testing portions at the beginning of each session. Overall findings from the study indicate that all participants demonstrated a mean increase between baseline and treatment. In baseline participants demonstrated a mean of 0.86 ($SD = 0.43$) for sight word recognition. In treatment participants demonstrated a mean of 2.87 ($SD = 0.55$) for sight word recognition with a mean increase of 2.01 ($SD = 0.37$). Overall trend was positive with five of the eight participants demonstrating an upward trend in treatment phase, two participants demonstrating a flat trend, and one a slight downward trend. Across the participants variability was high in both baseline and treatment with only three out of eight participants demonstrating decreased variability in treatment over baseline. Five out of eight participants demonstrated a relative immediacy of change upon introduction of the intervention. The overlap between phases was measured using PEM. The mean PEM for all participants and across all phases of sight word recognition
was 0.8 indicating that the treatment was moderately effective. In assessing consistency, at least six out of eight participants demonstrated an increased performance in the intervention phase, while high variability and several outliers skewed the functional relation for the other three participants in the baseline phase. Thus, based on the visual analysis of the overall results presented in Figure 2, there is evidence of moderate effectiveness of the ALL Curriculum on sight word recognition for middle school students with severe disabilities and communication disorders (Kratochwill et al., 2010). The detailed visual analysis of each participant’s results is as follows.
Figure 2. Sight word recognition. The number of correctly identified sight words for five target words across baseline (●) and across intervention (■) across eight participants with autism, intellectual disabilities, and communication disabilities.
Bobby

In response to research question two and as seen in Figure 2, Bobby’s demonstration of sight word recognition during baseline condition was low ($M = 0.60$, $SD = 0.51$) across all baseline sessions. The trend line was flat along the median although data presented in a curvilinear cyclical pattern (Kennedy, 2005). Variability was calculated high with 0% of data points falling within the 20% stability envelope in the 80-20 rule.

Bobby’s performance on sight word recognition demonstrated a change in level from baseline ($M = 0.60$, $SD = 0.51$) to the intervention phase ($M = 2.30$, $SD = 1.10$). Due to variability in the data, the split-middle method of calculating an estimate of trend was used (Gast, 2010). The trend line during the treatment phase had a low upward slope. There was no immediacy of effect upon introduction of the intervention; however by Session 4, Bobby’s performance indicated a change in level which persisted throughout the rest of the sessions with the exception of intervention Session 7. Absolute level change between baseline (1) and treatment (1) indicates a 0 change in level. Variability remained high throughout baseline and intervention phases with 0% of data points falling within the stability envelope in either phase. There was some overlap between the phases due to the four data points at the median level in the treatment phase. PEM was calculated at 0.6 indicating that the intervention was questionably effective. Although Bobby did not consistently demonstrate knowledge of the five target sight words, his performance was slightly higher in treatment than in baseline.
Garth

Garth’s demonstration of sight word recognition during baseline condition, as seen in Figure 2 (research question two), was low ($M = 0.6, SD = 0.51$) across all baseline sessions. The baseline trend was flat with high variability in baseline data.

Upon introduction of the intervention Garth’s performance on sight word recognition indicated a change in level from baseline ($M = 0.6, SD = 0.51$) to the intervention phase ($M = 2.33, SD = 0.65$). Due to variability in the data, the split-middle method of calculating an estimate of trend was used (Gast, 2010). The data presented a flat trend in the intervention phase with no change in stability between the baseline phase and intervention phases where 0% of data points fell within the stability envelope in either phase. However Garth demonstrated immediacy of effect upon introduction of the intervention with data presenting in a curvilinear cyclical data pattern (Kennedy, 2005). Absolute level change between baseline (0) and treatment (2) indicates a +2 positive change in level. There was a slight overlap between the phases due to one low data point in treatment phase. However, PEM was calculated at 0.9 indicating that the intervention was highly effective. Although he did not demonstrate knowledge of all five targeted sight words within the timeframe of this study, overall, Garth’s performance was higher during intervention than in baseline.

Chuck

In response to research question two and as seen in Figure 2, Chuck’s demonstration of sight word recognition during baseline condition was moderate ($M =$
1.85, SD = 1.06) across baseline sessions. There was a positive trend with high variability.

Upon introduction of the intervention Chuck’s performance on sight word recognition established a change in level from baseline (\(M = 1.85, SD = 1.06\)) to the intervention phase (\(M = 3.93, SD = 0.96\)). Due to variability in the data, the split-middle method of calculating an estimate of trend was used (Gast, 2010). The trend line was moderately upward in the intervention phase with data presenting in a curvilinear cyclical pattern (Kennedy, 2005). There was an increase in variability from baseline to intervention phase. There was a low immediacy of effect upon introduction of the intervention with an absolute level change between baseline (2) and treatment (2) indicating a 0 absolute change in level. Chuck’s performance in the treatment phase had high variability throughout the sessions with Chuck reaching mastery level at two points during intervention as seen in Figure 2. There was a slight overlap between phases due to one elevated data point in baseline. However, PEM was calculated at 0.9 indicating that the intervention was highly effective. Overall Chuck’s performance, while similar to baseline, demonstrated a higher mean level in the intervention phase than it was in baseline.

**Ash**

Ash’s demonstration of sight word recognition during baseline condition, as seen in Figure 2 (research question two) was low (\(M = 0.85, SD = 0.69\)) across baseline sessions. There was no positive trend in baseline due to an outlier in Session 6 as seen in
Figure 2. Variability was high with 0% of data points falling within the stability envelope.

Ash’s performance on sight word recognition demonstrated a change in level from baseline ($M = 0.85, SD = 0.69$) to the intervention phase ($M = 2.53, SD = 1.06$) upon introduction of the treatment. Due to high variability in the data, the split-middle method of calculating an estimate of trend was used (Gast, 2010). The data presented a slight downward trend in the intervention phase with no change in stability from baseline to intervention phase. There was a low immediacy of effect upon introduction of the intervention with an absolute level change between baseline (1) and treatment (1) indicating a 0 change in level for the first data point in treatment. There was a slight overlap between the phases due to one elevated data point in baseline and two median level data points in treatment. However, PEM was calculated at 0.8 indicating that the intervention was moderately effective. Although Ash only demonstrated knowledge of the five target sight words in the final intervention session, overall Ash’s performance was higher during intervention than in baseline.

Jo

In response to research question two and as seen in Figure 2, Jo’s demonstration of sight word recognition during baseline condition was low ($M = 0.8, SD = 0.63$) with moderate variability across all baseline sessions. The trend line was flat and variability was high with only 50% of data points falling within the stability envelope.

Upon introduction of the intervention Jo’s performance on sight word recognition established a change in level from baseline ($M = 0.8, SD = 0.63$) to the intervention
phase ($M = 2.5, SD = 1.58$). Due to variability in the data, the split-middle method of calculating an estimate of trend was used (Gast, 2010). The trend line was steeply upward in the intervention phase with a decrease in variability from baseline to intervention phase where variability was low with 80% of data points falling within the 20% stability envelope. There was slight immediacy of effect upon introduction of the intervention with an absolute level change between baseline (1) and treatment (2) which indicated a +1 positive change in level. As seen in Figure 2, Jo’s performance in the treatment phase demonstrated a rapidly increasing upward trend beginning at intervention Session 3. Jo reached the level of mastery for recognition of the five target sight words on the last intervention session. There was some overlap between the phases due to one elevated data point in baseline and three below median data points in treatment. However, PEM was calculated at 0.7 indicating that the intervention was moderately effective. Overall Jo’s performance was higher in intervention than it was in baseline.

Anna

Anna’s demonstration of sight word recognition during baseline condition, as seen in Figure 2 (research question two) was low ($M = 1.0, SD = 0.63$) with limited variability across all baseline sessions. The trend line in baseline was flat with moderate variability and an elevated last data point in baseline. As seen in Figure 2, there was a five-session break in the middle of baseline data collection due to Anna’s extended absence for a surgical procedure.

Anna’s performance on sight word recognition manifested a change in level from the baseline ($M = 1.0, SD = 0.63$) to the intervention phase ($M = 3.1, SD = 1.10$) upon
introduction of the intervention. Due to high variability in the data, the split-middle method of calculating an estimate of trend was used (Gast, 2010). The data presented a gradual upward trend in the intervention phase with an increase in variability from baseline to intervention phase where only 50% of data points fell within the 20% stability envelope. There was no immediacy of effect upon introduction of the intervention with an absolute level change between baseline (2) and treatment (1) indicating a -1 downward change in level in the first data point of the treatment phase. While variability remained high, Anna reached a maximum level of four sight words recognized which she maintained for four sessions (Figure 2). The data pattern presented was in a curvilinear cyclical pattern (Kennedy, 2005). There was a slight overlap between the phases due to one elevated data point in baseline and one median level data point in treatment. However, PEM was calculated at 0.9 indicating that the intervention was highly effective. Overall, Anna’s performance was higher in treatment than in baseline.

Sam

In response to research question two and as seen in Figure 2, Sam’s demonstration of sight word recognition during baseline condition was low (\( M = 0.6, SD = 0.89 \)) across baseline sessions. There was a slight upward trend in the baseline data due to variability beginning in Session 8. As seen in Figure 2, Sessions 1 through 7 were relatively stable. Overall variability in baseline was high.

Upon introduction of the intervention Sam’s performance on sight word recognition demonstrated a change in level from the baseline (\( M = 0.6, SD = 0.89 \)) to the intervention phase (\( M = 3.25, SD = 1.28 \)). Due to variability in the data, the split-middle
method of calculating an estimate of trend was used (Gast, 2010). The trend line was positive with a rapidly upward slope in the intervention phase. There was a decrease in variability from baseline, where 41% of data points fell into the stability envelope, to intervention phase where variability was moderate with 75% of data points falling within the stability envelope. Sam’s performance indicated high immediacy of effect with a rapid and immediate change in level upon introduction of the intervention and an absolute level change between baseline (0) and treatment (3) indicating a +3 upward change in level. Sam reached mastery of the five target sight words in Session 7 of the intervention phase and maintained that level across the remaining sessions. There was slight overlap between the phases due to two elevated data points in baseline. However, PEM was calculated at 1.0 indicating that the intervention was highly effective. Overall Sam’s performance was higher in intervention than it was in baseline.

**Dean**

Dean’s demonstration of sight word recognition during baseline condition, as seen in Figure 2 (research question two), was low \((M = 0.41, SD = 0.51)\) across all five baseline sessions. The trend line was flat with 0% of data points falling within the 20% of median stability envelope.

When the intervention was introduced, Dean’s performance on sight word recognition demonstrated a change in level from baseline \((M = 0.41, SD = 0.51)\) to intervention phase \((M = 3.0, SD = 0.92)\). Due to variability in the data, the split-middle method of calculating an estimate of trend was used (Gast, 2010). The data presented a flat trend in the intervention phase with a 37% decrease in variability from baseline.
(100% variability) to intervention phase (37% variability). There was a rapid immediacy of effect upon introduction of the intervention with absolute level change between baseline (0) and treatment (3) indicating a +3 upward change in level. Although the slope was flat in the intervention phase, Dean did demonstrate knowledge of all five sight words in the final session. Variability in treatment phase was moderate. There was no overlap between the phases and PEM was calculated at 1.0 indicating that the intervention was highly effective. Although he did not have the opportunity to replicate performance at the mastery level within the timeframe of this study, overall Dean’s performance was higher during intervention than in baseline.

**Results of Randomization Tests**

A regulated multiple-baseline randomization test (Koehler & Levin, 1998) was used in this study to confirm and further clarify the visual analysis results. The proportion of all possible data permutations showing the effect that is greater or equal to the actually observed effect represents the statistical probability. The results of the regulated randomization test for the letter-sound correspondence based on group averages was $p = .0026$ and based on all possible combinations of individual data was $p = .01$. Thus, there was a statistically significant difference between the participants’ acquisition of the letter-sound combinations with and without the ALL Curriculum. Also, the results of the regulated randomization test for the sight words based on group averages was $p = .008$ and based on all possible combinations of individual data was $p = .01$. Thus, there was a statistically significant difference between the participants’ acquisition of sight words with and without the ALL Curriculum.
**Group Instruction**

In this study, participants were randomly placed into groups of two for instructional purposes (research question three) in letter-sound correspondence for experiment one and sight word recognition in experiment two. All groups received direct instruction using the ALL Curriculum on both letter-sound correspondence and sight word recognition. Each group received their instruction in a group setting but each participant was individually assessed at the beginning of each session. An increase in mean from baseline phase to intervention phase was demonstrated across all participants and across both experiments. Aggregate means across all participants in each experiment was low in baseline, with lower participant baseline means in sight word recognition ($M = 0.86$, $SD = 0.43$) than in letter-sound correspondence ($M = 1.19$, $SD = 0.71$). Across all participants in each of the experiments, aggregate means indicate a change in level in treatment over baseline with higher participant treatment means in letter-sound correspondence ($M = 3.22$, $SD = 0.48$) over sight word recognition ($M = 2.87$, $SD = 0.43$). Group means are presented in Table 10.

<table>
<thead>
<tr>
<th>Group</th>
<th>Baseline M letter-sound correspondence</th>
<th>Treatment M letter-sound correspondence</th>
<th>Baseline M sight word recognition</th>
<th>Treatment M sight word recognition</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1.28 (0.24)</td>
<td>3.31 (0.70)</td>
<td>0.87 (0.61)</td>
<td>2.8 (1.36)</td>
</tr>
<tr>
<td>B</td>
<td>1.20 (1.10)</td>
<td>3.0 (0.92)</td>
<td>0.66 (0.49)</td>
<td>2.34 (0.89)</td>
</tr>
<tr>
<td>C</td>
<td>0.6 (0.84)</td>
<td>3.26 (1.41)</td>
<td>0.54 (0.77)</td>
<td>3.12 (1.08)</td>
</tr>
<tr>
<td>D</td>
<td>1.68 (1.35)</td>
<td>3.44 (1.33)</td>
<td>1.35 (1.0)</td>
<td>3.23 (1.22)</td>
</tr>
</tbody>
</table>
**Letter-Sound Correspondence by Groups**

Overall trend in group performance on letter-sound correspondence, as seen in Figure 3, was positive with three of the four groups demonstrating an upward trend in treatment phase, and one group demonstrating a flat trend (Group B). Variability in baseline was low across Groups C and D with higher variability demonstrated by Groups A and B. Variability was high in treatment phases for Groups C, D, and B. Three out of four groups demonstrated a relative immediacy of change upon introduction of the intervention. The overlap between phases was measured using PEM. The mean PEM for all groups and across all phases of letter-sound recognition was 0.9 indicating that the treatment was highly effective. In assessing consistency, at least three out of four groups demonstrated an increased performance in the intervention phase, while high variability and several outliers in baseline phase skewed the functional relation for one of the groups (Group B). Thus, based on the visual analysis of the overall results presented in Figure 3, there is evidence of moderate effectiveness of the ALL Curriculum on letter-sound correspondence for middle school students with severe disabilities and communication disorders (Kratochwill et al., 2010).

**Group A.** In experiment one, letter-sound correspondence (research question one), both participants in the group performed higher in treatment than in baseline. The group aggregate baseline was low ($M = 1.31, SD = 0.99$) across baseline with high variability. The group performance was higher in treatment ($M = 3.31, SD = 0.74$) over baseline ($M = 1.31, SD = 0.99$) with both participants in the group achieving similar individual treatment means (Jo: $M = 3.25, SD = 0.46$; Anna: $M = 3.37, SD = 0.91$).
Aggregate PEMs were calculated at 1.0 with both participants individually achieving a PEM of 1.0 indicating that the intervention was highly effective for this group.

**Group B.** In experiment one, letter-sound correspondence (research question one), both participants in the group performed higher in treatment than in baseline. The group aggregate baseline was low \((M = 1.20, SD = 1.10)\) across baseline with high variability. The group performance was higher in treatment \((M = 3.0, SD = 0.92)\) over baseline \((M = 1.20, SD = 1.10)\) with variability between individual participant treatment means \((\text{Bobby: } M = 2.87, SD = 1.12; \text{Garth: } M = 3.14, SD = 0.69)\). Aggregate PEMs were variable between the participants with Bobby’s performance at 0.8 PEMs which is considered moderately effective and Garth’s performance at 1.0 PEMs which is considered highly effective. Aggregate PEMs were calculated at 0.9 indicating that the intervention was highly effective for this group.

**Group C.** In experiment one, letter-sound correspondence (research question one), both participants in the group performed higher in treatment than in baseline. The group aggregate baseline was low \((M = 0.6, SD = 0.84)\) across baseline with baseline data patterns for both participants presenting in a curvilinear U-shaped pattern \((\text{Kennedy, 2005})\). The group performance was higher in treatment \((M = 3.26, SD = 1.41)\) over baseline \((M = 0.6, SD = 0.84)\) with variability between participant performance in treatment \((\text{Sam: } M = 3.8, SD = 1.14; \text{Dean: } M = 2.73, SD = 1.48)\). PEMs for both participants suggest that the intervention was highly effective with Sam’s performance demonstrating a PEM score of 1.0 and Dean’s performance demonstrating a 0.9 score.
Aggregate PEMs were calculated at 0.95 which indicated that the intervention was highly effective for this group.

**Group D.** In experiment one, letter-sound correspondence (research question one), both participants in the group performed higher in treatment than in baseline. The group aggregate baseline was low ($M = 1.3, SD = 1.0$) with high variability across baseline. The group performance was higher in treatment ($M = 3.44, SD = 1.33$) over baseline ($M = 1.35, SD = 1.0$) but there was variability in individual treatment means (Chuck: $M = 4.07, SD = 1.09$; Ash: $M = 2.76, SD = 1.42$). Aggregate PEMs were variable between the participants with Chuck’s performance at 0.6 PEMs which is considered questionably effective and Ash’s performance at 0.7 PEMs which is considered low to moderately effective. Aggregate PEMs were calculated at 0.75 indicating that the intervention was had a low moderate effective for this group in letter-sound correspondence.
Figure 3. Group performance on letter-sound correspondence. The number of correctly identified sight words for five target words across baseline (●) and across intervention (■) across eight participants with autism, intellectual disabilities, and communication disabilities.
Sight Word Recognition by Groups

Overall trend in group performance on sight word recognition, as seen in Figure 4, was positive with three of the four groups demonstrating an upward trend in treatment phase, and one group (Group B) demonstrating a flat trend. Variability in baseline was low across Groups A, B, and C with a few outliers in Groups A and C. Higher variability was demonstrated by Group D in baseline phase. Variability was high in treatment phases for Groups B and D. Two out of four groups demonstrated a relative immediacy of change upon introduction of the intervention. The overlap between phases was measured using PEM. The mean PEM for all groups and across all phases of sight word recognition was 0.8 indicating that the treatment was moderately effective. In assessing consistency, at least three out of four groups demonstrated an increased performance in the intervention phase, while high variability and several outliers in the baseline phase skewed the functional relation for one other group. Thus, based on the visual analysis of the overall results presented in Figure 4, there is evidence of moderate effectiveness of the ALL Curriculum on sight word recognition for middle school students with severe disabilities and communication disorders (Kratochwill et al., 2010). The detailed visual analysis of each group’s performance is detailed below.
Figure 4. Group performance on sight word recognition. The number of correctly identified sight words for five target words across baseline (●) and across intervention (■) across eight participants with autism, intellectual disabilities, and communication disabilities.
Group A. In experiment two, sight word recognition (research question two), both participants performed higher in treatment over baseline but there was more variability in individual means than in experiment one. Across baseline the aggregate group performance was low ($M = 0.87, SD = 0.61$) with similar levels of stability ($Jo = 50\%$ stability, $Anna = 66\%$ stability). Aggregate group performance in treatment demonstrated a mean increase in treatment phase ($M = 2.8, SD = 0.61$) over baseline ($M = 0.87, SD = 0.61$). However there was greater variability in performance in the treatment phase between the participants in experiment two ($Jo: M = 2.5, SD = 1.58$; $Anna: M = 3.1, SD = 1.10$) over experiment one ($Jo: M = 3.25, SD = 0.46$; $Anna: M = 3.37, SD = 0.91$). PEMs for experiment two ($Jo = 0.7$, $Anna = 0.9$) were also more variable than in experiment one ($Jo = 1.0$, $Anna = 1.0$) with an aggregate PEM score of 0.8 indicating a moderately effective intervention.

Group B. In experiment two, sight word recognition (research question two), both participants performed higher in treatment over baseline. Across baseline the aggregate group performance was low ($M = 0.66, SD = 0.51$) with both participants demonstrating similar baseline Means ($Bobby M = 0.66, SD = 0.51$; $Garth = 0.66, SD = 0.51$). Aggregate group performance in treatment demonstrated a mean increase in treatment phase ($M = 2.72, SD = 0.89$) over baseline ($M = 0.66, SD = 0.51$) with both participants demonstrating similar means in treatment phase ($Bobby: M = 2.3, SD = 1.10$; $Garth: M = 3.14, SD = 0.69$). Aggregate PEMs were calculated at 0.8 indicating that the intervention was moderately effective for this group.
**Group C.** In experiment two, sight word recognition (research question two), both participants performed higher in treatment over baseline. Across baseline the aggregate group performance was low \( (M = 0.54, SD = 0.77) \) with both participants demonstrating similar baseline Means (Sam: \( M = 0.66, SD = 0.98 \); Dean: \( M = 0.41, SD = 0.51 \)). Aggregate group performance in treatment demonstrated a mean increase in treatment phase \( (M = 3.21, SD = 1.08) \) over baseline \( (M = 0.54, SD = 0.77) \) with both participants demonstrating similar means in treatment phase (Sam: \( M = 3.25, SD = 1.28 \); Dean: \( M = 3.0, SD = 0.92 \)). Aggregate PEMs were calculated at 1.0 with both participants individually achieving a PEM of 1.0 indicating that the intervention was highly effective for this group.

**Group D.** In experiment two, sight word recognition (research question two), both participants performed higher in treatment over baseline. Across baseline the aggregate group performance was low \( (M = 1.35, SD = 1.0) \) with high variability in the data across both participants. Aggregate group performance in treatment demonstrated a mean increase in treatment phase \( (M = 3.23, SD = 1.22) \) over baseline \( (M = 1.35, SD = 1.0) \) with similar variability between participant means for treatment as in experiment one (Chuck: \( M = 3.99, SD = 0.96 \); Garth: \( M = 2.53, SD = 1.06 \)). PEMs for experiment two (Chuck = 0.9, Ash = 0.8) were similarly variable to experiment one (Chuck = 0.6, Ash = 0.7) with an aggregate PEM score of 0.85 for experiment two which indicated a moderately effective intervention for this group in sight word recognition.
Additional Analyses

In the following sections, further analysis on participant performance is presented. Due to the diverse nature of the participants in this study, analyzing the data through different category filters may help to shed light on whether or not additional variables impacted participant acquisition of the target letter-sound associations or sight word recognition in this study. In the first additional analysis section presented, student performance data were grouped by primary disability and analyzed first by letter-sound correspondence and then by sight word recognition.

Table 11

Means and Standard Deviations Across Disability Categories for Letter-Sound Correspondence

<table>
<thead>
<tr>
<th>Primary disability category</th>
<th>Baseline $M (SD)$</th>
<th>Treatment $M (SD)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>1.05 (1.21)</td>
<td>3.59 (1.05)</td>
</tr>
<tr>
<td>Autism</td>
<td>1.33 (1.21)</td>
<td>3.14 (1.37)</td>
</tr>
<tr>
<td>PD/ID</td>
<td>1.31 (0.99)</td>
<td>3.31 (0.70)</td>
</tr>
</tbody>
</table>

_Note._ ID = intellectual disability, PD/ID = physical and intellectual disabilities.

Letter-Sound Recognition by Primary Disability

Letter-sound correspondence and participants with intellectual disabilities.

Participants in the intellectual disabilities category ($n = 2$) had a primary eligibility of intellectual disabilities without other confounding issues. Both Sam and Garth earned a PEM score of 1.0 indicating that the treatment was highly effective. Additionally both participants decreasing variability in treatment phase. Both participants also demonstrated increased immediacy of effect with absolute level changes of +1.
Upon introduction of the treatment, both participants with intellectual disabilities demonstrated a change in level from baseline to treatment phases as seen in Table 11. Sam demonstrated a moderately upward trend in treatment phase while Garth demonstrated a trend line that was slightly negative (See Figure 1). Due to variability in data, the split middle-middle method of calculating an estimate of trend was used (Gast, 2010).

**Letter-sound correspondence and participants with autism and intellectual disabilities.** Participants in the autism category \( (n = 4) \) increased their overall treatment means over their baseline means. PEM scores for this group were varied. Dean scored a 0.9 indicating a highly effective treatment; Bobby and Ash’s scores (0.8 and 0.7) indicated a moderately effective treatment; Chuck, however, scored 0.6 indicating a questionable effect.

**Letter-sound correspondence and participants with physical disabilities and intellectual disabilities.** Participants in the physical and intellectual disability category \( (n = 2) \) demonstrated increased means in treatment phase over baseline phase, as seen in Table 11. Both Anna and Jo earned PEM scores of 1.0 indicating that the intervention was highly effective for this group. Both also demonstrated upward trends in the treatment phase, as seen in Figure 1. Both participants with physical and intellectual disabilities in this category also increased stability in data collected during the treatment phase (Jo = 36.5% increase in stability; Anna = 40.5% increase in stability).
**Sight Word Recognition by Primary Disability**

Small groups of students were taught five target sight words using direct instruction through the ALL Curriculum. Sight word recognition was assessed using multiple choice options and measured as the number of correctly identified target sight words identified during a testing period conducted at the beginning of each session. Calculation of PEMs indicated that five out of eight participants scored a 0.9 or 1.0 which suggests that the treatment was highly effective. Two of the eight participants scored PEMs of 0.7 or 0.8 indicating a moderately effective treatment effect. Only one participant, Bobby, scored a PEM of .6 indicating a questionable treatment effect. However Bobby did increase his level mean from baseline phase ($M = 0.66, SD = 0.51$) to treatment phase ($M = 2.30; SD = 1.10$).

Overall baseline aggregate mean across participants was lower in sight word recognition ($M = 0.86, SD = 0.43$) as compared to letter-sound correspondence ($M = 1.19, SD = 0.71$). Treatment means were correspondingly higher in letter-sound correspondence ($M = 3.22, SD = 0.48$) than in sight word recognition ($M = 2.87, SD = 0.55$) and the mean difference for both letter-sound correspondence and sight word recognition were equal.

In the next three subsections, performance in sight word recognition will be broken down and analyzed by participant primary disability. Participants were placed in one of three disability categories for this analysis which were defined as intellectual disabilities (ID), autism (Aut), and physical and intellectual disabilities (PD/ID). Overall findings of this analysis indicate that there was no significant difference in performance
in letter-sound acquisition between these groups. Each group increased their treatment mean as detailed in Table 12.

Table 12

<table>
<thead>
<tr>
<th>Primary Disability Category</th>
<th>Baseline $M$ (SD)</th>
<th>Treatment $M$ (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>0.66 (0)</td>
<td>2.81 (0.61)</td>
</tr>
<tr>
<td>Autism</td>
<td>0.94 (0.63)</td>
<td>3.02 (0.67)</td>
</tr>
<tr>
<td>PD/ID</td>
<td>0.9 (0.14)</td>
<td>2.8 (0.42)</td>
</tr>
</tbody>
</table>

Note. ID = intellectual disability, PD/ID = physical and intellectual disabilities.

Sight word recognition and participants with intellectual disabilities. Both Participants in the intellectual disabilities category earned a PEM indicating that the treatment was highly effective ($Sam M = 1.0$; $Garth M = 0.9$). While Sam decreased variability in treatment, Garth’s variability did not change between baseline and treatment. Additionally both participants demonstrated immediacy of change in level with Sam demonstrating an upward change of +3 and Garth demonstrating an upward change of +2. In the treatment phase, Sam’s performance indicated an upward trend line while Garth’s remained flat, although at a higher level (See Figure 2).

Sight word recognition and participants with autism and intellectual disabilities. Participants in the autism category ($n = 4$) increased their overall treatment means over their baseline means. Two of the four demonstrated immediacy of effect with positive changes in absolute level change ($Ash = +5$; $Dean = +3$). Bobby and Chuck demonstrated a zero change in level and no immediacy of effect. PEM scores for this group were varied. Two out of four participants scored in the highly effective treatment
range (Dean = 1.0; Chuck = 0.9). Ash scored a PEM of 0.8 which indicated a moderately effective treatment; Bobby, however, scored 0.6 indicating a questionable effect.

Dean was the only participant in this category to demonstrate decreased variability from high in baseline to moderate in treatment phase. Bobby and Ash demonstrated no change at all between treatment variability and baseline variability with both boys scoring 0% of data points falling within the stability envelope in either phase. Chuck’s performance demonstrated higher variability in the treatment phase than in baseline. Two of the four (Chuck and Bobby) demonstrated an upward trend in treatment phase with a low to moderate upward slope, as seen in Figure 2. Dean’s performance in treatment demonstrated a flat trend but at an overall increased level (baseline: $M = 0.41, SD = 0.51$; treatment: $M = 3.0, SD = 1.28$). While Ash’s trend line in treatment had a slight downward slope, his data stabilized in the latter portion of the treatment sessions and ended in a session at mastery level.

**Sight word recognition and participants with physical disabilities and intellectual disabilities.** Participants in the physical and intellectual disability category demonstrated increased means in treatment phase over baseline phase, as seen in Table 12. PEM scores were 0.7 for Jo and 0.9 for Anna indicating that the intervention was moderately to highly effective. Both participants in this category demonstrated a flat trend line in baseline with an upward trend in the treatment phase. Jo decreased variability from high in baseline to low in treatment phase (See Figure 2). Anna’s performance, however, demonstrated an increase in variability in treatment over baseline.
although both were high. This group did demonstrate a slightly lower mean difference between baseline and treatment phases than the other two disability groups.

**Participant Performance Analyzed by Additional Categories**

Due to the diverse nature of the participants in this study, analyzing the data through different category filters may help to shed light on whether or not additional variables impacted participant acquisition of the target letter-sound associations or sight word recognition in this study. The additional variables have been identified as IQ score, age, language spoken in the home, and choice selection method. Below are analyses of the participants’ performance data as filtered through these additional variable categories. Both participant data on letter-sound correspondence and sight word recognition are presented and discussed together for each additional category.

**Participant performance grouped by IQ levels.** For the purpose of analysis, participant performance data was grouped by the following two levels of participant IQ scores: IQs of 40-45 ($n = 5$) and IQs estimated at below 30 ($n = 3$). In letter-sound association, all participants across both IQ categories demonstrated increased means in treatment phase over baseline phase as seen in Table 13. Participants in the category with IQs below 30 had a higher mean difference between baseline and treatment ($M = 2.1$) than those participants in the category with IQ scores in the 40s ($M = 1.99$).

All participants across both IQ categories demonstrated increased means in treatment phase over baseline phase for sight word recognition as seen in Table 13. While the participants with higher IQ scores did have a greater mean difference between
baseline and treatment, all participants in both groups demonstrated progress toward
demonstration of sight word recognition.

Regardless of IQ scores, all participants were able to demonstrate progress toward
learning letter-sound associations and sight word recognition by exhibiting mean
increases in treatment phases over baseline phases.

Table 13

<table>
<thead>
<tr>
<th>IQ Range</th>
<th>Letter-sound correspondence baseline M (SD)</th>
<th>Letter-sound correspondence treatment M (SD)</th>
<th>Sight word recognition baseline M (SD)</th>
<th>Sight word recognition treatment M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-45</td>
<td>1.31 (0.88)</td>
<td>3.30 (0.58)</td>
<td>0.87 (0.56)</td>
<td>3.0 (0.66)</td>
</tr>
<tr>
<td>Below 30</td>
<td>0.99 (0.33)</td>
<td>3.09 (0.30)</td>
<td>0.83 (0.17)</td>
<td>2.67 (0.37)</td>
</tr>
</tbody>
</table>

Participant performance grouped by ages. For the purpose of analysis, participant performance data was subdivided by age groups. Although all of the students were consider of middle school age, there was a range of actual ages among the participants. For this analysis participants were broken into three age categories as follows: 11- to 12-year olds (n = 3); 13- to 14-year-olds (n = 2); and 15- to 16-year-olds (n = 3).

In letter-sound correspondence, all participants across all age categories demonstrated a mean increase from baseline to treatment phase, as seen in Table 14.
PEM scores for letter-sound correspondence in the 11- to 12-year-old group ranged were 0.7 (Ash), 0.8 (Bobby), and 1.0 (Sam) which indicates that the intervention was moderately to highly effective. Two of the three participants in this group demonstrated an upward trend in treatment while one participant (Bobby) maintained a flat trend line, although at a higher level over baseline. Sam was the only participant in this group to decrease variability of data in treatment to moderate variability over high baseline variability. Ash’s performance in treatment showed a slight decrease in variability over baseline while Bobby’s demonstrated an increase in variability rom baseline to treatment.

The participants in the 13- to 14-year-old category happen to also be the two who were placed in the PD/ID category. Overall both participants in this category demonstrated increased means in treatment phase for (Jo: \( M = 3.25, SD = 0.46 \); Anna: \( M = 3.37, SD = 0.91 \)) over baseline phase (Jo: \( M = 1.46, SD = 1.05 \); Anna: \( M = 1.11, SD = 0.92 \)) for letter-sound associations. Both Anna and Jo earned PEM scores of 1.0 indicating that the intervention was highly effective for this category. Both also demonstrated upward trends in the treatment phase and both increased stability in data collected during the treatment phase (Jo = 36.5% increase in stability; Anna = 40.5% increase in stability).

Participants in the 15- to 16-year-old category earned PEM scores in letter-sound correspondence which ranged from 1.0 (Garth), 0.9 (Dean), and 0.6 (Chuck) in letter-sound correspondence. Two of the three participants in this category demonstrated an upward trend in treatment while one participant (Garth) demonstrated a slightly
downward trend. Two of the three participants in this category decreased variability in treatment phase (Chuck and Garth) over baseline, while Dean’s variability remained constant with high variability in both baseline and treatment.

Table 14

<table>
<thead>
<tr>
<th>Participant age group</th>
<th>Baseline M letter-sounds (SD)</th>
<th>Treatment M letter-sounds (SD)</th>
<th>Baseline M sight words (SD)</th>
<th>Treatment M sight words (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11- to 12-year-olds</td>
<td>0.79 (0.31)</td>
<td>3.10 (0.60)</td>
<td>0.72 (0.1)</td>
<td>2.69 (0.49)</td>
</tr>
<tr>
<td>13- to 14-year-olds</td>
<td>1.31 (0.99)</td>
<td>3.31 (0.60)</td>
<td>0.9 (0.14)</td>
<td>2.80 (0.42)</td>
</tr>
<tr>
<td>15- to 16-year-olds</td>
<td>1.53 (1.10)</td>
<td>3.31 (0.68)</td>
<td>0.97 (0.76)</td>
<td>3.10 (0.78)</td>
</tr>
</tbody>
</table>

In sight word recognition, all participants across all age categories demonstrated a mean increase from baseline to treatment phase as seen in Table 14.

PEM scores for the 11- to 12-year-olds ranged were 0.6 (Bobby), 0.8 (Ash), and 1.0 (Sam) which indicates that the intervention had a moderate to high effect for two of the three and a questionable effect for one participant in sight word recognition. Two of the three participants in this category demonstrated an upward trend in treatment while one participant (Ash) demonstrated a slightly downward trend. Sam was the only participant in this category to decrease variability of data in treatment phase over baseline although both remained high. Both Ash and Bobby demonstrated a zero change in stability from baseline to treatment with 0% stability for both participants in all phases.
Overall both participants in the 13- to 14-year-old category demonstrated increased means in treatment phase (Jo: $M = 2.5, SD = 1.58$; Anna: $M = 3.1, SD = 1.10$) over baseline phase (Jo: $M = 0.8, SD = 0.63$; Anna: $M = 1.0, SD = 0.62$) in sight word recognition. PEM scores were 0.7 for Jo and 0.9 for Anna indicating that the intervention was moderately to highly effective. Both participants in this category demonstrated a flat trend line in baseline with an upward trend in the treatment phase. Jo decreased variability in treatment to low variability over high variability in baseline Anna’s performance, however, demonstrated an increase in variability in treatment over baseline. This category did demonstrate a slightly lower mean difference between baseline and treatment phases than the other two age group categories.

Participants in the 15- to 16-year-old category all earned PEM scores in the highly effective range (Garth = 0.9; Chuck = 0.9; Dean = 10) in sight word recognition. Two of the three participants in this category demonstrated a flat trend in treatment, although at an increased level, while one participant (Chuck) demonstrated an upward trend. Dean was the only participant in this category to decrease variability of data to moderate in treatment over baseline which was high. Garth demonstrated a zero change in variability from baseline to treatment with 0% of data points falling within the 20% stability envelope in all phases. Chuck performance increased variability of data in treatment over baseline although both remained high.

**Participant performance grouped by home language.** Because of the diverse nature of the student population at the Hartford Program and as reflected in the participants in this study, an analysis was conducted on participant performance based
upon language spoken in the home. Of the eight participants, three (Sam, Dean, Anna) came from homes where English was the spoken language. Three of the participants (Ash, Bobby, Jo) came from homes where Spanish was the language spoken. One of the participants came from a home where Amharic was spoken (Chuck) and one participant came from a home where Bengali was spoken (Garth). For the purposes of this analysis, participants were placed into one of two groups, English ($n = 3$) or Other Language ($n = 5$).

Table 15

*Means and Standard Deviations of Home Language Groups Across Dependent Variables*

<table>
<thead>
<tr>
<th>Home language groups</th>
<th>Baseline $M$ letter-sound correspondence ($SD$)</th>
<th>Treatment $M$ letter-sound correspondence ($SD$)</th>
<th>Baseline $M$ sight word recognition ($SD$)</th>
<th>Treatment $M$ sight word recognition ($SD$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>0.77 (0.29)</td>
<td>3.30 (0.53)</td>
<td>0.69 (0.29)</td>
<td>3.11 (0.12)</td>
</tr>
<tr>
<td>Other Language</td>
<td>1.44 (0.79)</td>
<td>3.21 (0.51)</td>
<td>0.96 (0.50)</td>
<td>2.88 (0.66)</td>
</tr>
</tbody>
</table>

**Participant performance grouped by choice selection method.** For the purpose of analysis, participant performance data was divided into three categories defined by the simplicity of their choice selection methods. The first category is denoted as the simple category which included Sam, Chuck, and Jo. Participants in this category had a straightforward and easy to interpret choice selection method that they came to the intervention with already in place. The researcher did not have to negotiate or teach
participants in this group how to make a selection or communicate to the researcher that a
selection had been made. All three pointed to their choice selections or picked up and
handed their choice selections to the researcher.

The second category of participants is denoted as the idiosyncratic category which
consists of Ash, Anna, and Dean. All of the participants in this category required some
level of choice selection instruction, intervention, or negotiation. While Anna had a
strong and steady eye gaze already in place, she needed to practice the process of moving
her eyes from the researcher’s face, to her choice selection and back to the researcher’s
face to indicate her choice selection prior to beginning intervention. Ash, while
physically capable of pointing to or picking up a choice selection, was hampered by his
need to ritualistically and repeatedly touch materials. The researcher negotiated with Ash
through a series of trials and errors in order to find a selection method that worked for
him and was clear to the researcher and IOA observers. The final and successful choice
selection method involved Ash using the researcher’s hand as a pointer to make his
selections. Likewise, while Dean was physically capable of making a choice selection, he
was also impeded by his engagement in a ritualized response pattern. Regardless of
whether or not Dean knew the answer to a request, he began at one end of the visual array
and moved systematically across the responses. The researcher worked with Dean to
break this pattern and eventually found that requiring him to place his open hands on the
researcher’s upturned palms prior to making a selection, helped Dean to visually focus on
the choice selections and increase his correct responses by breaking the ritualistic
response pattern.
The third category of participants is denoted as the behaviorally challenged category. Participants in this category, including Bobby and Garth, were both physically capable of making a choice selection. However, for both of these students, behavioral issues impeded their ability to make selections. Garth grabbed at materials within his reach and threw them on the floor. The researcher compensated for this behavior by holding the choice selections just barely out of Garth’s reach so that his outstretched fingers would brush against the target he was attempting to grab without him actually being able to grab the material. However, at times it felt to the researcher that Garth was putting more concentration into grabbing materials, than into selecting the correct response. Bobby’s behavioral challenges made it difficult for the researcher to gain or direct his attention to the choice selections. When the intervention took place in a large room, Bobby would get up and run from the table throughout the session. He also hid his face in his shirt and obsessed over smelling the researcher. Due to these behaviors his focus on the presented choice selections was often fleeting and twice an intervention session was concluded prematurely and prior to completing all steps due to extreme behavior.
Table 16

Participant Means and Standard Deviations Across Choice Selection Methods and Dependent Variables

<table>
<thead>
<tr>
<th>Groups by selection methods</th>
<th>Baseline $M$ letter-sound correspondence ($SD$)</th>
<th>Treatment $M$ letter-sound correspondence ($SD$)</th>
<th>Baseline $M$ sight word recognition ($SD$)</th>
<th>Treatment $M$ sight word recognition ($SD$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple</td>
<td>1.60 (1.08)</td>
<td>3.70 (0.41)</td>
<td>1.10 (0.65)</td>
<td>3.22 (0.77)</td>
</tr>
<tr>
<td>Idiosyncratic</td>
<td>0.77 (0.28)</td>
<td>2.95 (0.36)</td>
<td>0.75 (0.30)</td>
<td>2.87 (0.30)</td>
</tr>
<tr>
<td>Behaviorally Challenged</td>
<td>1.45 (0.28)</td>
<td>2.94 (0.27)</td>
<td>0.66 (0)</td>
<td>2.34 (0.05)</td>
</tr>
</tbody>
</table>

Summary

In this study, participants were randomly placed into groups of two for instructional purposes in letter-sound correspondence for experiment one (research question one) and sight word recognition in experiment two (research question two). All groups received direct instruction using the ALL Curriculum on both letter-sound correspondence and sight word recognition. Each group received their instruction in a group setting but each participant was individually assessed at the beginning of each session. Based on the visual inspection of data, a functional relation was demonstrated across all participants and across both experiments. In addition, the results of the randomization tests indicated statistically significant differences between baseline and treatment phases in both experiments.
CHAPTER FIVE

The primary purpose of this study was to determine the effectiveness of the ALL Curriculum in teaching letter-sound correspondence and sight word acquisition to groups of students with severe disabilities and communication disorders. The study was conducted in a school setting with small groups of participants being taught together in order to replicate an authentic teaching and testing environment.

This study was constructed with the four design criteria for evaluating single-case research designs as designated by Kratochwill et al. (2010) as the foundation of the research rigor. In the current study, a multiple-baseline design with four tiers was used to systematically stagger implementation of direct instruction of letter-sound correspondence and sight word recognition using the ALL Curriculum for eight middle school students with severe disabilities. This systematic manipulation of the independent variable by the researcher meets evidence standards as defined by Kratochwill et al.

For the current study, seven independent assessors measured variable outcomes on each condition and each phase across both experiments (letter-sound correspondence, sight word recognition). Thus it meets the design criterion requiring that more than one assessor measure each variable outcome over time on at least 20% of data points per condition and per phase (Kratochwill et al., 2010). The criterion of 20% of data points across time observed by independent assessors was exceeded in this study with an
average of 30% of baseline phases independently observed and an average of 49% of treatment phases independently observed. The design criteria requires interrater agreement to be between 80 and 90% in order to meet standards. In this study interrater agreement was averaged at 99% with a range of 98% to 100%.

Additionally, the current study demonstrated 16 phases with at least five data points in each phase. As a result this study meets the third design criterion which requires a multiple-baseline design to have at least six phases with a minimum of five data points per phase. Therefore the current study has met all of the design criteria to meet standards.

**Summary of Findings**

The results of this study indicate that middle school students with severe disabilities and communication disorders can benefit from direct instruction on letter-sound correspondence and sight word recognition using the ALL Curriculum and presented in small group settings. In comparison to Kratochwill et al.’s (2010) criteria for evidence of effectiveness the following criteria were met:

1. Five out of eight participants with severe disabilities, including intellectual disabilities, autism, physical disabilities, and communication disorders, increased their knowledge of letter-sound correspondence by demonstrating consistent improvement as seen in a mean change in level from baseline to treatment phases providing moderate to strong evidence of a functional relation between intervention and outcomes (Kratochwill et al., 2010).

2. Six out of eight participants with severe disabilities, including intellectual disabilities, autism, physical disabilities, and communication disorders, increased their
knowledge of sight word recognition by demonstrating a mean change in level from baseline to treatment phases providing moderate to strong evidence of a functional relation between intervention and outcomes (Kratochwill et al., 2010).

3. Students’ improvements on letter-sound correspondence and sight words were statistically significant \( p = 0.0026/p = 0.01 \) and \( p = 0.008/p = 0.013 \) respectively.

**Implications**

In this section findings from this study are discussed by dependent variables (letter-sound correspondence and sight word recognition). Each of these dependent variables are discussed as aggregate results and then disaggregated and discussed by categories such as primary disability, instructional groups, age, home language, and IQ levels. Additionally social validity and authenticity are addressed.

**Letter-Sound Correspondence**

Small groups of students were taught five target letter-sound associations using direct instruction through the ALL Curriculum. Letter-sound correspondence was assessed using multiple choice options and measured as the number of correctly identified target letter-sound associations identified during a testing period conducted at the beginning of each session. Overall, eight out of eight participants demonstrated progress toward acquisition of the targeted letter-sound pair associations, as indicated by increased level means in treatment phases over baseline phases. Five out of eight participants scored PEMs in the range which indicates that the treatment was highly effective for those participants. Two of the eight participants scored PEMs indicating a moderately effective effect. Only one participant, Chuck, scored a PEM which indicated
a questionable treatment effect. However, one possible explanation for this is that Chuck began with a higher baseline mean than the other participants and although he demonstrated consistent knowledge of all five target letter-sounds, the overlap was more significant due to the moderately high and variable baseline data.

Overall baseline aggregate mean across participants was higher in letter-sound correspondence as compared to baseline data in sight word recognition suggesting that participants may have had more, although limited, exposure to letter-sounds in general than to the specific sight words selected for each group. Treatment means were correspondingly higher in letter-sound correspondence to sight word recognition. However, the mean difference for both letter-sound correspondence and sight word recognition were equal.

While the research base on letter-sound correspondence acquisition for students with severe disabilities is still small, the growing awareness of the need for this foundational skill has fueled additional interest in the topic (Allor, Champlin, et al., 2010; Browder et al., 2006; Finnegan, 2012). The current study aims to add to this growing body of research into letter-sound correspondence acquisition for students with severe disabilities.

In the current study, use of multiple choice options contributed to the significant variability in both baseline and treatment data across participants. Since at any data point, participants had a one in four chance of answering correctly, independent of actual knowledge of the target letter-sound, some variability is expected. In addition, variability in performance has been identified as a characteristic of individuals with moderate to
severe intellectual disabilities and autism (Sherer & Shreibman, 2005). Traditional aspects of visual analysis may not be sufficient to determine functional relation between independent and dependent variables when the research participants have moderate to severe levels of intellectual disabilities and autism. In a study conducted by Bailey et al. (2011), there was high variability in the data with mean PND calculations for letter-sound correspondence matching across the four participants were 35%, 56%, 25%, and 22% respectively. Variability was also high across baseline. However, the authors pointed out that each of the participants made overall gains in their letter-sound correspondence skills. In the current study five out of eight participants decreased their data variability between baseline and treatment phases. One participant demonstrated a zero change in variability and two participants demonstrated an increase in data variability. The statistically significant results of the randomization tests provide additional evidence of the effectiveness of the ALL Curriculum to teach letter-sound correspondence to students with severe disabilities regardless of the variability observed in the data.

In the following subsections, performance in letter-sound correspondence was broken down and analyzed by participant primary disability. Participants were placed in one of three disability categories for this analysis which were defined as intellectual disabilities (ID), autism (Aut), physical and intellectual disabilities (PD/ID).

**Letter-sound correspondence and participants with intellectual disabilities.**

Participants in the intellectual disabilities category ($n = 2$) had a primary eligibility of intellectual disabilities without other confounding issues. While both of these participants
had experienced heart issues in their pasts, those issues did not impact them on a daily basis during the course of this study.

Results from the data indicate that the treatment used in the current study was highly effective for both of these participants. The ALL Curriculum, which utilizes direct instruction with systematic and explicit instruction, was an effective means of presenting letter-sound associations to these participants with intellectual disabilities. This is consistent with the body of research which indicates that both direct instruction, as well as systematic and explicit instruction, are effective strategies in teaching literacy to individuals with intellectual disabilities (Crowley et al., 2013; Ruwe et al., 2011).

Additionally, as was demonstrated in a study by Allor, Mathes, et al. (2010), systematic and explicit instruction is an effective strategy for teaching letter-sounds to individuals with intellectual disabilities. In another study conducted by Finnegan (2012), students in the treatment groups who received a systematic approach to phonics acquisition outperformed those participants in the control group who did not.

In this current study, Sam was able to demonstrate knowledge of all five letter-sounds consistently by the end of the intervention by correctly identifying all letter-sound associations in the last three sessions. While Garth did not demonstrate knowledge of all five letter-sound associations at any point during treatment, an error analysis indicates that he might have consistently acquired two of the letter-sound associations by the end of treatment. During the intervention phase testing, Garth missed each of the letter-sounds equally. However, he missed the letter-sound associations for p, m, and o consistently throughout the intervention at the same rate. He missed the letter-sound
associations for a and t more often at the beginning of treatment and infrequently toward the end of the treatment phase indicating that he may have learned these two letter-sound associations. Garth’s slower acquisition of the letter-sound associations is consistent with research indicating that students with intellectual disabilities may take longer than expected to acquire letter-sound associations. In a study conducted by Allor, Mathes, et al. (2010) students in group receiving treatment in literacy made statistically significant gains after two to three years of direct instruction in letter-sound correspondence. The duration of the current study was only three months.

Garth also had considerable behavioral issues (grabbing and throwing materials) that he exhibited during intervention sessions which may have impacted his ability to focus on the task at hand. Garth’s teachers indicated that the same behavioral issues were seen in class. The possible impact that Garth’s behavioral issues had on his performance during the intervention is discussed in a following section on the choice selection methods. However, Garth always came willingly with the researcher for intervention sessions, smiled during the sessions, and stayed in the chair he was sitting in. As a result, Garth was able to attend the sessions without a teaching assistant accompaniment.

**Letter-sound correspondence and participants with autism and intellectual disabilities.** Participants in the autism category (n = 4) had a primary eligibility of autism and were all being educated in classrooms for students with autism. These participants also demonstrated intellectual disabilities in the moderate to severe range. Although the common trait between all participants in the current study was intellectual disability, it is important to disaggregate the data to look specifically at how participants with autism
performed in order to determine if the intervention was as effective for these participants as for those without autism. Spector (2011) notes the lack of research in literacy instruction for students with autism and the failure of many studies to disaggregate the data in order to explicitly examine the effect of the treatment on individuals with autism.

Three of the four participants in this group (Bobby, Ash, Chuck) had significant behavioral concerns, to the extent that a teacher assistant accompanied them to intervention sessions. Bobby required a teacher assistant’s presence due to elopement issues and Ash required the presence of a teacher assistant due to aggressive behaviors. Once Chuck became comfortable with the researcher, however, his personal assistant stopped coming to sessions with him. Dean did not demonstrate behaviors that required the presence of a teacher assistant.

Additionally, in this group, idiosyncratic selection methods and stereotyped behaviors associated with autism may have impacted participant performances which are discussed further in the following section on the choice selection methods. Wolff, Hupp, and Symons (2013) note that these ritualistic behaviors found in the vast majority of individuals with ASD can interfere with educational and daily living activities.

For Chuck, the pattern of the overall session was important. Chuck needed to sign himself out in his classroom prior to going with the researcher for a session. This sometimes meant that Chuck’s sessions were shorter in length due to the need to return to the classroom prior to an intervention session, even if he was on the other side of the school closer to the intervention setting. That resulted in less time during the session.
Additionally, Chuck became distraught if there were any changes in the hallway as he was going to the intervention site.

Ash demonstrated considerable stereotyped behaviors associated with autism, including the ritualistic need to touch the sides of the table, each target choice presented, as well as the edges of the visual display prior to making any selections. Bobby also demonstrated considerable stereotyped behaviors associated with autism including rocking his body, slapping his forearms, refusing to make eye contact, and smelling the researcher. These behaviors impacted Bobby’s ability to focus on the task at hand and the researcher spent considerable time during each session gaining or redirecting Bobby’s attention to task.

Chuck quickly demonstrated consistent knowledge of the letter-sound associations for $t$, $o$, and $p$. He had the most difficulty learning the letter-sound association for the letter $a$. Bobby also had the most difficulty with learning the letter-sound association for the letter $a$. He missed it 21% more often than any of the other letter-sound associations. He demonstrated consistent knowledge of the letter-sound association for the letter $o$ and decreased his errors over the length of the treatment phase for the letter-sound associations for the letters $m$ and $t$, indicating that he might have begun to acquire knowledge of these letter-sound pairs toward the end of the intervention.

Ash and Dean did not demonstrate consistent knowledge of any particular letter-sound pairs. However, Dean only missed the letter-sounds for $n$ and $f$ once in the latter half of the intervention indicating that he might have begun acquiring knowledge of these letter-sound associations. Ash appeared to have the least difficulty learning $t$ and $p$ which he
missed more frequently at the beginning of the treatment phase. Chuck, Ash, and Bobby all demonstrated considerable difficulty with learning the letter-sound association for the letter *a*.

Research on acquisition of letter-sound correspondence by students with autism is mixed. Some research indicates that letter-sound correspondence is more difficult for students with autism (Mirenda, 2003). Other research purports that the rule-based nature of phonics is easier for students with autism than other literacy skills such as comprehension (Frith, 2003; Sigman et al., 1997; Whalon et al., 2009). The findings in the current study are consistent with this research base, since the results of the current study were mixed. While all of the participants with autism demonstrated increased means in treatment phase over baseline phase, they also demonstrated difficulties in consistently identifying specific letter-sound associations. However, participants with autism in the current study performed slightly better in letter-sound correspondence than they did in sight word recognition.

**Letter-sound correspondence and participants with physical disabilities and intellectual disabilities.** Participants in the physical and intellectual disability category (*n* = 2) had a primary disability that encompassed both a physical and an intellectual component. Jo had a diagnosis of cerebral palsy, which impacted her core stability, functional use of her left hand, her vision, and her ambulation. Anna had a diagnosis of Rett Syndrome, which impacted her ambulation, functional use of her hands, and core stability. Both of these participants also had intellectual disabilities in the moderate to severe range.
The intervention used in the current study proved to be highly effective with both of these participants as evidenced by their demonstration of an increase in mean level during treatment over baseline phase. In error analysis, both participants consistently demonstrated knowledge of the letter-sounds for \(c\) and \(m\) indicating that they might have acquired these two letter-sound associations.

Although Anna was the only participant to require eye gaze as her primary selection method, which she sometimes augmented with a reach approximation (as described in Chapter 3), her eye gaze selection method was precise. Anna would make direct eye contact with the researcher, while a directive was given (e.g., “Show me the letter that makes the sound \textit{aaaaaa}”). Then, she would demonstrate a steady eye gaze, which she held for approximately two seconds on her target selection followed by returning her eyes to the researcher’s face to indicate that the selection had been made. Several of the interassessor observers noted that her eye gaze was easy to interpret because it was so clear.

The effects of having a physical disability on literacy acquisition are well documented in research. Fatigue was an issue for both of these participants, which is consistent with the literature (Swinehart-Jones & Wolff Heller, 2013). Fatigue was most especially apparent for Anna. Participants with physical disabilities in another study expressed the valuable connection being literate afforded their peers was denied to them (Carpenter & Readman, 2006). One well-documented barrier to literacy acquisition for people with physical disabilities is that of a psychosocial, or attitudinal barrier (Carpenter & Readman, 2006; Erickson & Koppenhaver, 1995; Zascavage & Keefe, 2004). In the
current study, while Jo had had limited exposure to letter-sound correspondence, there was no reflection of any exposure to letter-sound correspondence in Anna’s records. Yet Anna was able to demonstrate considerable progress toward identification of the five letter-sound pairs presented to her during the course of the intervention.

**Sight Word Recognition**

Small groups of students were taught five target sight words using direct instruction through the ALL Curriculum. Sight word recognition was assessed using multiple choice options and measured as the number of correctly identified target sight words identified during a testing period conducted at the beginning of each session. All of the participants demonstrated a mean increase in level between baseline and treatment. This demonstration of sight word acquisition is consistent with the literature. Sight word recognition is the most commonly taught aspect of literacy for students with severe disabilities (Alberto et al., 2010; Browder et al., 2011; Erickson et al., 2008). Focusing literacy instruction on sight word recognition is an attractive proposition because automaticity in word recall is an important tool in acquiring fluency and thus in being independently literate (Alberto et al., 2013; Light & McNaughton, 2009; Schloss et al., 1995). Sight words selected for targeted instruction can also be tailored to fit the needs of an individual or a specific environment (Ruwe et al., 2011; Schloss & Alper, 1995). In the current study, sight words selected for the intervention were chosen from a variety of sources (e.g., parent and teacher suggestions, published sight word lists).

The use of multiple choice options in the current study resulted in significant variability in both baseline and treatment data across participants, since at any data point,
participants had a one in four chance of answering correctly independent of actual knowledge of the target sight word. Variability in performance has been identified as a characteristic of individuals with moderate to severe intellectual disabilities and autism (Sherer & Shreibman, 2005). Traditional aspects of visual analysis may not be sufficient to determine functional relation between independent and dependent variables when the research participants have moderate to severe levels of intellectual disabilities and autism (Bailey et al., 2011). In the current study three (Jo, Sam, Dean) out of eight participants decreased their data variability between baseline and treatment phases. Three participants (Bobby, Garth, Ash) demonstrated a zero change in variability and two participants (Anna, Chuck) demonstrated an increase in data variability. The statistically significant results of the randomization tests provide additional evidence of the effectiveness of the ALL Curriculum to teach sight word recognition to students with severe disabilities regardless of the variability observed in the data.

In the following subsections, performance in sight word recognition was broken down and analyzed by participant primary disability. Participants were placed in one of three disability categories for this analysis which were defined as intellectual disabilities (ID), autism (Aut), physical and intellectual disabilities (PD/ID).

**Sight word recognition and participants with intellectual disabilities.**

Participants in the intellectual disabilities category \((n = 2)\) had a primary eligibility of intellectual disabilities without other confounding issues. In the current study, the intervention was highly effective in teaching sight word recognition to both participants with intellectual disabilities. This finding is consistent with research suggesting that
students with intellectual disabilities are capable of acquiring sight words. Numerous studies have demonstrate that students with intellectual disabilities have the ability to learn sight word recognition (Alberto et al., 2013; Beecher & Childre, 2012; Browder et al., 2009; Van der Bijl et al., 2006).

Sam was able to demonstrate consistent knowledge of all five target sight words by the end of the intervention. Garth demonstrated more difficulty in consistently identifying the target sight words. However, by the end of the treatment, Garth consistently correctly identified the word *car*, and in error analysis, his performance indicated that he was acquiring *see* and *yellow*.

**Sight word recognition and participants with autism and intellectual disabilities.** Participants in the autism category (*n* = 4) had a primary eligibility of autism and were all being educated in classrooms for students with autism. These participants also demonstrated intellectual disabilities in the moderate to severe range. Three of the four participants in this group (Bobby, Ash, Chuck) had significant behavioral concerns to the extent that they were accompanied to intervention sessions by a teacher assistant. Dean did not demonstrate behaviors that required the presence of a teacher assistant.

Additionally, in this group, idiosyncratic selection methods and stereotyped behaviors associated with autism may have impacted participant performance as previously described.

Overall, the intervention had low to moderate effectiveness in teaching sight word recognition to the participants in this category. While all four participants with autism demonstrated increased level means in treatment phases over baseline phases, they
demonstrated more difficulty with acquisition of the sight words than of letter-sound associations. Letter-sounds are ubiquitous and do not carry an identifiable meaning in and of themselves. The participants with autism in the current study had only to learn the sound associations with a letter, but did not have to interpret or demonstrate comprehension of the meaning of the sounds. However, the sight words selected for this intervention (except for the word see) all represented objects. Therefore the participants with autism may have been trying, not only to learn to recognize the word, but to comprehend the object association as well. This finding is consistent with research indicating students with autism have difficulty with comprehension components of literacy at the word and sentence level (Mayes & Calhoun, 2003a, 2003b; Nation et al., 2006; Whalon et al., 2009).

In error analysis, while Chuck quickly demonstrated consistent recognition of the sight words green and yellow, he had the most difficulty learning the sight word home which accounted for 43% of his total errors. Ash also demonstrated consistent recognition of the word yellow and difficulty with the word home. One possible explanation for this is the concept of object comprehension, as noted in the literature. The concept of yellow was easily demonstrated on the response plate accompanying the lessons, but home is a much more ambiguous concept and thus might have been harder for the Chuck and Ash to learn. The word home did not appear in the word lists for the other participants with autism.

Sight word recognition and participants with physical disabilities and intellectual disabilities. Participants in the physical and intellectual disability category (n
had a primary disability that encompassed both a physical and an intellectual component in the moderate to severe range. Both of the participants in this category demonstrated increased level means in treatment over baseline phases. The intervention was moderately to highly effective in teaching sight word recognition to the participants in this category. However, physical disabilities can impact literacy acquisition.

One of the noted barriers to literacy acquisition for students with physical disabilities is a lack of broad experiences due to physical limitations, resulting in deficits in background knowledge important for reading comprehension (Swinehart-Jones & Wolff Heller, 2013). In the current study, Anna and Jo both demonstrated difficulty with recognition of the words lunch and car. The word car accounted for 30% of Anna’s errors and 23% of Jo’s total number of errors. For individuals who use a wheelchair, as Anna does, cars are rarely a mode of transportation they would encounter. Anna’s family most likely transported her in a van and she rode a bus to school. Neither girl had difficulty learning the word bus. Additionally, Anna and Jo demonstrated difficulty recognizing the word lunch. Experientially, the concept of lunch might have carried less meaning for the girls since Jo was G-tube fed and did not participate in actually eating during the lunch period at school. While Anna did eat lunch, she did not participate in selecting her food or in the cafeteria atmosphere since her lunch was selected for her and brought to her in the classroom where one of the teaching assistants fed her. These findings are reflective of the lack of broad experiential background knowledge that students with physical disabilities may have which interfere with the comprehension aspects of literacy (Swinehart-Jones & Wolff Heller, 2008).
Summary of participant primary disability on literacy acquisition. When participant performances were grouped according to primary disability (ID, Aut., PD/ID), very few differences were noted in comparison to each other. Overall baseline and treatment means were similar between categories with only a slightly lower mean difference demonstrated by the PD/ID category ($M$ difference = 1.9) as compared to the ID category ($M$ difference = 2.15) and the Aut. category ($M$ difference = 2.08). This may indicate that primary disability does not specifically or generically make literacy acquisition more likely for one group than another. All participants across all disability groups in this study demonstrated overall improvement in letter-sound correspondence and sight word recognition.

Participant Performance Analyzed by Additional Categories

Due to the diverse nature of the participants in this study, analyzing the data through different category filters may help to shed light on whether or not additional variables impacted participant acquisition of the target letter-sound associations or sight word recognition in this study. The additional variables have been identified as IQ score, age, language spoken in the home, and choice selection method. Below are analyses of the participants’ performance data as filtered through these additional variable categories.

Participant performance grouped by IQ levels. For the purpose of analysis, participant performance data was grouped by the following two levels of participant IQ scores: IQs of 40-45 ($n = 5$) and IQs estimated at below 30 ($n = 3$). For those participants with IQs estimated to be below 30, it was noted in their files that standard IQ scores were unobtainable for these participants and therefore estimated to be below a score of 30. Or
it was noted that no attempt to gain a standardized IQ test score was made due to perceived inability of the participant to obtain any score on the test and therefore IQ was deemed to be below 30. Participants were noted in the files as “untestable.” In the body of literature discussed in this study, on teaching literacy skills to individuals with intellectual disabilities, the preponderance of studies involved individuals with IQs in the 45-65 range (Browder & Shear, 1996; Finnegan, 2012; Ruwe et al., 2011; Schloss & Alper, 1995). A few studies indicated a range starting at 40 (Allor, Mathes, et al., 2010; Frederick et al., 2013) while some listed broad terminology (e.g., mild, moderate) in lieu of specific IQ scores (Bailey et al., 2011; Cihak et al., 2006; Swinehart-Jones & Wolff Heller, 2008; Wolery & Ault, 1992). Only one study specifically targeted literacy skill acquisition for students with IQs below 20 (Browder et al., 2008) but the target literacy skill in that study was shared stories, not a literacy strategy covered in the current study.

In letter-sound association, all participants across both IQ categories demonstrated increased means in treatment phase over baseline phase. Mean scores in baseline for participants with IQ scores in the slightly higher than baseline means for participants with IQ scores below 30. This may indicate that the category with higher IQ scores might have begun the intervention with slightly more exposure to letter-sounds than those participants in the lower IQ score category. Participants in the category with IQs below 30 had a higher mean difference between baseline and treatment ($M = 2.1$) than those participants in the category with IQ scores in the 40s ($M = 1.99$) indicating that not only did the below 30 category demonstrate progress toward learning letter-sound
correspondence, but they were equally as capable of learning the letter-sound associations as their peers with higher IQ scores.

All participants across both IQ categories demonstrated increased means in treatment phase over baseline phase for sight word recognition. Mean scores in baseline for participants with IQ scores in the 40s were similar to those for participants with IQ scores below 30. This indicates that both categories began the intervention with similar levels of knowledge of the target sight words. While the participants with higher IQ scores did have a greater mean difference between baseline and treatment, all participants in both categories demonstrated progress toward demonstration of sight word recognition.

Regardless of IQ scores, all participants were able to demonstrate progress toward learning letter-sound associations and sight word recognition by exhibiting mean increases in treatment phases over baseline phases.

Participant performance grouped by ages. For the purpose of analysis, participant performance data was subdivided by age categories. Although all of the students were considered of middle school age, there was a range of actual ages among the participants. When students with severe disabilities are eligible to receive special education services through their 21st birth year, the ages at which they move from elementary to middle and to high school can vary. Often, students who will remain in the school system through their 21st birthday spend longer in middle school than would typically be expected so that they are not in high school for more than seven years. Participants in this study ranged in age from 11 to 16 even though all were considered to
be in middle school. For this analysis participants were broken into three age categories as follows: 11- to 12-year-olds ($n = 3$), 13- to 14-year-olds ($n = 2$), and 15- to 16-year-olds ($n = 3$).

In letter-sound correspondence, all participants across all age categories demonstrated a mean increase from baseline to treatment phases. Participants in the 11- to 12-year-old category had the lowest baseline mean in letter-sound correspondence suggesting that they may have had less exposure to letters or letter-sounds than their older peers. While treatment performance means were the same between the older two categories, the 15- and 16-year-olds began with a higher baseline and thus had a slightly lower mean difference between baseline and treatment than the other two categories in letter-sound correspondence.

In sight word recognition, all participants across all age categories demonstrated a mean increase from baseline to treatment phases. Participants in the 11- to 12-year-old category had the lowest baseline mean which was also the case in letter-sound correspondence suggesting the possibility that they may not have had as much exposure to foundational literacy skills as their older peers. Treatment performance means were highest for the 15- and 16-year-olds who also demonstrated the greatest mean difference over the other categories. This finding is consistent with the results of a study conducted by Collins, Evans, Creech-Galloway, Karl, and Miller (2007), in which the participants aged 13 to 19 outperformed the younger, elementary-aged participants in sight word maintenance.
Regardless of age, all participants were able to demonstrate progress toward learning letter-sound associations and sight word recognition by exhibiting mean increases in treatment phases over baseline phases. The older category exhibited slightly higher treatment means and mean differences than the other two categories which might suggest that the older students were better able to learn the components of literacy tested in this study within the time constraints of the current intervention.

**Participant performance grouped by home language.** Because of the diverse nature of the student population at the Hartford Program and as reflected in the participants in this study, an analysis was conducted on participant performance based upon language spoken in the home. A small but growing body of research is beginning to look at how cultural and linguistic diversity impact literacy acquisition of students with severe disabilities. In a review of literature involving intervention research studies on literacy for students with autism or other developmental disabilities, Ming and Dukes (2009) report that only 4 of the 10 included articles included in their analysis referenced the home culture of the participants. The authors further report that of the 4 studies which did include cultural backgrounds of participants, none of them discussed culture or language as a variable in the literacy participation or acquisition of the participants. Likewise, Lanter, Watson, Erickson, and Freeman (2012) point to the absence of research into the impact of home languages on emergent literacy.

Of the eight participants, three (Sam, Dean, Anna) came from homes where English was the spoken language. Three of the participants (Ash, Bobby, Jo) came from homes where Spanish was the language spoken. One of the participants came from a
home where Amharic was spoken (Chuck) and one participant came from a home where Bengali was spoken (Garth). For the purposes of this analysis, participants were placed into one of two categories, English \((n = 3)\) or Other Language \((n = 5)\).

Overall all of the participants, regardless of home language, demonstrated mean increases between baseline and treatment phases in both experiments. Treatment means in letter-sound correspondence were very similar between the two categories, although the baseline means were higher for the Other Language category. This may be a reflection of Chuck’s high baseline scores in this area. In sight word recognition, the English category had a higher treatment mean than the Other Language category. Since both categories had similar baseline means, the English category had a greater difference in mean which may suggest that it was easier for the participants coming from English-speaking homes to learn the sight words, but not the letter-sound associations.

**Participant performance grouped by choice selection method.** For the purpose of analysis, participant performance data was divided into three categories defined by the simplicity of their choice selection methods. Students who do not have well-defined and clearly executed response strategies are often perceived as being unable to meaningfully participate in literacy activities (Erickson & Koppenhaver, 1995; Fallon et al., 2004; Kaderavek & Rabidoux, 2004; Zascavage & Keefe, 2004).

The first category is denoted as the simple category which included Sam, Chuck, and Jo. Participants in this category had a straightforward and easy to interpret choice selection method that they came to the intervention with already in place. The researcher did not have to negotiate or teach participants in this category how to make a selection or
communicate to the researcher that a selection had been made. All three pointed to their choice selections or picked up and handed their choice selections to the researcher.

The second category of participants is denoted as the idiosyncratic category which consists of Ash, Anna, and Dean. Thurman, Jones, and Tarleton (2005) define individuals who use idiosyncratic communication as students with “high individual communication needs” (p. 85). The authors suggest that the responsibility for successful communication with these individuals lies in the ability of their communication partners (teachers, researchers, peers, family) to learn and interpret the individualized response and communication cues of the individual with high communication needs. All of the participants in this category required some level of choice selection instruction, intervention, or negotiation.

While Anna had a strong and steady eye gaze already in place, she needed to practice the process of moving her eyes from the researcher’s face, to her choice selection, and back to the researcher’s face to indicate her choice selection prior to beginning intervention. Ash, while physically capable of pointing to or picking up a choice selection, was hampered by his need to ritualistically and repeatedly touch materials. The researcher negotiated with Ash through a series of trials and errors in order to find a selection method that worked for him and was clear to the researcher and IOA observers. The final and successful choice selection method involved Ash using the researcher’s hand as a pointer to make his selections. Likewise, while Dean was physically capable of making a choice selection, he was also impeded by his engagement in a ritualized response pattern. Regardless of whether or not Dean knew the answer to a
request, he began at one end of the visual array and moved systematically across the responses. The researcher worked with Dean to break this pattern and eventually found that requiring him to place his open hands on the researcher’s upturned palms prior to making a selection, helped Dean to visually focus on the choice selections and increase his correct responses by breaking the ritualistic response pattern.

The third category of participants is denoted as the behaviorally challenged category. Participants in this category, including Bobby and Garth, were both physically capable of making a choice selection. However, for both of these students, behavioral issues impeded their ability to make selections. Garth grabbed at materials within his reach and threw them on the floor. The researcher compensated for this behavior by holding the choice selections just barely out of Garth’s reach so that his outstretched fingers would brush against the target he was attempting to grab without him actually being able to grab the material. However, at times it felt to the researcher that Garth was putting more concentration into grabbing materials, than into selecting the correct response. Bobby’s behavioral challenges made it difficult for the researcher to gain or direct his attention to the choice selections. When the intervention took place in a large room, Bobby would get up and run from the table throughout the session. He also hid his face in his shirt and obsessed over smelling the researcher. Due to these behaviors his focus on the presented choice selections was often fleeting and twice an intervention session was concluded prematurely and prior to completing all steps due to extreme behavior.
Overall all participants across all selection methods demonstrated a mean increase from baseline to treatment phases across both experiments. As seen in Table 13, the aggregate treatment means of the behaviorally challenged category are lower in both letter-sound correspondence and in sight word recognition. The simple category had the highest treatment means in both experiments, but they also had higher baseline means resulting in mean differences that were similar to the idiosyncratic category.

It appears that once a choice selection method that works for a participant is found, idiosyncratic selection methods are as effective as simple ones. This is consistent with the literature base on literacy acquisition for individuals with communication needs. Behavioral challenges, however, did appear to impact the effectiveness of the participant’s ability to proceed as quickly in learning letter-sound associations and sight words as the other categories did.

**Participant Response to Group Instruction**

In response to research question three and for the purpose of this study, participants were divided into four small groups of two participants each for instruction in literacy (Group A, Group B, Group C, and Group D). These small groups of students were taught five target letter-sound associations and five target sight words using direct instruction through the ALL Curriculum. To begin with, participants were randomly assigned groups, after which changes were made to the groupings when scheduling conflicts or behavioral concerns were an issue. All groups were diverse across at least one of the variables discussed previously (primary disability, age, IQ scores, home language, or choice selection method). None of the participants were in a group with a
regular classmate. Detailed descriptions of each group’s response to instruction given in a small group setting are examined below.

**Group A.** Jo and Anna were the participants who comprised group A. They both fell into the physical disability category and both were between 13 and 14 years old. Jo, however, came from a Spanish-speaking home and had an IQ score between 40 and 45. Additionally she fell into the simple selection method group. Anna came from an English-speaking home, had an IQ score below 30, and fell into the idiosyncratic selection method category.

Jo in particular enjoyed the group aspect of this intervention. She tied to help Anna by moving her wheelchair closer or by pointing out the answer if she did not think Anna had gotten it right. When Anna was absent and Jo was tested alone, she demonstrated more difficulty concentrating because she kept repeatedly asking the researcher where the other girl was. (Jo used the ASL sign for “girl” combined with a shoulder shrug to ask about her group mate). While Anna accepted Jo’s attention, she did not seek it out, nor did she seem to notice if Jo was absent from a session.

Despite the differences in IQ scores, home language, and choice selection method both participants in this group demonstrated increased gains in letter-sound correspondence and in sight word acquisition as indicated by increased means in treatment over baseline phases across both dependent variables as seen in Table 11 in Chapter 4.

**Group B.** Participants in this group, Bobby and Garth, both fell into the behaviorally challenged choice selection method and home language as Other Language,
as their shared variable categories. Bobby had a primary diagnosis of autism, an IQ score that fell between 40 and 45, came from a Spanish-speaking home and was 11 years old. Garth, on the other hand, had a primary disability of intellectual disability, an IQ score that fell below 30, came from a home where Bengali was spoken, and was 16 years old.

Although the participants tolerated each other during group instruction, Bobby had a harder time waiting while Garth was given opportunities to respond. Conversely, Garth had no difficulty waiting while Bobby was given opportunities to respond. Despite the fact that both of these boys had significant behavior issues which impacted instruction and assessment during the intervention, they both did demonstrate some progress toward acquiring letter-sound correspondence and sight word recognition.

Behavioral issues not only disrupted group sessions, but may have contributed to this group having the overall lowest treatment means across dependent variables as shown in Table 11 in Chapter 4.

**Group C.** Sam and Dean were the participants who comprised group C. Their overlapping variable categories were English as a home language and IQ scores in the 40-45 range. Sam had a primary diagnosis of intellectual disabilities, a simple selection method, and was 12 years old. Dean had a primary diagnosis of autism, an idiosyncratic selection method, and was 15 years old.

Sam enjoyed the group interaction, asking for and giving high fives whenever he or Dean answered correctly. He liked to help Dean by pointing out correct answers if Dean got them wrong and by “telling” Dean to look at the choices. Sam imitated Dean’s ritualized clapping at times and sought connection to Dean whenever possible. Dean,
although less enthusiastic about his group mate, would go into Sam’s classroom to retrieve him for sessions. Dean began doing this on his own when the researcher would pick up Dean first and then go to Sam’s class on the way to sessions. Initially the researcher would open the door to Sam’s classroom, wave to the teacher, and motion for Sam to come. However, after a few sessions, Dean began to go through the door to wait for Sam to come along. Dean responded to requests for high fives from Sam, but never requested them himself.

Despite differences in primary disability, selection methods, and ages, both participants in this group demonstrated increased means in treatment phases over baseline phases in letter-sound correspondence and in sight word recognition as seen in Table 11 in Chapter 4.

**Group D.** The participants in group D, Ash and Chuck, shared a primary diagnosis of autism and came from homes where English was not the home language. Chuck’s home language was Amharic; he fell into the simple selection method category, had an IQ in the 40-45 range, and was 15 years old. Ash’s home language was Spanish; he fell into the idiosyncratic selection method category, had an IQ in the below 30 category, and was 12 years old.

While this group did not interact with each other, they became competitive with each other for the researcher’s attention. Initially Chuck would not make eye contact with the researcher and did not want social reinforcement in the form of physical touch such as a high five or fist bump. Ash, however, sought out physical reinforcements and made steady eye contact with the researcher. As Ash began to engage in the sessions and
participate more enthusiastically, Chuck began to seek out eye contact and physical reinforcers from the researcher. By the end of the intervention, Chuck was competing with Ash to get the correct answer by reading the visual display upside down during Ash’s response opportunities, answering the questions, and then seeking reinforcement from the researcher. While Ash did not intervene during Chuck’s response opportunities, he did begin to respond more quickly to researcher directives in order to beat Chuck to the answer during his own response opportunities.

Despite the differences in IQ scores, home languages, choice selection methods, and ages, both participants in this group demonstrated increased gains in letter-sound correspondence and in sight word acquisition as indicated by increased means in treatment over baseline phases across both dependent variables.

**Unanticipated Findings**

This intervention study was designed to measure the effectiveness of the ALL Curriculum in teaching letter-sound correspondence and sight word recognition to middle school students with severe disabilities and complex communication disorders. Due to the challenges teachers face in teaching literacy to the population of students who do not use verbal language as their primary mode of communication, this research study was designed to target that population. The ALL Curriculum uses a multiple choice approach to literacy learning which does not require students to verbalize their learning. Therefore participants in this study were not required to use any verbal output to demonstrate their learning.
However, one unanticipated finding of this study was that one of the participants (Chuck) began imitating the letter-sounds and eventually the sight words. During the instructional portions of the sessions, Chuck would watch the researcher’s mouth closely as she made the letter-sounds and spoke the sight words. Chuck began imitating the sounds and then started spontaneously pairing the sounds with his choice selection. As he would touch or pick up the letter card for the corresponding sound, he would produce the sound. Chuck then began to make approximations of the sight words. By the end of the intervention, the researcher was able to hold up individual letter and word cards and have Chuck read them out loud.

Chuck’s teacher told the researcher that as the research study progressed, she noticed Chuck attempting many word approximations in the classroom. This was something he had not previously been observed doing. Additionally, the teacher and the teaching assistant both informed the researcher that Chuck’s parents had communicated with them that they were noticing him doing the same thing at home.

Another unanticipated finding was Ash’s dramatic increase in engagement as well as his discovery of an effective choice selection method. At the beginning of the intervention, the researcher had to work hard to engage Ash in the literacy activities. He often sat sideways to the table and materials. Additionally he had to be coaxed to make a choice selection from the presented options during the sessions. In the instructional portions of the sessions, the researcher used a hand-under-hand technique to facilitate Ash’s participation with the materials. Note that this was used only during the instructional portions of the sessions and not during the data collection portions of the
sessions. As the intervention progressed, Ash began to spontaneously place his hand on the researcher’s during instructional sessions and then began to take charge by directing the researcher’s hand. This eventually became his preferred method of selection. Ash would take the researcher by the wrist and use her hand as a pointer. He was able to generalize this choice selection method to other people including a former teacher and one of his teaching assistants. As Ash became more confident with the material as well as with his newfound choice selection method, his enthusiasm and engagement increased. Ash also began sitting up at the table, watching the researcher.

**Social Validity**

Video files, anecdotal notes, and teacher, assistant, and student interviews were sources of qualitative data and social validity. Overall, while literacy was considered an important component of the educational experience, according to the teachers interviewed at the Hartford Program, inadequate training and perceptions of student capabilities made working with this population of students with severe disabilities and communication disorders challenging. All of the student participants demonstrated progress toward letter-sound correspondence and sight word recognition, and most of them indicated that they enjoyed the intervention sessions.

**Teacher and teacher assistant responses to intervention.** While three of the four teachers agreed that functional literacy would help their students to navigate the world, one teacher expressed concern that her students had too many challenges to make literacy a focus of the daily curriculum. This is sentiment is consistent with the low expectations for literacy acquisition reported in the literature base (Agran, 2011; Bailey et
al., 2011; Browder et al., 2008; Copeland & Keefe, 2007; Downing, 2005; Erickson & Kopenhaver, 1995; Kliewer, 2008; Mirenda, 2003; Zascavage & Keefe, 2004). Most of the teaching assistants who accompanied students to sessions and conducted IOA observations expressed some doubt as to the functionality of literacy education for their students. However, as the sessions progressed and the student participants began to make progress, most of the teacher assistants became excited about the possibilities of literacy acquisition for their students.

Formal and casual conversations with teachers indicated that they had received very little formal training in teaching literacy skills to the population of students they were working with. Two of the teachers had received their literacy training on specific curriculums designed for learners with mild learning disabilities. Both of these teachers felt that working with students who did not have verbal language was an instructional challenge for them. One of the teachers commented that, “Assessing nonverbal students is the biggest challenge I face.” When asked what they would look for in a literacy curriculum, both of these teachers said that they would look for a curriculum that was geared toward students with limited or no verbal language. A third teacher was, at the time of the study, taking a graduate class in literacy, but it was literacy geared toward a population with mild disabilities and the fourth teacher, although an experienced teacher, was in her first year of working with students who had severe disabilities including students who were considered nonverbal.

Although it was obvious that the teachers, assistants, and staff at the Hartford Program were all dedicated to the students and wanted the best for them, low
expectations for students in literacy acquisition proved to be a potential barrier to literacy education for some of the student participants. Specifically, as an example, the researcher was told by teachers, assistants, and specialists that Ash would most likely not be capable of making progress toward the goals of the intervention. Indeed, while Ash did prove challenging to the researcher, he ultimately made the most overall progress from nonresponsive or barely responsive to fully engaged in the intervention and making progress toward the end goals of letter-sound correspondence and sight word recognition. At one point during the intervention a passing staff member commented, “You are teaching ASH sight words?” One of Ash’s former teachers participated in the final session because she wanted to experience him demonstrating his knowledge of the target sight words. Ash cooperated by correctly identifying all five sight words for her. Her comment about his progress was, “I want to know how to do this.”

**Student participant responses to intervention.** Overall the participants responded well to the intervention. All of the participants came willingly with the researcher when it was time for a session. When asked directly if they enjoyed learning to read Sam, Dean, Chuck, and Garth all responded positively by selecting the “Yes” card or with a vocalization and head nod or by smiling. Bobby and Anna gave no response to the question. However, whenever the researcher was in Anna’s room, Anna would direct her visual attention to the researcher and sometimes she would smile. Jo responded “No” to the question but did so with a big smile on her face. Jo appeared to enjoy the sessions as she would always stop the researcher in the hall and try to go with her even if the researcher was working with other students at the time.
Ash, Chuck, and Sam were the most enthusiastically engaged participants in the actual instruction. Chuck watched the researcher’s face carefully as she made the letter-sounds and pronounced the sight words. Chuck’s teacher and personal assistant both independently told the researcher that Chuck was making more sounds and more word approximations in class after the intervention had begun. The teacher also let the researcher know that Chuck’s mother had reported that Chuck was making more word approximations and sounds at home after the onset of the intervention. During sessions, Chuck began imitating the letter-sounds and sight words. During one of the last sessions, the researcher was able to ask Chuck to read the sight words out loud, which he was able to do, except for the word *yellow* which was harder for him to approximate than the other sight words. Chuck also began reading the sight words and letters upside down as they were presented to Ash who was seated across from him in order to beat Ash to the answer.

Sam delighted in his growing success in identifying the letter-sounds and sight words and demonstrated his delight by giggling, and dancing in his seat upon getting correct answers. As Sam began to master the targets, he also took pleasure in helping Dean by pointing out the correct answers for him during the instructional portion of sessions.

Ash became so engaged with sessions that he would refuse to leave the table or the room if there were any materials in sight. In one session, the researcher and IOA observer had to quickly hide all the materials to get Ash to leave the room for a fire drill. As Ash began to really learn the letter-sound associations and sight words, he would
express his delight in himself, by giggling and making eye contact with the researcher. He also decreased latency between directive “show me the letter that makes the sound mmm” and his response over the course of the intervention.

**Recommendations and Practical Implications**

Literacy is an important part of any education and every endeavor to include students with severe disabilities in that education is paramount (Agran, 2011; Bailey et al., 2011; Downing, 2005; Forts & Luckasson, 2011). Results of this study indicate that foundational literacy skills such as letter-sound correspondence and sight word recognition are within reach of students who have severe disabilities and communication disorders given direct instruction in a systematic curriculum such as the ALL Curriculum which is specifically designed for students who require a high level of support in demonstrating understanding. These findings corroborate the results in existing research (e.g., Allor, Mathes, et al., 2010; Browder et al., 2011, Light & McNaughton, 2009).

**Authenticity**

One of the goals of this study was to replicate the original research but in an authentic setting to determine if the ALL Curriculum was effective in a classroom situation. The original research done by Janice Knight and David McNaughton was all conducted in a one-to-one setting, as was the pilot study. The current study was conducted with small groups of students in a school setting to replicate the way that a teacher might need to conduct instruction to accommodate time constraints. Ming and Dukes (2009) point to the need for intervention studies to be based on research questions which address “the reality of applied settings” (p. 91). In the current study, research
question three addresses the use of small group instruction in a school setting in order to address authenticity. During the course of the current intervention, sessions were impacted by fire drills, interruptions from other adults and students, sick or absent participants, time constraints, schedule changes, and snow days. All of these events are everyday realities in a classroom and therefore ultimately have an impact on the fluency of any lesson. Since the authenticity issue was addressed in one of the research questions for this study, the findings of this study may suggest the possibility that the ALL Curriculum is an effective intervention for use in a classroom.

**Setting and time.** As described in chapter 3, the intervention sessions took place in a variety of settings within the Hartford Program’s building. Many of these settings were classrooms or other multiply used spaces such as the library with teachers, assistants, and students coming and going throughout session. The busy atmosphere of the majority of the settings for the intervention sessions was reflective of instruction in a typical classroom where teachers rarely have the opportunity to instruct students, even in small groups, in isolation.

Additionally, time was a constraint during the course of this study due to scheduling issues. Although the researcher aimed to have 45 minutes to an hour with each group, the reality was that the researcher often had no more than a half an hour to conduct the sessions due to a myriad of typical school-related issues. For example, scheduling time around lunch, electives (art, music, gym), community vocational experiences, and special events was challenging. This meant that often, sessions had to be
fit into a shorter than desired time frame. Student issues, such as toileting, positioning, and behavior also impacted the amount of time in any given session.

In an analysis of settings and times, three of four groups (A, C, D) had higher treatment means in the later afternoon or in the time period immediately prior to lunch. Groups A and C demonstrated the lowest treatment means during the time period right after lunch, from 12:00 to 1:30. Group D never met during that time. Group B demonstrated no pattern of preference in times. Two of the four groups performed best in the library with Group A demonstrating the highest treatment means in the OT/PT room. No pattern of preference appeared for setting of intervention for Group B.

**Participants.** Teachers rarely get to determine which students will be in their classes. They are charged with providing instruction to whichever students may be in their class in any given year. In order to replicate this classroom reality, all of the participants for the current study came from one small school. While all of the participants met the inclusion criteria for this study, had there been a plethora of participant options, the researcher might have selected differently. As it was, the participants who ended up in the study represent a diverse group of learners. Additionally, because participants were put into small groups that crossed classrooms, the researcher was working with participants who were not accustomed to being in class together.

**Recommendations for Practitioners**

The results of this study indicate that students with severe disabilities and communication disorders can make progress toward learning foundational literacy skills.
Low expectations for literacy acquisition have historically been a problem in the field of education and a barrier to literacy acquisition for these students (Kliwer, 2008). Teacher perceptions of a student’s inherent ability to gain literacy skills may result in the exclusion of that student from literacy opportunities.

An important finding in this study is that IQ level did not predict performance in acquisition of literacy skills. Anna, who had no standardized test score except for the Bayley Scale of Infant Development on which she scored at the three-month level, had some of the highest mean differences between baseline and treatment phases across both dependent variables. Likewise, Ash made considerable progress toward acquisition of the target skills, although he was considered by teachers, assistants, and specialists to be incapable of performing the tasks required in the intervention. So it would be important for practitioners to not exclude students from literacy opportunities based upon IQ scores.

Additionally, primary disability made little difference in participant performance on letter-sound association and sight word recognition in this study. It is important for a disability category, like IQ scores, to not become an impediment to literacy opportunities for students. When instruction is direct and systematic, students from all disability categories can make progress. While all of the participants with autism in this study demonstrated stereotyped behaviors associated with autism, they were all capable of making progress in the target literacy skills. Participants with physical as well as intellectual disabilities had the lowest mean differences across dependent variables even though they demonstrated progress toward acquisition of letter-sound associations and sight word recognition. This might indicate that for this population, progress may be
slower than in groups where there are no physical limitations. Indeed, both Anna and Jo did tire more quickly during sessions, because they had to work physically harder to make selections. Jo in particular had to work hard to stabilize her trunk, so that she could use her arms and hands for selection. It is unknown if she would not tire as quickly if she was able to sit during the intervention in the adapted chair she used in the classroom. Anna was often very engaged at the beginning of sessions, but would lose focus by the end. Sometimes she seemed uncomfortable in her wheelchair and might have needed repositioning. Therefore, it would be important for practitioners to remember that when working with students who have physical disabilities, sessions may need to be shorter to accommodate the physical effort involved in providing responses. Ensuring that students with physical disabilities are in stable and comfortable positions may also help to improve focus and attention to lessons.

While all participants across all age categories made progress toward acquisition of the target letter-sound associations and sight word recognition, participants in the oldest group did slightly better in sight word recognition than the other two groups. *You are never too old to learn* is not just a cliché, but a reality for students with severe disabilities. As found in this study the older students learned as well, if not better than, the younger students. Even at 15 to 16 years of age, these students still have many years in the school system to work on literacy skills. Considering the progress made by these students in a four-month intervention which took approximately 45 minutes, three times a week, it is exciting to think about how much progress these students could make over the course of years of receiving direct and systematic instruction in literacy skills.
Behavioral concerns did appear to impact participant progress in this study, although even the participants who demonstrated considerable behaviors during intervention made some progress toward letter-sound association and sight word recognition. Bobby demonstrated better focus when the researcher was better able to control the environment such as in small rooms like the speech and OT/PT rooms. In these spaces, the researcher was able to place Bobby’s seat in such a way that he was unable to get up and run around or to slide under the table. Practitioners may want to look for ways to contain behavioral issues, but should not consider them as preclusions from opportunities for instruction in literacy skills.

**Limitations**

Due to the nature and scope of this study and although the results are encouraging, there are several limitations that must be considered in interpretation of this study’s results. Three major limitations include the time and duration of the study, the participants, and the researcher as the intervener.

**Time and Duration of Study**

This study was conducted over a relatively short length of time. Due to logistical issues such as receiving back all signed consent forms and developing an intervention schedule that accommodated everyone’s needs, the first baseline session did not occur until April 2014. The last intervention session took place on the final full day of school for the year on June 2014 for a total of 10 weeks, not including 1 week of spring break which occurred after the fifth baseline session. The proposed schedule of sessions included plans for each group to be seen for 45- to 60-minute sessions, three times every
week. However, there were many days on which any one group was unable to meet due to participant absences, assemblies, or schoolwide field trips. Additionally, the researcher rarely had an entire hour with any one group due to previously discussed issues such as behavior and toileting issues.

**Participant Limitations**

Another limitation in interpretation of the results of this study is that of the small participant sample size. Although there were only eight participants in this study, the extensive data collection across two experiments (letter-sound correspondence and sight word recognition) over 19-22 sessions presents ample opportunities for the examination of change over time. An additional limitation is the use of multiple choice as a means of participant responses. Use of multiple choice may have resulted in higher variability with some falsely correct responses based on a one in four chance of a correct response regardless of participant knowledge. However, because all of the participants were functionally nonverbal, multiple choice was the only response mechanism that would allow them to demonstrate their knowledge of the literacy targets being taught during the intervention. Further, multiple choice is an explicit foundational component of the ALL Curriculum, which is specifically designed for use with students who have limited to no verbal language.

**Researcher as Intervener**

An additional limitation to this study is that the researcher was the one to conduct all of the intervention sessions across baseline and treatment phases for both experiments. The researcher has 28 years of educational experience, 15 of which are with students who
have severe disabilities and communication disorders. As a result, the researcher could rely on past experiences which made it easier for her to find ways to work with those students who fell into the idiosyncratic method selection category. All of the teachers of the participants had five or fewer years’ experience working with the population at the Hartford Program and two of the four were in their first year with this population.

**Future Research**

Future research needs to be conducted using the ALL Curriculum with new and inexperienced teachers. Because the ALL Curriculum is scripted, designed for learners who have limited to no verbal language, and includes the majority of materials, it may be an effective tool for novice (as well as experienced) teachers to use. The teachers in this study commented that working with and assessing students who are nonverbal was one of their biggest challenges. They also noted that their literacy training had been inadequate for the population they were currently working with.

Additionally, future studies should examine the effectiveness of a comprehensive literacy program involving all of the five identified area of literacy as interdependent aspects of a total literacy program: phonemic awareness, phonic, reading fluency, vocabulary development, and comprehension strategies. A longitudinal study would also provide greater insight into individual participant progress, since, as noted earlier, students with intellectual disabilities demonstrate a slower rate of acquisition of new skills.

Future studies should also focus on extending and replicating the current study since the research base for determining evidence-based practices is limited at this time.
Additional participant participation in similar studies would add to the findings of the current study. Further, replication with different participants may highlight some of the findings from this study involving participants with IQ scores below 30, older participants, and those whose home language is other than English.

Summary

Literacy is arguably one of the most important skills students will learn, for upon literacy hangs the ability to access information and to communicate. However, literacy expectations for students with severe disabilities and communication disorders have historically been low. Thus low expectations begin the cycle of a self-fulfilling prophecy in which opportunities are not presented and then a student’s disabilities are blamed for a lack of literacy acquisition (Agran, 2011; Erickson & Koppenhaver, 1995; Keefe & Copeland, 2011; Kliwer & Biklen, 2007).

In this study, all participants across all disabilities, ages, IQ levels, home languages, and choice selection methods demonstrated progress in acquisition of the foundational literacy skills of letter-sound correspondence and sight word recognition. Participants with IQs below 30 made as much progress as their peers with higher IQs. Participants with autism did as well as their peers with intellectual disabilities. Likewise, whether participants used eye gaze, third party pointing, or direct select, it made little to no difference in their ultimate performance in the intervention. Direct instruction presented in small group settings appeared to be effective in teaching participants two foundational components of literacy and the ALL Curriculum appeared to be an effective
curriculum for teaching letter-sound correspondence and sight word recognition to a
variety of participants working in small groups.

This study adds to the limited body of research in teaching students who have
both severe disabilities and communication disorders letter-sound association and sight
word recognition.
APPENDIX A

Pilot Study Participant Graphs

Cathy
APPENDIX B

Office of Research Integrity and Assurance
George Mason University

DATE: July 29, 2013
TO: Anya Evmenova
FROM: George Mason University IRB

Project Title: [475388-1] Effectiveness of the ALL Curriculum to Teach Basic Literacy Skills to Groups of Students with Severe Disabilities and Complex Communication Needs
Reference: 6004
SUBMISSION TYPE: New Project

ACTION: DETERMINATION OF EXEMPT STATUS
DECISION DATE: July 29, 2013

REVIEW CATEGORY: Exemption category #1 & 2

Thank you for your submission of New Project materials for this project. The Office of Research Integrity & Assurance (ORIA) has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

Please remember that all research must be conducted as described in the submitted materials.

Please note that any revision to previously approved materials must be submitted to the ORIA prior to initiation. Please use the appropriate revision forms for this procedure.

If you have any questions, please contact Karen Matsinger at 703-993-4208 or kmatsinger@gmu.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within George Mason University IRB’s records.
Document of Informed Consent: Parental Consent

Research Title: Using the ALL Curriculum to teach Letter-Sound Correspondence to middle school students with significant disabilities

RESEARCH PROCEDURES
This research is being conducted to see if the ALL Curriculum would be beneficial for teaching letter sound correspondence and sight word skills to high school students with significant physical and intellectual disabilities. If you agree to allow your child to participate in this study, the researcher will use the ALL Curriculum to provide direct reading instruction to your child two to four times a week, for approximately 20 - 45 minutes a session, for approximately 15 weeks. Sessions will take place in the participant’s class at their school. This will not replace the reading instruction your child currently receives at school but will be supplemental literacy instruction. Data will be collected to chart student progress. An objective observer chosen by the researcher will watch the video tapes/or accompany the researcher during intervention in order to provide inter-rater reliability. Interviews will be scheduled for parent and participant to be conducted at your convenience. Parent interviews may be conducted in person or over the phone. Participant interviews will be conducted in person.

RISKS
There are no foreseeable risks for participating in this research.

BENEFITS
The primary benefit for your child is that they will receive additional instruction in reading skills.

CONFIDENTIALITY
The data in this study will be confidential. Students’ names or information will not be attached to any data collected or used in any reports. All student names will be changed on any written reports.

PARTICIPATION
Your child’s participation is voluntary, and you may withdraw your child from the study at any time and for any reason. If you decide not to participate or if you withdraw from the study, there is no penalty or loss of benefits to which you are otherwise entitled. There are no costs to you or any other party.

CONTACT
This research is being conducted by Melissa Ainsworth from the Graduate School of Education at George Mason University. She may be reached at 703-380-9633 or mainswor@gmu.edu for questions or to report a research-related problem. You may contact the George Mason University Office of Sponsored Programs at 703-993-2295 if you have any questions or comments regarding your rights as a participant in the research.
This research has been reviewed according to George Mason University procedures governing your participation in this research.

**CONSENT**
I have read this form and agree to participate in this study.

_________________________
Parent or Legally Authorized Representative

_________________________
Date of Signature

**VIDEO AND AUDIO TAPING**
Instructional sessions will be videotaped to help the researcher review every aspect of the group instruction. Additionally, the video tapes will be viewed by an objective observer in order to assess procedural fidelity and interobserver reliability. Interviews will be audio taped for later transcription.

_______ I agree to video/ audio taping.

_______ I do not agree to video/ audio taping.

Version date: June 2013
Assent Form

Assent Form for ALL Curriculum Study

1. Your class is going to start a new reading program.

2. This reading program may help you read better.

3. If you do not like the reading program you can say stop!

4. If you want to try the reading program write your name below or point to the picture of yes or no.

(see attached yes/no cards for pointing or eye gaze for those students unable to write their name)

name
Teacher Email Request

Dear Teacher,

Your school has been suggested by the FCPS Special Education Administration Team as a site for a research study involving some of your students with severe disabilities.

This research study is designed to determine the efficacy of group instruction in literacy using a curriculum called the ALL (Accessible Literacy Learning) Curriculum by Mayer-Johnson. This curriculum is specifically designed to work with individuals who have multiple and severe disabilities including communication difficulties.

I am Melissa Ainsworth and I will be conducting this research project. I am a former FCPS teacher of students with severe disabilities, parent of a child with severe disabilities and doctoral student at George Mason University.

I am happy to meet with you to further discuss the curriculum, the research study procedures or to answer any questions you may have. Please contact me at your earliest convenience to let me know if you would be willing to have some of your students participate in this literacy opportunity.

Thank you

Melissa Ainsworth, M.A., M.Ed.
APPENDIX C

Yes and No Cards

Yes

No

STOP
APPENDIX D

Researcher-Made Assessment Tool

Student___________________________________________ Pre-Test

Word set 1 ______________________
Possible additional words ______________________

Word + / 0

Lunch
bus
yellow
car
see
in
green
boy
girl
horse
home
happy

253
Comments and observations:

Student___________________________________________

Pre-Test

Letter set 1 ______________________
Possible additional letters ______________________

Letter + / 0

A
M
P
T
O
C
N
D
U
S
G
H
I

mad
sad
go

254
Comments and observations:

B

F
APPENDIX E

Sample Response Plate

Copyright ALL Curriculum 2009
APPENDIX F

Sample Letter and Word Cards
APPENDIX G

Sample Data Collection sheet

Data Collection Form 1
Assessment and Instruction in Sound Blending, Phoneme Segmentation, Letter-Sound Correspondences, Single Word Decoding, and Sight Words

<table>
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<th>Learner's name:</th>
<th>Circle one:</th>
<th>Assessment</th>
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<td>Instructor:</td>
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Summary of learner performance:
Number correct/10 trials
% accuracy
Error analysis

Comments

by Jessica Lott and David McNatt
© 2009 Naeve-Parrish
APPENDIX H

A Frame Pocket Chart
APPENDIX I

Laminated Sentence Strip
APPENDIX J

Researcher-Made Sample Response Plate

yellow
APPENDIX K

Scanning Procedure Sample Pictures

- bus
- dog
- eat
- drink
- banana
- pizza
APPENDIX L

Fidelity Check Sheets

Fidelity of Implementation – sight words

Observer’s Name: _____________________
Student’s Name: _____________________
Session #: __________________________

Directions: Please place a √ in the “Yes” box if the item was observed or completed. Please place a √ in the “No” box if the item was not observed or completed.

Item to look for YES – it was completed/done NO – it was not done/completed Comments?

Baseline – this will be the first 5 – 7 sessions per student

All 5 words were presented in a testing fashion.
The researcher gave the instructions “We are looking for” OR “Touch the word ____” and used it in a sentence.
Target words were presented with three other words on a visual array.
The researcher gave no additional help or instructions.

Teaching Time

Five (5) words were introduced and taught in the session using response cards.
Words were presented to student with systematically increasing foils up to 4 choices.
The student was given multiple opportunities to interact with the target word before moving on.

Testing Time

Four (4) words were presented each trial.
The student was given the instructions “We are looking for” OR “touch the word ____” and the word was used in a sentence.
The researcher did not give the student any additional instructions beyond “use your scanning”
Students were allowed to scan before asking to select their choice.
All 5 words were presented

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Fidelity of Implementation – Letter—Sound correspondence

Observer’s Name: ______________________
Student’s Name: ______________________
Session #: ____________________________

Directions: Please place a √ in the “Yes” box if the item was observed or completed. Please place a √ in the “No” box if the item was not observed or completed.

Item to look for

YES – it was completed/done
NO – it was not done/completed
Comments?

Baseline – this will be the first 5 – 7 sessions per student

All 5 letters were presented in a testing fashion. The student was given the instructions “We are looking for” OR “touch the letter that makes the sound ___” and given a word or two to clarify the sound. Letter sounds were used (not letter names) The researcher gave no additional help or instructions.

Teaching Time

Letter sounds (not names of letters) were used
Five (5) letters were introduced and taught in the session using response cards.
Letters were presented to the student with systematically increasing foils up to 4 choices. The student was given multiple opportunities to interact with the target letter before moving on

Testing Time

Letter sounds were used (not letter names) Four (4) letters were
presented each trial. The student was given the instructions “We are looking for” OR “touch the letter that makes the sound ___” and given a word or two to clarify the sound. The researcher did not give the student any additional instructions beyond “use your scanning.” Students were allowed to scan before asking to select their choice. All 5 letters were presented
APPENDIX M

Teacher Interview Questions

Thank you for all your support and help this spring! You all helped me so much with data collection! It was wonderful to get to know you and the students you work with. If you wouldn’t mind taking a moment to answer these questions - it will help me with the social validity aspect of my study (why it is important to teach literacy).

Thank you again for everything.

Melissa

Directions: Hit reply (not reply all) and answer the questions right in the email. Thanks!!

1. What role do you see literacy playing in your students' lives?

2. What experience have you had with literacy instruction for individuals with complex communication needs?

3. Since you sat in on one or more of the intervention sessions, how effective do you think the literacy intervention was?

4. If you answered “yes” to question 3, then what do you think made it effective

5. What is the biggest challenge in teaching literacy skills to your students who have severe disabilities and complex communication needs?
APPENDIX N

Student Interview Questions

1. Did you like working with me?

2. Did you like working with your group (name members of group?)

3. Are you a good reader?

4. Do you like to read?

5. Do you like learning to read?
REFERENCES


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Light, J. C., & Kent-Walsh, J (2003). Fostering emergent literacy for children who require AAC. *ASHA Leader, 8*(10), 4-29.


Literacy Council of Northern Virginia. (n.d.) *Literacy is a survival skill* [pamphlet]. Falls Church, VA: Literacy Council of Northern Virginia.


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Valiquette, C., Sutton, A., & Ska, B. (2010). A graphic symbol tool for the evaluation of communication, satisfaction and priorities of individuals with intellectual


BIOGRAPHY

Melissa K. Ainsworth, a native West Virginian, earned a B.A. in English in 1986 from West Virginia University with the idea of being a journalist. She earned an M.A. in English from the University of Wyoming in 1988 where she fell in love with teaching. After that she taught English at the high school and college levels until 1995. After the birth of her second child who has severe disabilities, Melissa pursued an M.Ed. in special education from George Mason University and graduated in 1999. She spent the next 14 years working in Fairfax County Public Schools as a teacher of students with severe disabilities and as an assistive technology specialist. She currently teaches in the Graduate School of Education at George Mason University.