

**SIGN IT, SAY IT, READ IT: THE EFFECTIVENESS OF AMERICAN SIGN
LANGUAGE AS A SUPPLEMENT TO READING INSTRUCTION FOR CHILDREN
WITH DOWN SYNDROME**

by

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Abstract

“Sign it, Say it, Read it” was a 16 session study designed to isolate and examine the effect of using sign language within a comprehensive reading program for students with intellectual and developmental disabilities. A group of 19 students were divided between a treatment and a control group. The treatment group received a comprehensive reading intervention augmented with explicit sign language instruction. The control group received the same comprehensive reading program, but without the sign instruction. Initial and final assessments were conducted of the entire group using a mix of standardized tests and informal inventories. For 16 sessions, a teacher at the Down Syndrome Research Foundation delivered a reading program specific to this population of students. In conjunction, two school reinforcement sessions occurred each week for the duration of the study. The pre and post-performance measure scores were analyzed using repeated measures analysis of variance, (ANOVA) and t-tests for within subjects and between groups. Significant results were found for within subject ANOVA tests. Large effect sizes were found for the treatment group when comparing between group paired t-tests. The findings suggest that this intervention is effective for students with ID/DD. It also appears that sign language augmentation favourably affects language and literacy outcomes. Follow up investigation using a larger sample size for a longer period of time is recommended.

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CHAPTER ONE INTRODUCTION

While learning to read can pose challenges for typically developing students, it is especially problematic for students with intellectual disabilities and/or developmental disabilities (ID/DD). Reading development is extremely complex. It involves multiple simultaneous cognitive processes and constant self-monitoring for comprehension (Brynes & Wasik, 2009). Traditional phonological and phonics based literacy instruction has been mostly ineffective for students with ID/DD. Research has shown that less than 25% of these students acquire basic literacy skills (Katims, 2001). There are new interventions created every year to address the academic and social needs of students with disabilities; however to comply with BC legislation and the response to intervention educational model (Ministry of Education, 2011), it is imperative to use evidence based interventions. Currently, there is a lack of evidence based literacy interventions for students with ID/DD (Hall, 2013; Simpson, 2005).

While students with ID/DD often have difficulty with phonology and auditory acuity, they also frequently exhibit strong visual skills. Teaching sight words, using visual techniques and incorporating gesture have all been recommended as effective intervention practices (Allor et al., 2009). Given the effectiveness of a visual learning style, employing additional visual methods may be an important tool for teaching students with ID/DD. Current “best practice” literacy techniques for this population will be explained in the literature review. The intervention delivered in “Sign it, Say it, Read it” used these methods and expanded upon them with the inclusion of sign language.

Purpose

The purpose of “Sign it, Say it, Read it” was to evaluate the effectiveness of a comprehensive reading program augmented with sign language for students with ID/DD. All members of the study population presented with Down syndrome. As detailed in Chapter 3, some participants had comorbid diagnoses of Autism Spectrum Disorder (ASD). The researcher wished to investigate if the use of sign language during a comprehensive reading program contributed to language and literacy gains for students with ID/DD. Although gains made by the control group throughout the intervention were of interest, the main point of examination was the effect of including sign language on language and literacy outcomes. The research goal was to demonstrate that explicit sign language instruction combined with a comprehensive reading program would have measurably better outcomes on the language and literacy skills of students with ID/DD than a comprehensive reading program alone. It is interesting to consider whether a sign-based reading program on its own, i.e. without spoken words, might produce enhanced literacy outcomes. As the prevailing direction in learning strategies leans towards multi-modal techniques this possibility was not explored.

Background

The researcher was motivated to undertake this study due to previous experience with a similar intervention delivered in 2012 at the Down Syndrome Research Foundation (DSRF) in Burnaby. This intervention was a pilot project, delivering 45 hours of individual reading instruction for students with Down syndrome (and some also with autism) between the ages of three and seven. The intervention was delivered over the course of a year in three different communities: Abbotsford, White Rock and Burnaby. Data from that project was analyzed by Dr. Paola Colozzo and her team at the Child Language and Cognition Lab in the School of

Audiology and Speech Science at the University of British Columbia. The study results indicated significant phonological awareness skill development and sight word identification acquisition at post assessment. Individual sight word gains were positively correlated to pre-intervention language ability in most cases.

The final results described by Colozzo, McKeil, Petersen and Szabo (2015) and several first hand observations by the researcher during the program implementation were influential to this study. As observed by the researcher, the incidental use of sign language appeared to be helpful for recall, positive reinforcement and language development.

Sign language was used incidentally and inconsistently throughout the program. At first sign language was a necessity due to the number of non-verbal students participating. When prompted with the sign, some students would recall which sight word the researcher was probing. While this does not demonstrate reading, it does indicate that students were learning the signs when presented with their sight words and that the signs served as an effective memory prompt.

Students also appeared to be motivated to say a word that they could sign. Perhaps the multi-sensory element of signing helps with initiation or perhaps supplying a sign makes them an active participant which increases the likelihood of involvement through speech. These observations are also noted by a small body of literature that suggests gains in IQ, language development, comprehension, and reading ability when using sign-augmented interventions (Daniels, 2004; Goodwyn, Acredolo & Brown, 2000). More information about this is included in the literature review.

Aside from the use of sign language during the pilot project, there were measurable

literacy and language gains. Findings from Colozzo et al. (2015) indicate significant gains in phonological awareness, sight word knowledge and language (expressive and receptive). Most of the participants in this project were non-verbal or demonstrated limited verbal communication. It was noted that the process of learning to read positively impacted their expressive and receptive language capabilities (Colozzo et al., 2015). The comprehensive reading program used for the Early Foundations program was customized for “Sign it, Say it, Read it.”

Conceptual Lens

The theoretical orientations behind this study came from multiple perspectives; behaviourism, cognitive-processing and social constructionism. The customized reading program used in “Sign it, Say it, Read it” incorporates elements that align with the principles of behaviourism, specifically Thorndike’s Laws of Connectionism (Slavin, 2003). Thorndike proposed the *Laws of Readiness, Identical Elements and Exercise*. The reading program used for the study was adapted to meet the *readiness* of each student; easier tasks always preceded more difficult ones. Each individual reading session used *identical elements* such as match, select and name (Oelwein, 2009) to follow a predictable schedule. In addition, the treatment group used sign in multiple situations to increase the chance of generalization. Using sign language instead of locally developed gestures, as some popular songs and literacy programs do (Lloyd, 1992), offered another identical element. This also ensured consistent implementation across settings and personnel. Finally, Thorndike’s *Law of Exercise* states that the more connections used, the stronger the bonds will develop (Tracey & Morrow, 2012). The reading program used in this study employed repetitive, multisensory stimuli to increase and strengthen connections.

Current cognitive/information processing theories echo Thorndike’s laws with emphasis placed on practice, retrieval and rehearsal. Models of cognitive development suggest that

practice is vital to cognitive growth (Pressley & McCormick, 2007). Once a task has been practiced multiple times it becomes automatic, this frees up short term memory for other tasks. If short term memory is not being used for the practiced task, then there is space to pay attention to new things. This can appear as greater competency and cognitive growth (Pressley & McCormick, 2007). Skills that are first linked to specific contexts are generalized with experience and automaticity (Pressley & McCormick, 2007). Eventually, skills learned in context are generalized to other situations.

Sign-augmented instructional sessions encourage students to process orthographic, phonological and gestural information. Presenting information in this multi-sensory manner enhances the reception of information and may allow for greater retention (Tracey & Morrow, 2012).

Key elements of Vygotsky's social constructivism theory (1978) were incorporated in the reading program. According to Vygotsky, external cultural forces (Pressley & McCormick, 2007) help with the development of cognition. Language is one of the biggest cultural factors contributing to cognitive development. Vygotsky believed that limited language would result in limited cognition (Bodrova & Leong, 2007). Typically students with ID/DD also have deficits in receptive and expressive language (Fidler, 2005; Winzer, 2008; Brynes & Wasik, 2009). Learning sight words in the reading program helps receptive language development. Sight words are taught in isolation (on flashcards), and in a generalized situation (books and play scenarios). Participants gain a deeper understanding of what the words mean by being exposed to them in different contexts. Sign language augments language development by providing both a receptive prompt and an expressive outlet for those with limited vocalizations.

“Say it, Sign it, Read it” also implemented Vygotsky’s widely recognized theory of the *zone of proximal development* (Tracey & Morrow, 2012). The zone of proximal development is a student specific level, which is optimal for learning; instruction and tasks are neither too difficult nor too easy. In this zone, tasks match the developmental level of the student and additional supports, called *scaffolds*, are implemented to ensure success. The study utilized scaffolds to provide the right level of support for both the control and treatment group. Examples from the study are: individual sessions with teacher support, visuals, task analysis, extra processing time, reinforcement activities, positive behaviour support and errorless learning (Oelwein, 2009). Sign language was used as an additional scaffold for the treatment group.

Individualized programing hinges on the success of the scaffolds used by the instructor to ensure tasks are in the student’s *zone of proximal development* (Pressley & McCormick, 2007; Bodrova & Leong, 2007). In a classroom setting with many students, it can be difficult to provide this support, because finding the zone of proximal development is contingent on knowing student abilities and supporting the student at their exact level (Pressley & McCormick, 2007).

The design and sequence of the reading program delivered in “Sign it, Say it, Read it” consciously incorporated elements of education and psychological theory to provide an effective, transferable program for students with ID/DD. The program was also modelled after a previous project taught by the researcher. The additional supplement of sign language was included because of both anecdotal first-hand experience and previous research that is detailed in the literature search.

CHAPTER TWO LITERATURE REVIEW

Students with developmental and/or intellectual disabilities (ID/DD) are an “at risk” group for learning basic literacy skills (Katims, 2001). These skills are often considered secondary to managing behavior or working on life skills. This is unfortunate, given the importance of basic literacy. Learning to read is a complicated process that requires, among other things, language comprehension and auditory acuity. Students with ID/DD often have receptive language and auditory processing deficits that can make traditional phonological awareness and phonics based literacy instruction especially challenging (Burgoyne et al., 2012, Brynes & Wasik, 2009). While inclusion fully integrates students physically into the classroom, extra intervention is typically needed for effective literacy acquisition.

According to Katims (2001), less than 25% of students with ID/DD acquire literacy skills necessary to functional in their communities. Research has established that these students often have strong visual skills and are more apt to attend to visual information (Broun, 2004, Broun & Oelwein, 2007). Given a predisposition to visual learning, existing studies validate sight word instruction as an effective way to learn to read (Bowder et al. 2006, Allor et al., 2009). Expanding on the sight word only method to include aspects of phonological awareness, concepts of print and comprehension has recently been recommended as the new direction of reading programs/research for students with ID/DD (Browder, 2008; Naess, Melvag & Hulme, 2012; Lemon & Fuchs, 2010; Burgoyne et. al., 2012; Allor et al., 2014). In addition to using a comprehensive reading program as described, various visual techniques (pictures, symbols,

graphic organizers) and gestures have been suggested to augment instruction.(Allor et al.,2009, Burgoyne et. al, 2012).

Sign language instruction is a popular reading and communication research topic for deaf or hearing impaired students. For this population, sign language may function as the primary form of communication. However, sign language has also been used as a support for students with typical hearing ability. Studies have demonstrated the statistically significant impact of sign instruction on receptive language, phonemic awareness, sight word retention and reading comprehension for typically developing students (Daniels, 1996, Daniels, 2004). Sign language instruction is multi-sensory; allowing for information to be received through multiple pathways. It is a concrete tool, both visual and kinetic, that assists comprehension and retention of abstract auditory information (Daniels, 2004). Please note that while multiple versions of sign language exist, American Sign Language (ASL) is the version referred to unless otherwise stated.

Some studies focus on the efficacy of different reading programs or approaches for students with special needs, and while they may make recommendations to include sign, they do not specifically examine its role in the intervention (Allor, 2009). There appears to be a limited body of research investigating the efficacy of sign assisted literacy instruction for students with ID/DD. Beecher and Childre (2012) provide a compelling and positive account of their study evaluating the effects of reading instruction and sign language for students of this population. However, their study has several limitations, mostly notably the exclusion of a metric to measure the effect of sign language and a sample size of three. The authors indicate the need for further research in order to garner statistically significant results.

Evaluating the effectiveness of sign assisted literacy is important for a number of different groups working with special needs students. Teachers, paraprofessionals and therapists

routinely provide literacy instruction. These professionals, as well as parents, will be interested in learning about additional tools to aid their literacy practices at work and at home. Researchers and administrators who design curriculum and make curricular decisions will want to know about literacy interventions that work for students with developmental disabilities. Including all students in classroom literacy instruction is difficult and appears to have limited efficacy. Additional effective tools are needed and will be welcome in the special education community.

In order to present the relevant research for this study, the literature search has been divided into two broad categories: reading interventions for students with ID/DD and sign language. These two categories are further broken down to show both a general and specific understanding of the research problem.

Reading Interventions for students with ID/DD

There is an identified lack of literacy assessment measures and curriculum specifically designed for students with ID/DD (Browder, 2008; Burgoyne et al., 2012). When the National Reading Panel report (2000) was completed, it produced guidelines for comprehensive evidence-based reading programs. However, students with disabilities were largely left out of their research (Browder, 2008). Reading programs for this population have focused on teaching sight words through flashcards, relying on visual strengths. Other aspects of reading such as phonological awareness, vocabulary and comprehension are slowly being investigated. This section of the literature review will present a summary for some of the relevant literacy research and interventions for students with ID/DD.

One body of research focuses on using the visual strengths of students with ID/DD. Learning sight words has been validated in multiple studies as an effective way to learn to read for this population of students (Bowder et al. 2006, Bradford et al. 2006, Burgoyne et al. 2012).

This method involves the memorization of flashcards with high frequency or high meaning words. Students with ID/DD rely on orthographic recognition to identify the printed word. The development of phonological and phonemic awareness is not addressed in this approach. The rationale behind this omission assumes that short-term memory and auditory deficits make phonological instruction too difficult (Beecher & Childre, 2012).

A successful sight word intervention is Oelwein's match, select, name method introduced in her book, *Teaching reading to children with Down syndrome* (1995). Students have repeated exposure to sight word flashcards. First, they match the word to the same word (both on flashcards), then they select a demanded word from a group and finally they read the flashcard. This process is repeated and practiced daily. This approach can be modified for non-verbal learners, with sign language replacing the vocal naming stage. The words introduced should be motivating and personalized books should contain practiced words. This approach is successful with visual learners (Oelwein, 1995, Broun & Oelwein, 2007). Not only do flashcards support literacy acquisition, but also research suggests that the orthographic print helps language acquisition (Megoni, Nash & Hulme, 2013). However, there are more components to literacy than just sight word acquisition; consequently, recent programs for students with ID/DD are focusing on a more comprehensive approach.

In a modified version of the original program, Broun & Oelwein (2007) expanded instruction to include phonological awareness after a requisite number of sight words is mastered. The approach was aimed at students with autism spectrum disorder (ASD), Down syndrome and other developmental disabilities. Phonics are introduced using a "top down" approach (Broun & Oelwein, 2007); first whole word recognition and then phonological awareness is practiced using the sight words acquired. The authors note that comprehension

remains a problem. Limited life experience and stereotypical interests can contribute to a narrow understanding of vocabulary. Lack of generalization of learned vocabulary to novel situations persists (Broun & Oelwein, 2007).

The methods outlined in *Literacy skill development for students with special learning needs* (Broun & Oelwein, 2007) are foundational for both the one to one reading and classroom programs at DSRF. Other locally developed activities and programs are used in conjunction. These alternate activities are included to create a comprehensive literacy program and the basis for these inclusions will be discussed in upcoming sections of this review.

Increasingly, researchers are focusing on expanding reading interventions for students with ID/DD to encompass more than just sight word instruction. A growing body of research is investigating the efficacy of phonological awareness training. Phonological awareness is the ability to manipulate individual sounds (phonemes) which subsequently helps with decoding whole words. This approach has been studied extensively in the typical reading population producing convincing results of its importance in the reading process (Stanovich, 1982; Lundberg, 2009).

Lemons and Fuchs (2010) wrote a meta-analysis regarding phonological awareness instruction for students with ID/DD, specifically students with Down syndrome (DS). The article gives an overview of the traditional sight word approach for teaching students with DS to read and how this method has often been used in isolation. This instructional focus ignores important recommendations of the National Reading Panel's report (Browder, 2006) which emphasized phonological awareness, comprehension and fluency in addition to sight words. Lemons and Fuchs (2010) reviewed 16 articles about the relationship between phonological awareness and

reading in adults with DS. They also included an additional four articles that investigate phonological awareness interventions for children with DS. The methodologies of these four studies are examined further as they relate to the study design of “Sign it, Say it, Read it.”

To be included in the meta-analysis, the studies needed to be written in English and published in a peer-reviewed journal. All of the studies featured one to one sessions, three with an instructor and one with parents. The delivery model of “Sign it, Say it, Read it,” is one to one instruction with teacher; there is no parent involvement for the 16-week study duration. It is important to note that interventions using parents are subject to many unknown and confounding variables. Interventions using teachers provide controls for certain factors: professional certification, knowledge of teaching and behaviour strategies and objectivity. While parents have expert knowledge of their child, their relationship can become a significant unknown variable.

The length of the studies was typically short, between three to five weeks long. Only one study was conducted over a 16-week period with five sessions of forty minutes per week. This study also had 15 participants which was the largest compared to the other three studies consisting of a range from three to seven participants (Lemons & Fuchs, 2010). The intervention delivered in “Sign it, Say it, Read it,” combined the best elements of the interventions described in this meta-analysis. The intervention was administered by an instructor, not previously known to the participants or involved in any assessments, the sample size was relatively large (19) and the duration was 16 weeks consisting of one 45 minute session and two 20 minute reinforcement sessions.

Upon analysis, it appeared that positive outcomes occurred for some, but not all participants during these interventions. Certain aspects of phonological awareness like letter name and sound correspondences appeared to be easier skills to acquire than rhyming or syllable segmentation (Lemons & Fuchs, 2010). In fact, in some cases letter name/sound correspondences and nursery song knowledge of students with DS were comparable to typically developing children (Snowling, Hulme & Mercer, 2002). However, these authors noted a wide disparity of study methodology in the reviewed intervention designs. While phonological progress was recorded in all interventions, “non-rigorous” design and small sample size question the significance of the outcomes (Lemons & Fuchs, 2010, p.327).

The authors made several suggestions based on their meta-analysis of phonological awareness studies and interventions. These suggestions include: reducing the cognitive demand of phonological awareness tasks by providing visuals, reducing the number of phonemes being targeted (three or four), ensuring sufficient treatment intensity and implementing strategies to teach generalization skills. Lemons and Fuchs (2010) also proposed that the combination of visual and phonics approaches may serve this population of students best because of unique characteristics resulting in atypical learning styles (Fidler & Nadel, 2007).

Pertinent conclusions from this meta-analysis were incorporated in the program design of “Sign it, Say it, Read it” which combined both sight word and phonological awareness instruction. The novel inclusion of sign language served as an extra visual scaffold. Other recommendations included in the study design were staggered phoneme introduction, a variety of reinforcement activities to practice phonological awareness, and practice extended to multiple contexts to support generalization. The length and intensity of the intervention delivered in

“Sign it, Say it, Read it” was comparable to some the longer interventions mentioned in the meta-analysis, however it is still noted as a limitation (see Chapter Five).

Factors affecting the decoding ability of students with DS were the subject of a meta-analysis of eight articles (Naess, Melby-Lervag, Hulme & Halass Lyster, 2012). Eight articles met the author criteria; only two studies had more than 20 participants and three had 12 or less participants. The relationship between phonological awareness, vocabulary skills, and decoding ability was the center of investigation. The meta-analysis confirmed that orthographic word recognition skill is a strength for students with DS. Additionally, the findings propose that certain aspects of phonological awareness seem to be trainable for students with DS (Naess et al., 2012; Lemons & Fuchs, 2010). Interestingly the results suggest that their decoding skills are less closely tied to phonological awareness than the typical population (Naess et al., 2012) The authors speculated that short-term memory and vocabulary deficits appeared to play a larger role in decoding difficulties than phonological awareness. Recommendations to teach decoding using short words to help with memory issues echoed what Lemons and Fuchs (2010) also concluded from their meta-analysis.

Naess et al. (2012) expand the discussion beyond sight words and phonological awareness to focus on vocabulary. They supposed that for students with DS, decoding and comprehension skills would be compromised primarily because of receptive language (vocabulary) difficulties. This is applicable for students with ID/DD in general. Inherent deficits in language abilities are likely compounded by limited exposure to literacy tasks (Allor, 2009; Browder, 2006, Brynes & Wasik, 2009). Language, both expressive and receptive, plays a crucial role in reading development. Students will continue to struggle to decode words if their meaning is not comprehended (Brynes & Wasik, 2009).

As students with DS struggle with generalizing information from one context to another, intensive vocabulary support is warranted. The authors suggest repeated exposure, direct experiences with the target vocabulary and the use of everyday words as the basis for intervention (Naess et al. 2012). The reading program implemented in “Sign it, Say it, Read it” incorporated these recommendations by engaging in “read and do” activities. Students read about making cookies and then pretended to make cookies with kitchen objects or they read about a picnic and then set-up a pretend picnic. These activities, with additional sign language support, helped students to see vocabulary used in different situations and helped to attach concrete experience with abstract concepts. Naess et al. (2012) conclude that vocabulary deficits underpin reading difficulties and further research is necessary. The authors hoped that their findings would spur the creation of new vocabulary targeted interventions.

There is a small body of research that focuses on comprehensive reading programs for students with ID/DD. In a practical article, Allor et al. (2009) describe six key components of basic literacy instruction for students with intellectual disabilities: phonological awareness, phonics, word recognition, fluency, comprehension, and language development. In the article, these six components were combined to create a comprehensive reading program which was based on Early Intervention in Reading (Mathes & Torgesen, 2005). The authors modified this program to create their own version entitled, Foundation Level (Allor, Mathes, & Jones, 2009). This program stressed the importance of using meaningful topics to engage the student’s interest, keeping instruction fast paced and repeating material in different ways until mastered. The article charted the progress of three students described in case studies. These students received 26 months of instruction and demonstrated the ability to apply phonological awareness to decoding with explicit and repetitive teaching. While Allor et al. (2009) did not specify the use of sign

language as a visual aid; they do suggest the use of gestures to aid with comprehension. The connection between receptive language and reading ability was emphasized again, similarly to Lemons & Fuchs (2010) and Naess et al. (2012). While the findings of this article are interesting because they demonstrate the use of a comprehensive reading program with students with ID/DD, the methodology is limited due to the small sample size and the lack of a control group. Allor, Mathes, Roberts, Cheatham and Otaiba (2014) remedied these issues in a later investigation. This time they conducted a longitudinal study investigating the effects of a comprehensive reading program delivered daily. The study involved 141 students with ID divided between treatment and contrast groups. Significant gains were made by the treatment group, demonstrating the importance of a comprehensive program delivered intensely and over a sustained amount of time.

In 2008, Browder, Ahlgrim-Delzell, Courtade, Gibbs and Flowers completed the initial phase of a five-year intervention study. Browder et al. note three important outcomes from the study: the development of a comprehensive reading curriculum called the Early Literacy Skills Builder, the development of an appropriate measure called the Non-Verbal Literacy Assessment and the comparative effects of their curriculum versus a traditional sight word program (Browder et al. 2008).

The planned five-year study was evaluated during its first year with pre and post tests occurring at the beginning and end of the school year. All students had IQ scores ranging from moderately to profoundly disabled. The 23 participants were randomly assigned to either treatment or control group. The control group was taught using Edmark, a commercial sight word and picture program, with additional story based lessons to develop concepts of print. The treatment group was instructed with the Early Literacy Skills Builder program and the additional

story based lessons identical to the control group. Teachers were trained and intervention fidelity was monitored during the program with 55 observations over the course of the school year. Medium to large effects were noted in the treatment group for receptive and expressive language, phonological awareness and concepts of print (called conventions of reading in this study). Twenty-three participants is not a large number; however the study design and length are both exemplary. Implications for practice noted by Browder et al., (2008) are the ability of students with ID/DD to engage in a comprehensive program including phonological awareness, decoding and comprehension, the need for curriculum and measures specific to this population and the advantages of a longitudinal study.

A study by Burgoyne et al. (2012) also examined the efficacy of a comprehensive reading program for students with developmental disabilities. The authors created a program in conjunction with Down Syndrome Educational (DSE) and York University. The program is specifically targeted to improve the literacy and language skills of children with Down syndrome between the ages of 5 and 11. It includes techniques that leverage the common strengths of Down syndrome students and generally effective reading and language intervention strategies.

The DSE program is clear and comprehensive. The introductory section of the handbook gives a general description of the intervention, explains for whom it is intended and gives a common developmental profile of a student with Down syndrome. The second section of the handbook presents the sequence of the intervention, assessment measures and links to resources. The final part of the handbook discusses the evaluation study of the intervention. The aim of the DSE program handbook is to present a thorough, ready to use language and literacy intervention.

Prior to the teacher's handbook publication in December 2012, a randomized control trial of the intervention took place in different public schools in the UK. Fifty-seven students ranging in age from 5 to 10 years old participated in the study, five days a week for a total 40 weeks. The authors used a waiting list control design, where half of the participants started after 20 weeks. Testing occurred pre-intervention, at the 20-week point and post intervention. Most improvements were detected during the initial 20-week period; small to moderate gains were noted on sight words, phonemic blending, letter/sound knowledge and taught expressive vocabulary (Burgoyne et al., 2012). The participants, who were both young and had good receptive language scores, seemed to make the most gains during the intervention. Overall, the intervention yielded non-significant results and a perceived lack of generalization. The authors felt that given the lack of meaningful improvements over 40 sessions, there was a need to re-evaluate the program and conduct further research on how best to improve aspects of reading and language development for students with ID/DD (Burgoyne et al, 2012).

However, this was only one study evaluating the program and there seemed to be a discrepancy between the program described in the handbook and the program taught during the study. Differentiated and individualized aspects of the program were sacrificed during the study in order to create a unified curriculum. Instructors were given pre-prepared and scripted lessons. This is a contradiction to the meaningful and individual program described in the handbook. It could be that a set program was not sufficiently motivating for students. This was also a consideration of "Sign it, Say it, Read it." In order to have a program ready for implementation in school settings and be controlled for assessment purposes, set materials were used. This is contrary to the Oelwein (1995) individualized program which is usually delivered at DSRF. Instead a homogenous program was implemented differentiated by skill level only and not

individual interests. Perhaps if each participant had been given a truly individualized program the results would have been different.

Sign Language Assisted Literacy

American Sign Language (ASL) is a popular language in North America with unique syntax and pragmatics (Daniels, 2004). Its popularity as a language grew in the 1960's with formal publications describing structure and conventions (Stokoe, 1960). Many studies cite the influence of ASL on the learning outcomes of deaf children. There is also a small, but interesting body of research from the 1980s and 90s dedicated to demonstrating the effects of ASL on the literacy skills of hearing children. These studies focus on spelling ability (Hafer, 1984), vocabulary retention (Daniels, 1996, Holmes & Holmes, 1980) and combinations of skills to evaluate reading ability in general terms (Daniels, 2004, Felzer, 1998).

An important study by Daniels (2004) evaluated the effects of sign assisted early literacy instruction with typically developing kindergarten students in the US. The study aspired to reproduce and modify an earlier 18-month pilot project in the UK called Sign in Education (Roberts, 1997). Two typical kindergarten classes formed the treatment and control groups in a rural school in Vermont. Both of the groups were heterogeneous in terms of social economic status and homogenous in terms of English language ability (Daniels, 2004). The treatment group's teacher instructed the class with ASL from the beginning through to the end of the school year. The manual alphabet and finger spelling were used to teach concepts of phonological awareness. Circle time stories were augmented with ASL for vocabulary and comprehension questions were posed in ASL. Daniels (2004) evaluated the receptive and expressive language, ASL ability, and emergent reading level of the participants over the course of a school year. Similarly to Sign it, Say it, Read it, pre and post tests were administered to

assess receptive language, Peabody Picture Vocabulary Test (PPVT) and expressive language, Expressive Vocabulary Test (EVT). Daniels also tested pre and post intervention comprehensive reading ability (sight words, phonological awareness, concepts of print) utilizing the Reading Recovery Observation Study (Daniels, 2004).

The results indicated significantly larger gains for the treatment groups on all outcomes except for concepts of print (in which the groups performed similarly). Interestingly, the use of ASL did not have negative effects on the participants' expressive language skills. These findings influenced the intervention delivered in "Sign it, Say it, Read it." These results, gains in language and literacy because of ASL support, were what the author hoped to demonstrate with a sample of special needs students.

Sign Assisted Literacy for Students with ID/DD

The second body of research about sign language reviews its effects on the language and literacy for students with ID/DD. One of the common concerns of using sign with students who are non-verbal or have limited vocalizations is that they will rely on sign and not develop expressive language. A study by Goodwyn, Acredolo and Brown (2000) demonstrates no delay of expressive language due to the use of sign. This large study examined the effects of using gestures when teaching language to toddlers starting at 11 months and continuing until 36 months, measuring five different age intervals for both receptive and expressive language. Three groups were used in the study, one receiving vocabulary instruction with consistent sign training, one receiving vocabulary training, and finally one receiving no training at all. The sign training group measured significantly higher on both language measures, in particular expressive language. The discussion suggests that perhaps the results can be attributed to increased infant

directed speech, child directed topic selection, and increased language scaffolding by using sign (Goodwyn, Acredde & Brown, 2000, Vygotsky, 1978).

Carbone et al. (2010) report similar results for students with ID/DD. The authors created a study by conducting discrete trials of specific applied behavioral analysis techniques in order to increase the vocal requests of children with ID/DD. The study concluded that the use of manual sign language did increase the students' ability to vocalize requests. This is relevant to the research topic because it demonstrates that sign does not have a negative effect on expressive language. A sample size of three students however limits the ability to generalize results to a larger population.

Sensenig, Mazeika and Topf (1989) were interested in looking at the effects of sign language when used to augment a sight word reading program for students with ID/DD. The authors conducted a study of 15 equally mixed male and female teenage subjects with standard IQ scores ranging between 30-50. Exact Signed English was used in conjunction with sight words for the treatment group and only sight words were introduced to the control group. The authors reported significantly better sight word identification results for the treatment group and recommended signing as both an interesting addition to educational practice and an area for further research.

Beecher and Childre (2012) examined the current literature, noted several effective current practices and identified a gap in the research. Most reading interventions for students with ID/DD focus on practicing isolated skills, like sight words or letter/sound relationships. In their literature search, the authors provide examples of successful comprehensive reading programs and other examples of how sign language enhances language and literacy for students with ID/DD. They conclude their literature search by identifying that the combination of

comprehensive reading programs and sign language integration had not been previously addressed. The authors hoped to create a superior method of reading instruction for students with ID/DD.

They designed a study to investigate the effects of a comprehensive reading program with the aid of a consistent visual support, i.e. sign language. Their literacy program provided instruction on five key components of literacy: concepts of print, phonological and phonemic awareness, sight word recognition, vocabulary, and oral language/comprehension. Three students with ID/DD were selected to participate in a 45-session intervention. Their teacher was the primary researcher in the study. In order to evaluate progress of the comprehensive program, three standardized performance tests and two curriculum/program based tests were selected to provide pre and post intervention scores.

They used single-subject A-B design. A-B time series design establishes “A” the baseline period and “B” the intervention period. By implementing a baseline period, the subject serves as the control as repeated measurements of the dependent variable are taken to establish meaningful data (Beecher & Childre, 2012). During the baseline and intervention, probes occurred every fifth session to collect regular and reliable data. However, the probes were limited to letter, letter/sound and sight word knowledge. Probing only these three areas may have been a result of teacher/researcher bias during the intervention. Features of a single-subject design are baseline, intervention and reversal, but Beecher and Childre did not implement the reversal phase. By not using a reversal phase, perhaps they wished to avoid the ethical issue of withholding treatment. But, by omitting this phase, they lost an opportunity to get valuable information. There were no specific metrics introduced to assess the role of sign. Perhaps, if there was a reversal phase, they could have phased out the sign language component, and evaluated the effects.

The study's data analysis revealed significant growth in phonological awareness (letter/sound knowledge), sight word knowledge and listening comprehension. Although the results demonstrated efficacy of the program, several limitations of the study are noted. These are: the small sample size, the possible bias introduced by the dual role of teacher/researcher, and the need to isolate the effects of sign language on the intervention.

While Beecher and Childre (2012) designed their study to teach and measure five components of literacy, they did not implement metrics to isolate the impact of sign language on the reading program. The effect of sign language on the outcomes of the intervention is unknown, other than anecdotal comments by the researchers. The authors noted this point in the discussion and proposed that future research should implement an intervention "with and without sign language" to be able to measure its 'effect. (Beecher & Childre, 2012, p.499)

This study contributed more evidence about the role of language development on reading comprehension and the importance of phonological awareness on early literacy. The authors failed to present any new information on sign language as an effective tool, as they did not include any metrics to measure it. Although the study provides hope that sign language may be a valuable tool for literacy intervention, it does not provide supporting data.

Literature Review Conclusion

The study by Beecher and Childre (2012) combines both comprehensive reading programs for students with ID/DD and the use of sign language to support language and literacy outcomes. This study and the conclusion made by the authors provided the research idea of "Sign it, Say it, Read it." The researcher modified and expanded this study in order to isolate the effects of sign. Successful aspects of study methodology and key elements of comprehensive

reading programs discovered in the literature search were implemented in the design of this study. Additionally, the researcher applied previous teaching and curriculum design experience to customize the reading program for both the control and treatment group. The aim of “Sign it, Say it, Read it” was to evaluate best practice and add to the small body of research combining a comprehensive reading program and sign for students with ID/DD.

CHAPTER THREE METHODS

Overview

“Sign it, Say it, Read it” used an experimental, quantitative research design (Creswell, 2012). The study examined the impact of sign language on the language and literacy skills of 19 students diagnosed with ID/DD at the Down Syndrome Research Foundation (DSRF). DSRF is an education and research facility located in Burnaby, British Columbia. The 19 participants were assigned into two groups: treatment or control. The group assignments were completed using a matched random assignment strategy (Creswell, 2012, Johnson & Christensen, 2010). The control group received the identical intervention as the treatment group, but without the addition of sign language. The five-month study was conducted over 20 sessions, including 4 sessions for pre and post assessment.

A customized version of the DSRF one to one reading program was used for the intervention. This reading program incorporated different literacy components from both evidence based programs and locally developed teacher initiatives. Books from Reading A-Z (Reading A-Z, 2013) provided the weekly reading material and high meaning sight words chosen for each participant. Letter name and sounds were introduced and rehearsed each week with the Jolly phonics program (Lloyd, 1992). Phonological awareness activities developed by teachers at DSRF practiced letter name/sound correspondence, initial sound identification, and syllable and phoneme segmentation. Regular shared reading activities helped develop concepts of print and comprehension throughout the intervention. While many of these activities are used in the one to one reading programs at DSRF, the researcher compiled multiple sources and created a standard implementation for the purpose of this study. The result was an adapted and streamlined program ready to be delivered in a variety of settings: therapeutic, school and home.

The 19 students were distributed between the two groups and taught by one teacher at DSRF. The instructional material was identical for both groups. The reading materials were divided into three levels of difficulty. Participants were given materials from one of these three difficulty levels based on initial literacy assessments and ongoing formative observations. In addition to a weekly DSRF session, there were two reinforcement sessions each week delivered at the participants' school. Additional school sessions were necessary to achieve a more intense level of treatment (Ukrainetz, Ross & Harm, 2009; Warren, Fey & Yoder, 2007). However, there were other benefits to including the participants' schools. These included: training school learning resource teachers, additional intervention time/intensity, the inclusion of a specialized program within the school system and the potential to continue the program in schools after the conclusion of the study. In the special education community, many professionals comprise a team, however all too often they work in isolation. Specialized knowledge often remains in the hands of only a few. Bringing the program to schools demonstrated how to deliver an intervention model within the school system and how to train and involve more professionals. There were issues associated with extending the program to the schools; these are noted as limitations (Chapter Five). All school personnel involved were enthusiastic about the program and saw the value of being involved in the study. A survey evaluating the perceived value of the intervention is discussed in the results section (Chapter Five). An example of the survey is included as Appendix D.

Recruitment of Participants

There are over 20 students enrolled in the DSRF One to One Reading Program each term. Three teachers teach these students, the researcher being one of them. This is a popular program with a wait list for most terms. For this study the director of programs and services at

DSRF initially recruited 22 participants, both females and males, using the DSRF network of families, child development centres and school district learning service directors in both public and private school districts. In order to qualify for the study, the participants had to be new to the DSRF reading program, had to have a pre-kindergarten or kindergarten reading level, had to attend a local school and had to be between the ages of four and ten. All families and participants were unknown to the researcher. Recruitment took place over a period of ten weeks in the fall and winter of 2014/15. Prior to participation, all families were given a summary of the purpose, method and proposed dissemination of the study results. Participation in the study was voluntary and the participant families were aware that they could withdraw at any time. One potential family decided that they were unable to meet the weekly requirements of the study because they lived too far away. Another candidate sadly passed away two weeks before the start of the study. Finally, one family was dissatisfied with the assessment schedule and process. It appeared that they were expecting a language assessment similar to one they had at DSRF in the past. Upon withdrawal, the participant's assessments were removed and destroyed.

Consent

In order to undertake this study, five levels of consent were necessary. First, the Board of Directors at DSRF approved that the study could be located at their facility and involve participants recruited through their networks. The DSRF board also agreed to finance the study, paying for the teacher time and all student materials. Second, approval was granted from the University of Northern British Columbia, where the researcher was studying. The UNBC Research and Ethics Committee granted approval on August 1st, 2014. Third, all parents of the participants gave consent not only for their child to be involved in the intervention, but that their performance scores could be used in the research report and any other publications (see

Appendix A). Fourth, teachers and school principals gave consent. The teachers agreed to deliver the school reinforcement sessions and be listed as a teacher (numbered reference) in the research report if necessary. Finally, the principal at each school signed a consent form to allow the program to occur at their school (see Appendix C). These consent forms were approved by the UNBC Research and Ethics Committee.

Timeline and Budget

The study was conducted during the 2015 Winter and Spring terms at DSRF. The intervention occurred weekly for 16 weeks, with an additional four sessions for assessment. DSRF paid for the pre and post assessments and for the 16 weeks of intervention. The teachers at each participant's schools were not paid for their involvement. The researcher, as part of their thesis project, completed the program design, training sessions, preparation of materials, statistical analysis and write-up. All the materials were prepared at DSRF as part of the project.

Information and Training Sessions

The researcher prepared a one-hour presentation intended to give additional information to parents and answer any outstanding questions or concerns. This presentation took place in the boardroom at DSRF with the director of programs and services, the DSRF teacher and the researcher present. The session consisted of a Power Point presentation, written handouts and a question/answer period. The researcher reiterated information about the purpose and sequence of the study. General information was presented about the method, with a promise to provide comprehensive training for parents prior to the end of the study to ensure the continuity of the program. Many parents expressed interest in receiving this specific training so they could facilitate sessions with their children at home after the study's conclusion.

Two teacher training sessions were held at DSRF prior to the start of the study. These sessions gave learning resource teachers from each of the participants' schools a mix of theory, practical strategies and materials. Teachers were introduced to successful methods of reading instruction for students with Down syndrome through a power point and video presentation. The teachers, with feedback from the researcher, practiced practical strategies. An outline of reinforcement session activities was provided along with all necessary materials. A sample of the reinforcement session outline is included (see Appendix E).

After the training sessions, teachers left with a theoretical understanding of why the study was being conducted, practical knowledge and all required resources to deliver the content. Many teachers expressed excitement about being involved in the study and gratitude for receiving specialized training on how to instruct reading and related activities for students with ID/DD.

Several of the teachers were unable to attend the training sessions at DSRF, so the researcher travelled to their schools to deliver personalized sessions. An additional five schools were visited in Langley, Maple Ridge, Richmond, Vancouver and Coquitlam. The researcher ensured that all teachers were trained and had the necessary materials.

Several teachers emailed the researcher with questions immediately following the training and throughout the study. Many of the teachers expressed interest in continuing the program after the completion of the study. The researcher offered to be available to help teachers transition from the study to their own sessions.

Pre-Intervention Assessment

In order to assess the student's response to the intervention, pre and post intervention performance measures were conducted. There are several factors that can make the assessment of students with ID/DD difficult (Anderson, Farley & Tindal, 2015; Fawcett, 2004). These include behaviour issues, mental age versus chronological age, fine motor ability, and fatigue. In order to accommodate these difficulties, two weeks was allotted for assessment. All study participants received two pre-intervention assessment sessions at DSRF. In these two sessions a mix of standardized and locally developed tests were administered.

Five different performance measures were used to assess language and literacy. The Peabody Picture Vocabulary Test (PPVT-1V) and the Expressive Language Test (EVT-2) are both standardized, have high reliability, validity and alternate forms for re-testing (Brynes & Wasik, 2009). These two tests were administered by a registered speech language pathologist at DSRF. Both of these tests were given in one session with breaks to accommodate fatigue and boredom. The test order was controlled; half of the participants received the PPVT first and the EVT second while the other half received the reverse order. The combination of these two tests provided a reliable and detailed account of receptive, expressive and general language comprehension.

The DSRF head teacher administered the literacy pre-intervention assessment. The role of this teacher was only to assess students; they did not participate in the intervention in any other capacity. To assess literacy (phonological and phonemic awareness, sight word knowledge and concepts of print) three other measures were selected. The Test of Phonological Awareness (TOPA, 2004) was used as a standardized measure of phonological knowledge assessing initial sound identification. The Reading Readiness Screening Tool (LDAA, 2011), a diagnostic

measure for students with special needs, was used for letter names, letter name/sound correspondence and syllable segmentation. The Marie Clay Concepts of Print test was used to assess print knowledge. Participants were asked to read sight words from the pre-primer and primer Dolch word lists. This was conducted informally and was used to help put students in leveled groups. The validity and reliability of the latter three non-standardized measures is unknown and has been noted as a limitation of the study.

In addition to the speech language pathologist and teacher assessments, information was collected from parents. Parents were asked to complete a MacArthur Communication Developmental Index (MCDI) and a locally developed questionnaire. The MCDI is a parent reported language index; parents indicated sounds, words and sentences that their children have said. The second form, Words and Sentences, was used to accommodate the older than recommended age range for this inventory. This is not a standardized test, but helped provide additional information to create matched pairs for group assignment.

Parents of the study participants were also asked to complete a survey compiled by the researcher. The survey included questions routinely asked when starting a program at DSRF. These include questions regarding age, school, interests, hearing, vision or sleep abnormalities, current/past therapy sessions and dual diagnosis information, see Appendix F. One of the DSRF speech language pathologists also provided questions regarding behaviour and attention. The purpose of the questionnaire was to provide information to help group assignment, perhaps answer questions regarding outliers or study anomalies and provide resources to parents who expressed a desire for supplemental information. For example, individuals with DS are more susceptible to sleep apnea (McGuire & Chicoine, 2006), may consequently need therapy, and

specialized sleep equipment. Several information nights regarding sleep apnea were subsequently held which benefited those parents who had requested to receive more information.

Group Assignment

After all the pre-intervention language and literacy assessments were completed, their scores were used to create the study and control groups using matched random assignment. Scores were entered into a spreadsheet and grouped into two categories. The first category was called “Formal Testing.” This consisted of PPVT, EVT, and DSRF Literacy test scores. The participants were ranked in order of achieved percentage, which ranged from 0% to 45%. The second section was entitled MCDI and consisted of the scores on this test. Since this was a parent reported inventory, it was not included with the formal assessments. Once again the participants were ranked by reported percentage, which ranged from 1% to 60%. The rankings of the participants were re-assessed to determine whether their MCDI score increased or decreased their ranking in comparison with their formal score. Adjustments were made and a final ranking was produced. Additional data was entered with the participants’ scores to help create matched pairs. This data indicated whether a student had an additional diagnosis such as Autism Spectrum Disorder (ASD), used English as a Second Language (ESL), or had a dependence on sign language for daily communication. Eight matched pairs were created including one pair from each of the special categories noted above. Due to the uneven number of the group (19), the median student was excluded from the matched pairs. It was decided when the 20th student dropped out of the study that the extra student would be added to the treatment group when it was established. This was considered the ethical approach, enabling more students to get the treatment intervention.

Eighteen participants were paired and put into two groups. For example the two students who ranked the highest were paired and then randomly split into groups A and B respectively. Two identical pieces of paper bearing either an A or B were folded and placed in a container. The intervention teacher, in front of the researcher, decided that the first group to be chosen would be the “no sign” group. The teacher reached in and randomly chose the paper labelled Group A. This group consisted of nine students of varying assessment scores and special factors. The other group, entitled B, consisted of the matched pairs and the extra participant was added to create a group of 10 participants. Once the groups were formed, the researcher sent an email to each of the school teachers, indicating whether their student was in the “sign” or “no sign” group.

Program Description

The 16 week intervention portion of the study took place between January 26th 2015 and May 23rd 2015. Each week study participants attended an individual 45 minute session at DSRF and had two 20 minute follow-up sessions at their schools. If students were unable to attend their DSRF session, a make-up time was arranged (maximum of 3 sessions). Spring break was a one week break at DSRF and two weeks for most school districts. Participant attendance is noted and discussed in Chapter Four.

The sessions at DSRF followed a predictable structure, working on phonological awareness, sight words, book reading and concepts of print. A copy of the Session Outline is included as Appendix G. There are five components to each session: warm-up, letters, phonological awareness, sight words and reading comprehension/concepts of print. The 45-minute sessions included both direct instruction and reinforcement activities to ensure repetitive practice of these foundational literacy skills. Each of these five sections will be briefly described.

Warm-up. The purpose of the warm up was to entice the participant into the session. Creating an environment that will motivate the child to transition independently into a therapy situation was important. Different activities were offered and categorized into tactile (playdough, squishy ball, sand, rice), fine motor (blocks to stack, puzzles, ABC blocks), functional play (racing cars, trains on a track), symbolic play (tea party, making pizza, changing baby, putting animals in a barn) and music/movement (student selects a favourite song to sing and dance to).

Letters. During this section of the session participants worked on learning the names of the alphabet and being able to recognize the sound that corresponds to each letter. Those who already knew the letters and sounds began learning digraphs (wh, th, ch, sh) and word families (at, an, ap). Songs, tactile materials and toys were used to maintain motivation. The Jolly Phonics Program (Lloyd, 1992) was used with all students. This program sequentially teaches all 26 letter names and sounds with songs and actions. For advanced participants additional digraphs (th, sh, wh,ch) were also introduced using this program. In conjunction with Jolly Phonics, letter boxes (boxes labelled with letters and containing corresponding objects), leap frog (magnetic device which plays a song to match the letter inserted) and games (feed letters to a puppet, find letters with fly swatter, identify letters in an ABC book) were used. The iPad was effectively employed to offer a break while still practicing letters and letter sounds.

Phonological Awareness. Two aspects of phonological awareness were targeted: initial sound identification and syllable segmentation. Phoneme segmentation was also introduced with some of the advanced participants. Initial sounds were practiced in two different ways. In the first method, the teacher said the target sound and the participant selected which picture matched the initial sound from a choice of two. In the second method, the teacher placed two

letters on the table and said a word. The participant was asked to select the printed letter corresponding to the initial sound.

Syllable segmentation was practiced by singing a song, “Bee bee bumble bee can you clap this word for me?” Immediately following this song, participants were shown a picture of one, two or three syllable words. The teacher said the words and clapped the syllables; participants were prompted to follow and complete the same action. Eventually, participants were cued to complete this task independently.

A few participants were introduced to phoneme segmentation. Using a stretchy worm, participants stretched with each phoneme (sound) of a word. For example, Cat became C....A....T.... stretching the worm bigger with each letter. Participants with more advanced phonological awareness skills practiced this more often.

Sight Words. Sight word instruction included a combination of high frequency and high meaning words. The Dolch word lists are the most commonly found sight words in children’s literature and the Fry word lists are the most common words used in English. Words from these two lists were combined with personally motivating words to assist comprehension and sustain attention. Participants were grouped into three different reading levels according to pre-intervention assessment scores. There were four units introduced: animals, action verbs, cooking, and routines. Each unit spanned four weeks. The first three weeks were teaching new sight words and practicing reading the book. The final week was reserved for review. All units included concrete, hands-on activities to reinforce sight words, receptive/expressive language and text comprehension.

The Oelwein method (Oelwein, 1995), “Match, Select, Name”, was used to both introduce and practice sight words. Various additional props were employed to make the activity fun and to promote repetition. Some of these props include a frog or dragon puppet to feed the words to, a magnetic wand to pick up bells or chips on top of different words or a mailbox to select and mail words into. Whenever applicable, concrete activities were completed after reading the sight words and corresponding books. For example, participants learned sight words relating to and read a book entitled, “We Make Cookies.” Upon completion, students pretended to make cookies with mixing bowls, fake ingredients and toy cookies. These activities motivated students to read and practice their sight words. They also helped receptive language acquisition, by providing real-life context for the sight words (Hill & Lauder, 2010; Naess et al., 2102). Additional games were played, with the sole purpose of repetitious sight word reading. These games included, bowling(reading the words on pins knocked down), finding and swatting words with a fly swatter, mailing the words, singing a song with the words and putting the words on objects like toys trains or buses.

Reading Comprehension/Concepts of Print. In each DSRF session, a picture book was read aloud to the students. Aspects of shared reading such as predicting, making personal connections, answering ‘wh’ questions and relating story incidents to real life were techniques used during this story time. Basic elements of concepts of print were also practiced. For example students were asked to turn the pages, point to a word, or indicate where reading on a new page begins. Books about Pete the Cat were popular and included additional songs.

The reinforcement sessions at school followed a similar sturcture. The DSRF teacher made notes about the session and gave suggestions of activities on a weekly Reinforcement Session Outline (see Appendix E). During the training sessions, all of the program activities

were described to the teachers and there was time for practice and questions. During the interventions several teachers asked questions about the activities or sought specific clarifications. The researcher answered all questions and provided several emails with suggestions and updates to the group throughout the study. The school sessions were shorter than the weekly DSRF sessions. For that reason emphasis was placed on practicing the participants' sight words, reading their books and phonological awareness activities. If there was extra time, it was up to the discretion of the teachers to engage in other suggested activities from the session outline. At the end of the study the reinforcement session logs were collected and reviewed by the researcher.

Parental Follow-up Training

During the second week of post intervention assessment, a parental training session occurred. The purpose of the session was to give parents an overview of what the intervention consisted of (see program description) and to provide training with specific methods. Although all aspects of the intervention were demonstrated during the training session, emphasis was placed on sight word introduction and practice using the Oelwein method (Oelwein, 1995). The training closely followed the Early Foundations Training session that DSRF has offered to the parent community in the past. Parents were able to practice the Oelwein method and get feedback from the researcher and DSRF teachers who were present. Information was also presented on ways to continue the program through DSRF if desired. Further support via email to answer questions or to provide specific materials was offered to all parents in the hope that they would be interested in continuing practice at home.

Intervention Fidelity

The weekly sessions at DSRF were observed four times over the course of the intervention. Due to limited time, the researcher was not able to conduct observations at the participant's schools. Observations yielded two main findings. Firstly the intervention implementation during the one to one sessions at DSRF varied. Students with ID/DD possess a wide range of strengths and weaknesses. Often, due to deficits, motivation to attend to and complete tasks is variable (Winzer, 2008). Consequently, slightly different activities, reinforcers or approaches were used for some participants. Secondly, the implementation of sign was implemented in a controlled consistent manner and was the same for all participants in the treatment group. The lack of strict fidelity and school session observations is noted as a limitation in the study.

Post Intervention Assessment

Participants participated in two weeks of post-intervention assessment, which followed the same process as the pre-intervention assessment. Students were evaluated by a DSRF speech language pathologist on an alternate form (Form B) of both the PPVT and the EVT. As in the pre-assessment, half of the participants received the EVT first and half received the PPVT first. For the post-assessment, the order was alternated, so those who previously received the EVT first, completed the PPVT first. Both of these assessments were administered in one session, as noted in the Limitations.

The reading assessment was also completed in one session, by two teachers who were uninvolved in the intervention. The reading post-assessment was the same as the pre-assessment, except for the testing of initial sounds (TOPA) and sight words. The standardized TOPA test administered at the pre-intervention assessment was challenging for the participants.

The pictures were too small and abstract for correct identification, consequently less than 5% of participants were able to complete the test. Due to the limited results of the initial TOPA test, it was not repeated at post intervention or included in the data analysis. All of the sight words introduced during the course of the 16 week intervention were recorded and prepared as flashcards for testing at the post-assessment. Participants were asked to read the flashcards when presented by the teacher. Words that the student was able to identify (say, or in some cases, sign) were recorded.

Data Analysis

Data was collected from the six pairs of pre-intervention (T1) and post-intervention (T2) test scores. These pairs were receptive language, expressive language, letter names, letter sounds, syllable segmentation and concepts of print. Sight word data was recorded for T2 only. Three composite scores were tabulated: language, literacy and a total combination of all tests. The data was entered into SPSS for descriptive analysis, which resulted in a final data set described in Chapter Four.

CHAPTER FOUR STUDY RESULTS

This chapter presents the results obtained from pre and post intervention testing. The purpose of the statistical analysis was to determine if the mean differences between pre and post assessments were significantly larger in the treatment group. The Null Hypothesis (H_0) states that additional sign language instruction for the treatment group will make no difference to their language and literacy outcomes. This is interpreted to mean that in this study the means of the treatment and control group are equal. A non-significant difference between the groups will result in retention of H_0 . The Alternative Hypothesis (H_1) states that there will be a difference between the groups. This is interpreted to mean in this study that the means are not equal and that something has happened to create this scenario. A statistically significant difference detected when comparing the treatment and control group mean differences will result in the acceptance of the (H_1). To test H_0 the researcher used three types of analysis: repeated measures analysis of variance (ANOVA), independent t-tests and paired t-tests. The data were investigated by looking at both within subject and between group differences.

Participant Demographics

At pre-treatment the participants were 4 to 9 years old with Intellectual disability and developmental disabilities (ID/DD) (*mean age 6.11, range 4.6 -9.10*). All students had Down syndrome (DS). The definition of Down syndrome used for this study is an individual karyotyped as having extra genetic material on chromosome 21. Sub-classifications of Down syndrome as defined by further medical testing were not disclosed to the researcher. The completed parent questionnaires provided additional information regarding additional diagnosis, special medical considerations, second languages and preexisting or ongoing therapy. After

reviewing the scores of time one (T1) pre-treatment assessment, participants were divided between control and treatment groups using matched random assignment. This process involved creating matched pairs of students based on assessment scores and the additional information. The matching process resulted in two groups evenly divided on pre-existing ability/knowledge and secondary characteristics described in the questionnaire. Table 1 displays how these demographics were divided.

Table 1

Control and Treatment Group Characteristics

	Control Group	Treatment Group
Gender	5M: 4F	5M: 5F
Additional diagnosis	None: $n = 7$ ASD: $n = 1$ ADHD: $n = 1$	None: $n = 9$ ASD: $n = 1$
Vision corrected*	No: $n = 5$ Yes: $n = 4$	No: $n = 5$ Yes: $n = 5$
Hearing loss	Mild: $n = 2$ Significant: $n = 0$	Mild: $n = 3$ Significant: $n = 2$
Ear tubes during intervention	No: $n = 8$ Yes: $n = 1$	No: $n = 9$ Yes: $n = 1$
Second language	No: $n = 8$ Yes: $n = 1$	No: $n = 9$ Yes: $n = 1$
Disrupted Sleep/Apnea	No: $n = 7$ Yes: $n = 2$	No: $n = 8$ Yes: $n = 2$
ASL as primary communication	No: $n = 8$ Yes: $n = 1$	No: $n = 9$ Yes: $n = 1$
Concurrent therapy	No: $n = 4$ Yes: $n = 5$	No: $n = 4$ Yes: $n = 6$

Note: Vision may be corrected with glasses however participants often refused to wear them or took them off during treatment.

Two participants had significant hearing loss. One participant wore an frequency modulation system (FM), while the other participant relied on one ear for hearing.

Concurrent therapy refers to weekly or bi-monthly occupational therapy (OT), physio-therapy (PT) or speech and language therapy (SLP) therapy. If a participant received any of these services in less frequent intensity, it was not noted.

Descriptive Statistics

The assessment data were entered into SPSS v. 23 for all quantitative analyses.

Frequencies (mean, median, mode, standard deviation, range) were produced for all tests. Table 2 and 3 show these results for all literacy and language measures, respectively. Table 4 outlines the descriptive results as grouped into three composite scores: literacy, language and a total combination of all measures.

Table 2

Descriptive Statistics for Reading Sub-tests for T1 and T2

	Letter Name /26		Letter Sound /24		Concepts of Print /22		Syllable Segmentation /14	
Test Time	T1	T2	T1	T2	T1	T2	T1	T2
Mean	10	13	5	10	4	5	2	5
Median	6	15	0	10	5	6	0	6
Mode	0	1	0	0	5	6	0	0
Standard Deviation	11	10	8	9	7	3	3	4
Range	0-26	0-26	0-22	0-24	0-14	0-12	0-10	0-12

The mean increased in all literacy measures between T1 and T2. The standard deviation remained constant except in the case of Concepts of Print where it reduced by over 50 percent. Effect sizes (Cohen's d) were small for Letter Names and Concepts of Print. A medium effect, $d = 0.58$, was found for Letter Sounds and a large effect, $d = 0.85$, was found for Syllable Segmentation. Two participants performed at ceiling for letter names at T1 and T2. While five participants received a score of 0 at T1, only one participant was still at the floor at T2. A larger

effect was seen in scores for Letter Names. At T1 there were 10 participants who scored 0 and one who scored at the ceiling. At T2 there were only four still performing at the floor and two at the ceiling. For the Concepts of Print measure, minimal growth and effects were noted. There was no change in the number of participants at the floor or the ceiling. The largest effect was found for syllable segmentation where 10 participants scored 0 at T1 and only 5 at T2.

Table 3

Descriptive Statistics for language sub-tests T1 and T2

	PPVT* T1	PPVT T2	EVT** T1	EVT T2
Mean	29	34	23	27
Median	31	38	17	25
Mode	44	0	0	0
Standard Deviation	21	22	20	20
Range	0-82	0-77	0-58	0-55

Note: * Peabody Picture Vocabulary Test, ** Expressive Vocabulary Test

While the mean increased for both the PPVT and EVT between pre and post assessment, the effect sizes were small for both, $d = 0.2$. There was also little change found in the number of participants performing at the floor. There was one participant who scored 0 on the PPVT at T2 and two who scored 0 at T2. There was no change for the EVT with three participants performing at the floor for both T1 and T2.

As the data indicates there are statistically significant correlations between literacy and language outcomes at T1. A Spearman bivariate correlation was conducted due to the small sample size and nonparametric data. A statistically significant positive correlation was found

on all literacy and language measures $r \geq .465$, $p = .05$ except for concepts of print $r \geq .357$, $p \geq .05$.

Table 4

Descriptive statistics for composite tests T1 (pre-intervention) and T2 (post-intervention)

	Comp Lit. T1*	Comp. Lit. T2	Comp. Lang. T1**	Comp. Lang. T2	Total Comp. Lit/Lang. T1***	Total Comp. Lit/Lang. T2
Mean	22	33	52	59	74	93
Median	18	34	47	60	72	100
Mode	27	29	0,47	0, 94	117	148
Standard Deviation	21	22	39	41	56	58
Range	0-65	0-74	0-140	0-132	7-205	0-206

Note: * Composite Literacy score, **Composite Language Score, *** Total Composite Literacy and Language score

The composite scores consolidate information from Tables 2 and 3. Given that there were participants who continued to score 0 at T2, some case by case analysis was conducted. There were three participant scores that were at odds with the overall trend to improvement noted in the descriptives. Case 1 missed 5 of 16 sessions and did not show up for the final language assessment, despite several efforts to reschedule it. In spite of these deterrents, it was noted by the intervention teacher that this student made progress during the intervention, and did not score 0 on the T2 composite literacy. Consequently this case was retained for further analysis. Case 2 scored 0 at T1 due to non-compliance. This participant was unable to complete any part of the test at T2, this time due to emotional distress. The data for this case was removed from the treatment group for any further analysis. Due to concerns raised during the study, this

participant and their family received follow-up support. Case 3 was the top scoring participant in the treatment group at T1. Unfortunately, her score at T2 did not represent her knowledge. For example, they scored 22/24 for letter sounds at T1 and 3/24 at T2. It is unlikely that over a period of 16 weeks of practice that this participant would ‘unlearn’ her letter sounds.

Discrepancies of this kind were unique to this one participant and consequently, they were excluded from further analysis from the treatment group. With the exclusion of these cases, the adjusted participant numbers are $n = 9$ (control) and $n = 8$ (treatment).

ANOVA Tests

Repeated measures ANOVA tests were conducted using SPSS to look at the mean differences between composite tests at T1 and at T2. ANOVA results were found for two different conditions: within subjects and between groups. Within subjects ANOVA results indicated the mean difference for every participant for T1 and T2 composite scores (see Table 5). While the between subjects ANOVA results revealed mean differences between the control and treatment group for T1 and T2 composite scores (see Table 6).

Table 5

ANOVA Results for Within Subject Measures

	Composite Literacy	Composite Language	Total Composite Lit/Lang
F(observed)	17.555	7.209	16.652
<i>p</i>	.001	.017	.001

Note: $df = 1$, df error = 15 for all three tests

For within subject measures, Mauchly’s test indicated that the assumptions of sphericity were met in all three cases. There are only two conditions being measured in each test so

Mauchly's $W = 1.00$. The ANOVA results show that the treatment significantly affected participants' literacy, $F(1, 15) = 17.555, p = .001, \eta_p^2 = .54$ and language scores, $F(1, 15) = 7.209, p = .017, \eta_p^2 = .32$. The total combined composite literacy and language score was $F(1, 15) = 16.652, p = .001, \eta_p^2 = .52$. Effect sizes (η_p^2) ranged from medium (literacy and composite) to small (language).

Table 6

ANOVA Results for Between Subject Measures

	Composite Literacy	Composite Language	Total Composite Lit/Lang.
F (observed)	2.409	.830	1.431
p	.141	.377	.250

Note: $df = 1$, $df_{error} = 15$ for all three tests

For Between Subject measures, Mauchly's test indicated that the assumptions of sphericity were also met in all three cases, with Mauchly's $W = 1.00$. The results show that there were not significant differences between the treatment and control groups on composite literacy score, $F(1, 15) = 2.409, p = .141$ and language scores, $F(1, 15) = .830, p = .377$. The total combined composite literacy and language score was $F(1, 15) = 1.431, p = .250$. The effect sizes were very small; in all cases $\eta_p^2 \leq .14$.

T-Test Results

Independent t-tests were conducted on all measures for both T1 and T2 results. There were no significant differences found. In order to identify what effect the intervention may have had, a change variable was calculated to measure the difference within all subjects between T1

and T2. The change variable is the difference of the T1 and T2 scores ($X = \bar{X}_{T2} - \bar{X}_{T1}$). The results are shown in Table 7.

Table 7

Change Variable t-Test Results

Test Name	Participant	N	Mean	Standard Deviation	Effect Size	<i>t</i>	<i>p</i>
Reading A Letter names	Control	9	0	3	0	-2.011	.074
	Treatment	8	6	8	0		
Reading B Letter Sounds	Control	9	7	9	.12	.339	.739
	Treatment	8	6	5	.12		
Reading C Concepts of Print	Control	9	1	4	0	.405	.691
	Treatment	8	1	3	0		
Reading D Syllable Segmentation	Control	9	4	4	.25	.154	.880
	Treatment	8	3	4	.25		
PPVT Peabody Picture Vocabulary Test	Control	9	6	10	0	.074	.942
	Treatment	8	6	10	0		
EVT Expressive Vocabulary Test	Control	9	4	7	0	.055	.843
	Treatment	8	4	8	0		
Composite Literacy	Control	9	12	14	.29	-.556	.587
	Treatment	8	16	14	.29		
Composite Language	Control	9	8	17	.21	-.431	.673
	Treatment	8	11	11	.21		
Total Composite	Control	9	20	28	.30	-.586	.567
	Treatment	8	27	17	.30		

Note: *df* = 15. Except Reading A Test *df* = 9.3. In order to find the effect sizes with different groups, a calculation was used to pool the control and treatment standard deviations.

Levene's Test was carried out and proved non-significant in all cases except for Reading A (letter names). Equal variances were not assumed in this case, $t(9.3) = -2.01, p = .074$. None of the measures indicated any practically significant findings or effect sizes $d < 0.2$.

Paired t-tests

Separate paired t-tests were conducted comparing T1 and T2 mean scores for both the control and treatment groups. The paired t-tests analyzed within group results in order to see if differences between the groups were apparent. Results are shown for the control group in Table 8 and the treatment group in Table 9.

Table 8

Control Group Paired t-tests for T1 and T2 scores

Test Name	Participant	N	Mean	Standard Deviation	Effect Size (d)	<i>t</i>	<i>p</i>
Reading A Letter names	T1	9	15	11	0.00	-.199	.847
	T2	9	15	11			
Reading B Letter Sounds	T1	9	6	9	.74	-2.613	.031
	T2	9	13	10			
Reading C Concepts of Print	T1	9	5	4	.29	-.985	.354
	T2	9	6	3			
Reading D Syllable Segmentation	T1	9	3	4	.75	-2.685	.028
	T2	9	6	4			
PPVT Peabody Picture Vocabulary Test	T1	9	34	24	.27	-1.734	.121
	T2	9	40	20			
EVT Expressive Vocabulary Test	T1	9	25	20	.24	-1.811	.108
	T2	9	30	22			
Composite Literacy	T1	9	29	21	.52	-2.650	.029
	T2	9	41	25			
Composite Language	T1	9	61	40	.18	-1.410	.196
	T2	9	68	40			
Total Composite	T1	9	89	59	.33	-2.135	.065
	T2	9	109	60			

Note: df = 8

Statistically significant changes in mean scores between T1 and T2 were found for two specific literacy measures: letter sound knowledge $t(8) = -2.613, p = .031, d = .74$ and syllable segmentation $t(8) = -2.685, p = .028, d = .75$. These scores were reflected in the significant p values and small to medium effect sizes of the composite literacy score, $t(8) = -2.650, p = .029, d = .52$, and the total composite score $t(8) = -2.135, p = .065, d = .33$.

Table 9

Treatment Group Paired t-tests for T1 and T2 scores

Test Name	Participant	N	Mean	Standard Deviation	Effect Size (d)	<i>t</i>	<i>p</i>
Reading A Letter names	T1	8	5	8	.71	-2.256	.059
	T2	8	11	9			
Reading B Letter Sounds	T1	8	2	4	1.2	-3.263	.014
	T2	8	8	7			
Reading C Concepts of Print	T1	8	4	2	.40	-.595	.571
	T2	8	5	3			
Reading D Syllable Segmentation	T1	8	2	2	1.0	-2.171	.067
	T2	8	5	4			
PPVT Peabody Picture Vocabulary Test	T1	8	24	17	.24	-1.517	.173
	T2	8	29	24			
EVT Expressive Vocabulary Test	T1	8	20	17	.22	-1.269	.245
	T2	8	24	20			
Composite Literacy	T1	8	13	14	-1.0	-3.260	.014
	T2	8	29	18			
Composite Language	T1	8	42	33	.30	-2.783	.027
	T2	8	53	41			
Total Composite	T1	8	55	44	.56	-4.467	.003
	T2	8	82	53			

Note: df (7) for all tests

Significant changes in mean scores between T1 and T2 were found for the letter sound identification test, $t(7) = -3.263$, $p = .014$, $d = 1.2$. The large effect size indicates participant scores improved by more than one standard deviation. Two other literacy measures were close to being statistically significant and had large effect sizes: letter names, $t(7) = 2.256$, $p = .059$, $d = 0.71$ and syllable segmentation, $t(7) = -2.171$, $p = .067$, $d = 1.0$. Neither of the language tests alone were significant, but combined in a composite score were noteworthy, $t(8) = -2.783$, $p = .027$, $d = 0.3$; as was

the combined literacy score, $t(7) = -2.783, p = .027, d = 0.71$. The total composite score was the most promising result, $t(7) = -4.467, p = .003, d = 0.56$. Overall, the difference between the treatment group means showed more significant differences and produced larger effect sizes than the control group.

Sight Word Identification

During the T2 assessment, participants were also tested on their sight word knowledge. Throughout the intervention participants were introduced to a number of sight words corresponding to books they were reading. Unfortunately, individual differences in the number of sight words introduced interfered with any systematic analysis. This is noted as a limitation. Each sight word was augmented with sign language for the treatment group. Because of the difficulty of assessing the number of known sight words at baseline testing (T1), it was decided to assess words that were introduced during the intervention only at T2. Consequently, there were no means to compare and statistical tests were not used to analyze the data. Table 10 outlines the average number of words read by the participants at T2.

Table 10

Sight Word Averages for Control and Treatment Groups

	Control Group	Treatment Group
Group number	$n = 9$	$n = 8$
Sight Word Average	13	14

The amount of sight acquisition appears to be the same between the two groups. Differences reflected during teacher assessment are noted in the limitations.

Value of the Intervention

Two surveys rating the value of the intervention were distributed at the end of the study; one for parents and one for school teachers. Samples are shown in Appendix D. The parent surveys were completed anonymously at the final training session. All parents who completed a survey ranked the value of intervention as significant (the highest rank). Seventy percent of respondents noted an increase in language and communication as a secondary benefit of the intervention.

The teacher respondents on average rated the intervention a four (out of five) with the mode being five. The most common anecdotal comments referred to noticing more frequent language attempts and an increase in vocabulary. While only 10 out 19 teachers responded, the intervention and its' school partnering model was perceived as valuable. Nine of the study participants enrolled in follow-up model based on the design of this intervention.

|

CHAPTER FIVE CONCLUSION

The main study purpose was to isolate the effects of explicit sign language instruction during a comprehensive reading program. The 20 week study divided a group of 19 students with DS evenly between a treatment and control group. For 16 weeks, the treatment group received a comprehensive reading intervention augmented with explicit sign language instruction. The control group received the same comprehensive reading program, but without the sign instruction. Initial and final assessments were conducted over an additional four week period and combined a mix of standardized and informal tests. These pre and post-performance measure scores were analyzed for statistical significance and effect size using repeated measures analysis of variance, (ANOVA) and t-Tests for both within subjects and between groups.

The study was successful from a pedagogical perspective. As the descriptive statistics indicate, the intervention increased the literacy and language knowledge of the participants. The value of intervention surveys completed by parents and participating school teachers were also positive. The intervention was perceived to be valuable; anecdotal comments and survey scores confirm growth in both the language and literacy skills of participants. The within subjects ANOVA indicate the treatment was effective for all composite measures. These results also indicated medium effect sizes for both composite literacy and total composite.

However, the between subjects ANOVA test, which compared group means, did not indicate different outcomes for the treatment group. The effect size was also trivial. However, when using paired t-tests to analyze the groups separately, the within treatment group scores demonstrated greater mean growth than the within control group scores.

Large effect sizes were seen on three of the treatment group individual literacy tests: letter names, letter sounds and syllable segmentation. The latter two tests had effect sizes indicating growth of one or more standard deviations. Additionally, all composite measures were significant and the composite literacy had a large effect size (one standard deviation). These effect sizes were not seen in the control group. Two of the individual measures were significant and had medium to large effect sizes, but none of the composite scores had large effect sizes or significance values equal to or greater than the treatment group. Considering the paired t-test results, it appears that the H_1 is accepted; the treatment mean differences for more variables were statistically significant and produced larger effect sizes than the control. The explicit addition of sign language appears to positively impact language and literacy outcomes in a comprehensive reading program for students with ID/DD.

The results of this study add to the research indicating that students with ID/DD are capable of acquiring literacy skills with intensive instruction (Allor et al., 2009, 2010, 2014; Burgoyne et al., 2012). Mounting evidence, including these results, also suggest that learning to read supports language acquisition with this population (Megoni, Silvana, Nash & Hulme, 2013; Colozzo, et al., 2015). It also appears that instruction augmented with sign language effectively supported the gain of both phonological and language skills as demonstrated by the larger effect sizes produced by the treatment group. It is encouraging to see that while longitudinal studies are advised with this population an intervention of only 16 weeks was effective.

Letter name identification and sound identification are integral aspects of phonological awareness (Lundberg, 2009). As noted in the literature search, given its importance in the reading process, many studies focus on the remediation of phonological awareness for students with ID/DD. The conclusion of these studies appears to be that some phonological skills are

trainable with appropriate instruction (Naess et al., 2012; Lemons & Fuchs, 2010). Sufficient time and explicit instruction are also necessary components (Allor et al., 2014). The results of “Sign it, Say it, Read it” are promising; both treatment and control group made significant gains with large effect sizes in letter sounds identification which is a cornerstone of phonological awareness. The fact that these results were detected after only 16 weeks is also noteworthy. In support of the research hypothesis, the treatment group made greater gains with letter sounds and improved significantly on letter name identification as well.

Both groups improved on syllable segmentation. However the significance and effect sizes were again larger in the treatment group. The effect size for this group was very large; one standard deviation. This area of phonological awareness has not received the same amount of attention in the literature. These results are interesting and are noted in implications for further practice and research.

Gains in concepts of print were minimal and effect sizes were small. Perhaps this shows the difference between explicit and implicit instruction for students with ID/DD. The intervention did not explicitly target concepts of print, instead high interest picture story books were read during each session at DSRF. Students were encouraged to hold the book right side up, turn the pages and follow each word read from left to right. During school sessions sight words and phonological awareness activities received precedence over concepts of print. It is not known why these skills did not develop at the same pace. It may have been due to indirect teaching, reduced exposure or some combination of both.

The intervention supported language development. In only 16 weeks, the composite score for both receptive and expressive language of the treatment group was significantly improved.

This was also an area of anecdotal interest. Many teachers and parents noted language development as the most important outcome of the intervention.

The participants learned sight words each week as an important part of the intervention. An assessment of these words was conducted at T2 for both groups. Significant differences between the groups were not seen; however sign language made a difference to sight word instruction during the sessions conducted at DSRF. The teacher noted that when a participant was shown a sight word flash card, if they did not know the word, a sign from the teacher would usually prompt them to sign and/or say the word back. Once this step was finished, the teacher could praise and reinforce their efforts. When the same thing occurred in the control group there wasn't a prompt to use and consequently the teacher would just say the word often without further engagement from the participant. The teacher mentioned that using sign language to support vocabulary growth was a powerful and engaging tool.

Limitations

While the methodology and implementation of the intervention were carefully planned, there are several limitations to the study. The limitations include: sample size, duration of treatment, large variance, fidelity of the intervention and confounding variables.

The sample size was small. While implementing an intervention for 19 students with ID/DD is a significant achievement, it remains a small number when statistically analyzing data. Working with a small sample size reduces power, which refers to the ability to find statistical significance in the event of real differences. Having a small number is also difficult because participants may leave the study or have frequent absences. These occurrences further reduce the sample size. In "Sign it, Say it, Read it," as mentioned in Chapter Four, two students were

excluded from final analysis for valid reasons. Unfortunately, both of these students were part of the treatment group. An additional case was examined due to session absences and an incomplete T2 language assessment. Although this participant was retained in the results analysis, they were also part of the treatment group. This means the intervention for three participants, although personally worthwhile, has little or no value to the findings and negatively affects the treatment group.

A second limitation was the limited duration of the intervention; 16 weeks is now judged to be an insufficient length of time given the learning characteristics of the participants. An intervention of this length may be more effective for a typical population of students. Students with ID/DD need extra processing time, repetitive rehearsal of routines and extra exposure to overlearn concepts (Broun & Oelwein, 2007). A 16 week intervention is just the tip of the iceberg; a longitudinal study of a year or more would be more revealing and valid for this population. As Allor et al. (2014) detected, sustained periods of time (1 to 4 years) and high frequency (daily practice), yielded significant letter sounds and sight word knowledge for students with ID/DD. The five year study conducted by Browder (2008) also produced medium to large effect sizes for a treatment group of participants with ID/DD. Both of these examples highlight the benefits of consistent, long-term treatment.

Gathering meaningful assessment data is difficult for students with ID/DD. There was a large variance observed in the results both within and between participants. The within participant variance refers to changes seen in participants who performed erratically during the assessments and the intervention sessions. Some changes in behaviour may have been due to additional medical conditions such as sleep apnea (McGuire & Chicoine, 2006). The study design maintained assessment independence. An impartial teacher uninvolved in the

intervention and unknown to the participants administered the formal T1 and T2 assessments. While this is a feature of well-designed quantitative methodology, it negatively impacted the study findings. The intervention teacher noted greater participant improvement than seen in the formal statistical analysis. Many of the studies reviewed in the literature search or used as a comparison, did not enforce such strict testing conditions. The same teacher who delivers the intervention is often also the primary assessor (Beecher & Childre, 2012; Naess et al., 2012; Colozzo et al., 2015).

Between subjects variance was observed in the large standard deviations. The sample size was small and non-parametric therefore large variance in the total group was seen. Many participants scored at the floor for T1 assessments in part due to issues with being assessed. Standardized measures are often difficult to complete independently for students with ID/DD (Anderson, Farley & Tindal, 2015; Fawcett, 2004). “Sign it, Say it, Read it,” employed a mixed measures design, combining both standard and non-standard tests, in an effort to decrease standardized testing problems. Regardless of using different types of tests, issues of using a one-time performance metric versus a cumulative collection of data exist in the final analysis and represent a study limitation.

A key component of the study was to collaborate with schools to deliver the program both at DSRF and the participants’ schools. This design component enabled follow-up sessions to be conducted at schools in addition to a weekly DSRF session. The follow up sessions facilitated greater treatment intensity and shared both the program and materials with school partners. These were benefits for the education and participant communities however, this shared approach creates limitations in maintaining treatment fidelity. Although all the learning resource teachers received initial training and ongoing support, it is unknown what their individual effect

on student learning was. Many teachers were unfamiliar or had limited experience dealing with their student and/or their specific learning profile. While all teachers participated in a training session, only a portion of them responded to regular email updates during the intervention or completed a survey rating the value of the intervention (9 teachers). Teacher/student relations are important as they contribute to the student's academic learning rate and behaviour (Baker, Grant & Morlock, 2008). It is a limitation of the study to not have observed and rated the fidelity of these sessions. Ideally, all intervention sessions would have taken place in the controlled environment at DSRF; however in order to achieve treatment intensity during this short study, the school follow-up sessions were essential.

The final study limitation pertains to control and confounding variables. There were several control variables identified in the study methodology prior to the intervention. These include gender, age, pre-existing ability and instructional time of day. An attempt to control these variables was made by creating matched pairs and evenly dispersing participant sessions. Ultimately, it is unknown whether these variables were sufficiently mitigated or to what extent they may have affected outcomes. In addition there were a number of confounding variables that although identified, could not be controlled. These include: the degree of disability of each student, their academic behaviour, the student/teacher relationships, cultural perspectives, social economic status (SES) and student attendance. The researcher attempted to control for some of these factors by stratifying the sample. The degree to which any student is motivated or able to perform under study conditions is clearly a factor of myriad variables; perhaps SES and parental attitudes varied considerably in the study population, and possibly affected otherwise similar students in very different ways. Ultimately it is difficult to be certain that the controls were effective, and to what degree the confounding variables became a factor.

Ethical Concerns

Two possible ethical considerations were identified prior to the study implementation: use of a control group and maintenance of participant confidentiality. Using a control group can be an ethical concern because potentially effective treatment is withheld from this group. In the case of “Sign it, Say it, Read it,” only one part of the treatment was withheld from the control group; the inclusion of sign language. The control group received the same popular reading program currently offered at DSRF. The use of sign language during this program is incidental and entirely up to the discretion of the instructor. There is no policy regarding the consistent use of sign as an augmentative tool at DSRF. However in order to minimize any potential ethical concerns of using a control group, upon completion and publication of this thesis, all study results will be shared and explained to the families of the participants. Training and materials, regarding how to implement the reading program, were offered to all participants at the completion of the intervention. At that time, it was discussed how to incorporate sign language into the sessions, but not whether it was valuable. With the publication of this thesis, participants’ families and schools will be encouraged to incorporate sign language instruction into their reading sessions.

The second ethical consideration was the maintenance of participant confidentiality. In order to protect privacy, the parental consent form included a confidentiality clause. Students were identified using codes during the data analysis and no identifiers were used in the results section. Computer files were kept exclusively on the researcher’s protected computer in a locked office. Following completion of the thesis and any technical reports the data will be destroyed.

Implications for Practice and Research

This study adds further data to the body of research promoting early intervention and explicit, high intensity instruction of literacy skills for students with ID/DD. Incidental learning or learning by observation may be effective methods for typically developing students, they are not recommended for students with disabilities. Skills practiced repetitively, frequently and in more than one setting seemed to be most successfully acquired for this population (Allor et al., 2014; Broun & Oelwein, 2007). Because this process takes time, it is beneficial to start early literacy intervention as young as three years old. While many students may be non-verbal at this age, starting an intervention young will benefit both their literacy and language skills (Colozzo et al., 2015; Megoni et al., 2013).

The treatment group showed advantages on several measures at T2. This indicates the effectiveness of using sign language to augment instruction. Sign language adds a kinetic and visual element to instruction. This aids comprehension and memory (Daniels, 2004). Teachers also found that sign language added a fun interactive element to the sessions and provided a useful prompt for sight word instruction.

The collaboration between DSRF and the participants' schools, which took place during "Sign it, Say it, Read it" provided the framework for a new pilot project launched at DSRF. Nine of the study participants enrolled in the school/DSRF collaboration program launched in September 2015. Based on the model of "Sign it, Say it, Read it," DSRF created a similar reading project including one to one sessions at the centre and follow-up school sessions. Initial training, ongoing mentoring from a DSRF teacher and materials are provided to the participant's schools. The program will run for the 10-month duration of the school year. One of the popular

aspects of the study was the collaboration with schools. The continuation of this model is an important educational implication of “Sign it, Say it, Read it.”

Significant results and large effect sizes on some measures of phonological awareness found in this study are consistent with results described in the literature search. The study was a success despite limitations of length and size. Consequently, the study design should be repeated with a larger number of participants for a longer period. A longitudinal study would allow further development of phonological skills and the exploration of whether the addition of sign language would positively affect sight word knowledge.

Syllable segmentation is a phonological awareness skill linked to word decoding ability (Stanovich, 1982). The effect size noted by the treatment group was large (one standard deviation). Further research is warranted to see if progress is sustained during a longer intervention and whether this skill could be expanded to work on word decoding. Currently comprehensive reading programs for students with ID/DD are considered best practice (Allor et al., 2014) however in the past reading instruction for these students was limited to sight word recognition (Bowder et al. 2006, Allor et al., 2009). Decoding words is not a reading method typically recommended for this population. It would be interesting to explore whether syllable segmentation skills could be successfully used as a method and/or starting point to teach word decoding.

Both the statistical results and the anecdotal comments of parents and teachers indicate that the study participants made language gains during the 16 weeks. It appears that sign language may help language acquisition, something already seen in large-scale studies with typical children (Daniels, 2004). Pre-existing language ability is a predictor for reading ability in

the typical population (Brynes & Wasik, 2009). This relationship is not as clear for students with ID/DD as many have delayed speech or remain non-verbal. In these cases, learning to read can help language acquisition (Megoni et al., 2013, Colozzo et al, 2015). Regardless, receptive language deficits (vocabulary) sustain reading difficulties even within this population of students (Naess et al.,2012). Further investigation as to the effects of sign language support on sight word and consequently vocabulary development would be interesting. Does sign language assist students in the comprehension, retention and generalization of vocabulary? It might also be interesting to discover to what extent the treatment group retains their acquired signing skills and whether they would use them when provided opportunity; for example with hearing impaired individuals.

Summary

The intervention delivered in “Sign it, Say it, Read it” increased the literacy and language skills of the participants. The research purpose was to identify whether the addition of sign language would significantly impact the outcomes of a comprehensive reading intervention. 19 participants, aged four to seven with ID/DD, received a 16 week free intervention delivered in partnership between DSRF and their schools. Weekly one to one sessions occurred at DSRF followed by two reinforcement school sessions. Participants were assigned to either the control or treatment group using matched random assignment. Pre and post assessment measured four literacy and two language skills. In order to analyze the data the researcher used repeated measures ANOVA and paired t-tests. The post intervention assessment (T2) ANOVA revealed that significant growth on all outcomes occurred within subjects. Between group differences were not significant for the repeated measures ANOVA. Paired t-tests were conducted for all the control and treatment groups separately, revealing interesting differences between groups.

Larger effect sizes were seen for the treatment group on all composite measures, most notably the composite literacy score with an effect size measuring one standard deviation.

The intervention was perceived to be valuable by the participants' families and teachers. Survey results and anecdotal comments indicated that literacy and language improvement were observed at home and school during the course of the intervention. Based on the positive feedback and results of "Sign, Say it, Read it," DSRF created a pilot project modelled on the intervention content and delivery mode. Half of the study participant families elected to sign up for this program at their own expense.

There were several limitations described that may have affected the results. Some of these limitations would be difficult to eliminate such as testing difficulty and confounding variables. Other limitations such as the sample size and the length of the intervention become factors for future examination. Positive conclusions drawn from this study suggest that a longer and larger project is warranted. Differences between the treatment and control group suggest that the addition of sign language was effective. "Sign it, Say it, Read it" added to the body of literacy research about students with ID/DD and left a practical offering; use sign language.

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Appendix A

Parental Consent Form

Sign it, Say it, Read it

Dear Parent(s) / Guardians(s),

This study is being undertaken by Masters student Amanda Szabo of the University of Northern British Columbia under the supervision of Dr. Peter MacMillan, School of Education & School of Health Sciences.

The purpose of the study is to evaluate the supplemental effects of American Sign Language (ASL) use on the language and literacy outcomes of a reading intervention for children with Down syndrome. All participating students will benefit from this study as they will receive the regular One to One Reading Program program at the Down Syndrome Research Foundation(DSRF) for 12 weeks at no charge. There are absolutely no risks associated with this study to any of the participants involved.

Your child was deemed eligible for this study because of their age, the fact they have Down syndrome and that they have previously not had reading instruction at DSRF. Your child's participation in this study is completely voluntary. If you decide to withdraw your child at any time, it will not result in any disadvantage to you or your child at the time of withdrawal or in the future. If you choose to withdraw during the study, any information or data regarding your child will be removed and destroyed. Any changes in the study will be brought to the attention of the participants' families and the Research and Ethics Board at UNBC. In the event of incidental findings during the research, you will be notified. The researcher will consult the UNBC Research and Ethics Board about these findings if deemed necessary.

In addition to receiving the One to One Reading Program, your child will be assessed by both a DSRF Speech Language Pathologist and Teacher to establish pre and post intervention abilities. This data will be kept confidential and secure by the researcher. During the study, half of the students will comprise the treatment group and receive the reading intervention supplemented with ASL. The other half of the students will be in the control group and receive the regular reading program without ASL. Findings from the study will be presented to you with both an information meeting and a copy of any subsequent publications.

The identity of all participants will remain confidential. All students will be identified through the use of codes instead of names in the report and the key to those codes will be kept separately in a file in a secure location. All data will be stored in a locked office. Computer files will be kept exclusively on the researcher's protected computer in the same locked office. Pat Hanbury, Director of Programs and Services at DSRF, will be available to answer any questions regarding the research process or concerns throughout the study. She will remain uninvolved with the researcher or research team for the duration of the study. If you have any questions please, contact Pat Hanbury at pat@dsrf.org.

This proposed study has been approved by the Research Ethics Board at the University of Northern British Columbia. For questions regarding participant rights and ethical conduct of research, contact the Office of Research by email at reb@unbc.ca or telephone at (250) 960-6735.

Your signature gives consent for your child to participate in this study and acknowledges the purpose, procedures, and publication of this study. A signed copy for your records will be sent by mail.

Signature

Date

Appendix B

Teacher Consent Form

Sign it, Say it, Read it

Dear Teachers,

This study is being undertaken by Masters student Amanda Szabo of the University of Northern British Columbia under the supervision of Dr. Peter MacMillan, School of Education & School of Health Sciences.

The purpose of the study is to evaluate the supplemental effects of American Sign language use on the language and literacy outcomes of a reading intervention for children with Down syndrome. All participating students will benefit from this study as they will receive the regular One to One Reading Program instruction at DSRF free of charge. There are absolutely no risks to any participants or yourself with any of the procedures that will be used.

Your participation in this study is completely voluntary. You may choose not to be involved or may withdraw from the study at any time resulting in no disadvantage of any kind to you. Your identity will be kept confidential. You will be assigned a teacher code and be referred to this way in any records or publications. The key to those codes will be kept separately in a file in a secure location. All data will be stored in a locked office. Computer files will be kept exclusively on the researcher's protected computer in the same locked office.

I _____ (name of teacher), agree to:

1. Keep all the research information shared with me confidential by not discussing or sharing the research information in any form or format (e.g. disks, tapes, transcripts) with anyone other than the Principal Investigator;
2. Keep all research information in any form or format secure while it is in my possession;
3. Ensure participant confidentiality by referring to them only by number when sharing information with the Principal Investigator.

Your signature acknowledges the purpose, procedures and potential publication of this study. A signed copy for your records will be sent by mail.

Signature

Date

If you have any questions please, contact the Principal Investigator at szaboa@unbc.ca. This proposed study has been approved by the Research Ethics Board at the University of Northern British Columbia. For questions regarding participant rights and ethical conduct of research, contact the Office of Research by email at reb@unbc.ca or telephone at (250) 960-6735.

Appendix C

Principal Consent Form

Dear Principals,

This study is being undertaken by Masters student Amanda Szabo of the University of Northern British Columbia under the supervision of Dr. Peter MacMillan, School of Education & School of Health Sciences and the Down Syndrome Research Foundation (DSRF).

The purpose of the study is to evaluate the supplemental effects of American Sign Language (ASL) use on the language and literacy outcomes of a reading intervention for children with Down syndrome. The participants will be involved in the study for 20 weeks (four weeks for assessment and 16 weeks for the intervention). The study participants will be expected to attend 16 weekly intervention sessions at DSRF and receive follow-up sessions delivered by a resource teacher at their school. All participating students will benefit from this study as they will receive the regular One to One Reading Program at the Down Syndrome Research Foundation (DSRF) for 16 weeks at no charge. There are no perceived risks associated with this study for any of the participants, your staff or school.

DSRF is a non-profit foundation located in Burnaby, BC dedicated to empowering the lives of people with Down syndrome. DSRF supports individuals and their families by offering a variety of programs and services delivered by teachers, speech language pathologists, occupational therapists and researchers. The goal of DSRF is to maximize the academic, social, health and language development of individuals with Down syndrome.

We would very much appreciate the assistance of the participant's school in this study. Students that cannot receive two follow up sessions of 20 minutes each will not be able to participate in the program.

If your school would like to help the students and this research program by allocating the necessary 40 minutes per week per student, please sign below. If you have any questions please don't hesitate to contact Pat Hanbury, pat@dsrf.org.

Signature

Date

This proposed study has been reviewed by the Research Ethics Board at the University of Northern British Columbia. For questions regarding participant rights and ethical conduct of research, please contact Amanda Szabo at szaboa@unbc.ca or Peter MacMillan at Peter.Macmillan@unbc.ca. Any concerns or complaints should be directed to the Office of Research by email at reb@unbc.ca or telephone at (250) 960-6735.

Appendix D

Value of Intervention Survey**Sign it, Say it, Read it: Post Intervention Survey**

Please indicate the response that best matches your experiences during this intervention.

1. How easy was the intervention to implement? Answer: _____

1 2 3 4 5
Very difficult Somewhat difficult Easy

2. Please indicate which statement best describes your implementation of the intervention. Answer: _____

a. We missed a lot of sessions: difficult to schedule and/or student was away a lot.

b. We missed some sessions due to usual disruptions and absences.

c. We missed a couple of sessions: our schedule was regular.

3. Which number best indicates typical student behaviour during the sessions?

Answer: _____

1 2 3 4 5
Very difficult Somewhat difficult Easy

4. Did you notice improvement on outcomes practiced (phonological awareness/sight word acquisition, comprehension.) Answer: _____

1 2 3 4 5
Not at all Yes, inconsistently Improved on everything

5. Did you notice any improvements and/or gains in other areas (language, behaviour, communication, other) not specifically targeted by the intervention?

Answer: _____

6. Please indicate your opinion about the value of this intervention. Answer: _____

1 2 3 4 5
No value Some value Significant value

Additional Comments:

Appendix E

Reinforcement Session Outline

School Session Log

Student: _____

Date: _____

Teacher: _____

American Sign Language Support: **YES** **NO**

Skills	Activities	Comments
Letters	<ul style="list-style-type: none"> • Reinforcement (find letters and feed/mail, apps, ABC songs) • Jolly Phonics 	
Phonological Awareness	<ul style="list-style-type: none"> • Initial Sound (Tell me, I hear with my little ear, Dino ABC book, find pictures) • Syllable (Bee, Clap it out) • Phoneme segmentation (word stretching) 	
Sight Words	<ul style="list-style-type: none"> • Match, select, name • Read book • Read and Do activity • Game • Sentence Building (shaky shake, carrier phrases) 	
Reading Comprehension	<ul style="list-style-type: none"> • Shared reading of picture book, concepts of print • Comprehension (“wh” questions) • Personal connections 	

Sleep:

Schedule Disruptions:

General Mood:

Appendix F

Parental Questionnaire**Parent Questionnaire**

This questionnaire will help create an individual profile of your child. Formal assessment may only capture a small amount of information about your child; consequently additional qualitative data collected through parent questionnaires is important. Hopefully this data will be useful in identifying meaningful patterns or explaining outlying information. All information collected will remain confidential and anonymous.

Thank you for your time in filling out the questionnaire. If you have any questions, please don't hesitate to ask Pat Hanbury pat@dsrf.org

1. Name: _____
2. Birthdate: _____
3. Grade (if in preschool, please identify the year and how often they attend)

4. Does your child have any other diagnosis (e.g. autism, ADHD, medical diagnoses)?
5. Is your child currently taking any medications? If yes, please list below.
6. Please indicate if your child, either in the past or currently, participates in any therapy. If yes, please note the length, frequency and type of the sessions. For example, six months, 45 minute per week of occupational therapy.
7. Please indicate if your child has any vision impairments.
8. Please indicate if your child has any hearing impairments and/or chronic infections.
9. Does your child have any sleep difficulties? If yes, have they participated in a sleep study?

10. Please describe your child's attention span.
 - a. How long can your child pay attention to a preferred activity?
 - b. How long can your child pay attention to a non-preferred / difficult activity?
 - c. Is your child able to sit at a table? If yes, for how long?
11. Is your child able to take turns in a game or conversation?
12. Please describe any behavioural concerns you have about your child below (e.g. noncompliance, self-stimulatory/repetitive behaviour, aggression, temper tantrums, leaving assigned areas, etc.)

Appendix G

DSRF Session Outline

Session Log

Student: _____ # _____

Date: _____

American Sign Language Support: **YES** **NO**

Skills	Activities	Comments
Warm up	<ul style="list-style-type: none"> • Music • Toys (baby, dinos, cars) • Fine Motor (playdough, sand, puzzles, drawing) • Auditory Activity (Fruit salad, pizza, washing machine) 	
Letters	<ul style="list-style-type: none"> • Jolly Phonics • Letter Boxes, Leap Frog • Reinforcement (find letters and feed/mail, apps, ABC songs) 	
Phonological Awareness	<ul style="list-style-type: none"> • Initial Sound (Tell me, I hear with my little ear, Dino ABC book, find pictures) • Syllable (Bee, Clap it out) • Phoneme segmentation (word stretching) 	
Sight Words	<ul style="list-style-type: none"> • Match, select, name • Read book • Read and Do activity • Game • Sentence Building (shaky shake, carrier) 	

	phrases)	
Reading Comprehension	<ul style="list-style-type: none"> • Shared reading of picture book, concepts of print • Comprehension (“wh” questions) • Personal connections 	