Spring 2014

Challenges with Literacy Development in Children who are Deaf or Hard of Hearing

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B.S., Southern Illinois University, 2012

A Research Paper

Submitted in Partial Fulfillment of the Requirements for the

Master's Degree

Rehabilitation Institute

in the Graduate School

Southern Illinois University Carbondale

MAY 2014

RESEARCH APPROVAL

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Master's

in the field of Communication Disorders and Sciences

Approved by:

Sandie Bass-Ringdahl, Chair

Graduate School

Southern Illinois University Carbondale

April 2, 2014

TABLE OF CONTENTS

PAGE

Introduction

According to the National Association of Educational Progress ("National assessment of," 2014) to be a proficient reader, a student must be able to read at grade level and also be able to synthesize, explain, and analyze what he/she read (i.e., comprehend and make reasonable inferences of written material). Reading is related to cognitive development, language development, and emotional development. Reading is a fundamental skill necessary to function successfully in today's society (Kirsch, Jungeblut, Jenkins & Kolstad, 2002). Reading comprehension aids in the development of ideas, exploration of new knowledge, and the exchange of information. The ability to comprehend written language is a greater framework that stems from the development of literacy skills by the time students reach their school age years.

Reading Achievement

Literacy is often viewed as emerging from a child's oral language development. The linguistics approach to language development is formed on the notion that children do not need to be taught directly how to speak; language development and its pragmatics are learned from conversations near children indirectly. Expressive language acquisition then forms the foundation for written language comprehension as the ability to decipher the common phonemic sound system of language is enhanced. This underlying principle of connecting sound to print relies upon the established knowledge of the spoken language in order to aid in the reading process. Unfortunately, children with severe to profound hearing impairment are placed at a disadvantage by not having complete access in developing the ability to deduce the phonemic sound system. With 90% of children with severe-profound hearing impairment being born to adults with normal hearing ("National deaf children's," 2014, the majority of children do not

develop adequate understanding of any language modality—whether it be oral communication, sign language, or cued speech/lip-reading to assist in the process of comprehending written language. Children born with severe-profound hearing impairment may fail to develop a fluent system of communication as well as fail to develop phonemic decoding abilities necessary to become proficient readers. Kyle and Harris (2010) found that children with normal hearing and children with severe-profound hearing impairment utilize slightly different reading strategies over the first 2 years of schooling. Despite both groups of children exhibiting similar levels of reading progress in the early stages of reading development, their reading trajectories diverged after the second year of reading instruction. Reading delays in beginning readers with severe-profound hearing impairment were not as severe as that typically observed with older children with severe-profound hearing impairment; however, the severity of delay increased with age (Kyle & Harris 2010).

For more than fifty years, students with severe-profound hearing impairment have consistently displayed poor reading comprehension abilities. The average student with severe-profound hearing impairment leaves high school scoring the same reading level as that of third or fourth grade student. Researchers and educators consider what factors contribute to the failure of children with severe-profound hearing impairment to advance in reading comprehension. An investigation of current literature reveals conflicting reports as to how literacy skills are developed in children who are both deaf and hard of hearing.

Research suggests that readers with normal hearing decode words in two ways (Goff, Pratt & Ong, 2005). They depend upon the sound-based relationship between the letters of a word and the sound that corresponds with each letter. This is the basis of phonological skills also referred to as sounding out a word. This approach allows children to read words that they have

not seen in print before. The second approach, or lexical approach, depends on whole word recognition (Goff, Pratt & Ong, 2005). Also known as print-based reading, this approach works with words that do not follow phonological rules but require that the child has had previous exposure to the word in its printed form. The general assumption is that children with normal hearing use the phonological approach for unfamiliar words and the lexical approach for familiar words (Goff, Pratt & Ong, 2005).

A clear foundation has been established for how children with normal hearing learn to read and therefore any impairment can be assessed, evaluated, and rehabilitated according to these standards. However, there is no agreed standard that can be applied to children who are deaf or hard of hearing. In comparison to other learning disabilities, researchers in the field of deaf education argue that there is a lack of research addressing the quality of educational opportunities specifically in the realm of progress in reading achievement (Luckner & Handley 2008). With the lack of research, evidence based practice is limited along with the knowledge of strategies to provide intervention. The purpose of this paper is to identify the major problematic areas in reading comprehension within the school aged (6-11 years old) population of children who are deaf or hard of hearing. This review of the literature seeks to discover which aspects of literacy are the most challenging to children with severe to profound hearing impairment. In addition, it seeks to determine if this population follows the same patterns of reading predictors as do children with normal hearing as well as to identify common trends of reading skills based upon degree of hearing loss, and to recognize the relationship of reading skills to other developmental factors (i.e., first language acquisition, primary mode of communication, and type of amplification).

Patterns of Reading Development

Because this population cannot rely solely on hearing sensitivity to aid in reading, it is reasonable to assume that they will not follow the same pattern of reading predictors (Kyle & Harris 2010). Research supports memory, spelling, vocabulary, grammatical knowledge, and other cognitive and language based skills as evidence for reading predictors in children (Goff, Pratt & Ong, 2005). Research is inconsistent in determining predictors of reading success in students who are deaf or hard of hearing. However, studies have contributed information toward the understanding of the reading acquisition process by identifying factors that appear to impact reading success. The most prominent of these is phonological awareness or the ability to access and manipulate speech sounds (Harris & Beech 1998). Phonological awareness has been shown to be a strong predictor of reading outcomes (Weinrich & Fay 2007). Another factor is a student's orthographic processing skill. There is increasing evidence of a relationship between orthographic processing skill and reading ability (Deacon, Benere, & Castles, 2012).

Orthographic dependence or knowledge is a key area that many researchers propose is a foundational skill and predictor of reading ability in students who are deaf or hard of hearing (Miller 2005). According to the American Speech-Language Hearing Association (ASHA, 2011), orthographic knowledge refers to the information that is stored in memory that informs us of how to represent spoken language in written form. Orthographic knowledge depends upon the understanding of both mental grapheme representations and orthographic rules of a language (Apel, 2011). Mental grapheme representation utilizes stored mental representations of specific written words or word parts. Orthographic rules are the laws that govern how speech must be represented in writing (Apel, 2011).

Paul Miller (2006) conducted a study to determine the nature and efficiency of the strategies used by individuals with prelingual deafness for the recognition of written words with reference to an orthographic self-teaching concept. Each participant was asked to make categorical judgments for real words and pseudo homophones of the real words. Pseudo homophones are considered words that are phonetically identical to a word. Participants were native signers between seventh and tenth grade. Participants met the criterion of hereditary deafness and had parents who were deaf. Due to the low prevalence of hereditary deafness, students were chosen from different grade levels. The findings of the study showed that the participants with deafness were impaired in their phonological decoding abilities; however, their efficiency in recognizing and categorizing written words was similar to that of their peers with normal hearing. The finding suggests that these students developed strategies for the acquisition of orthographic knowledge which does not rely on phonology (Miller, 2006). These findings are consistent with the author's previous study in 1997. In studying the effects of communication mode on the development of phonemic awareness in students with prelingual deafness, Miller (1997) found that older children performed above chance level on a picture rhyme-matching task involving both orthographically congruent and incongruent items. Their performance was similar to that of their peers with normal hearing only when items were orthographically congruent. Many other authors suggested that adolescents and children with deafness are heavily influenced by or rely upon orthography when making judgments of phonological similarity.

Other research proposes that phonological awareness remains a major predictor in reading abilities in both children with normal hearing and in children with severe-profound hearing impairment. Harris and Beech (1998) studied implicit phonological awareness and early reading development in children with prelingual deafness. A group of students with severe-

profound hearing impairment were participants in their longitudinal study of reading progress as compared with a hearing control group. The students began the study when they were 5 years of age and were pre-readers. The authors controlled for IQ scores between the groups. The children with severe-profound hearing impairment varied considerably on implicit phonological awareness, oral ability, and familiarity with sign language and fingerspelling measures. This group also made significantly less reading progress than their peers with normal hearing during the first year of schooling. In addition, they scored significantly lower on the test of rime and onset awareness (Harris & Beech 1998).

Deacon, Benere, and Castles (2012) determined that orthographic processing skills follow, or track, the outcome of reading acquisition rather than underpin its development. Their study found that early word reading significantly predicted later orthographic processing ability after controlling for age, vocabulary, non-verbal reasoning, phonological awareness, and earlier measures of orthographic processing skill. These results were consistent, emerging when predicted, from grade 1 to grades 2 and 3 and from grade 2 to grade 3. Orthographic processing skill, both lexical and sub-lexical, did not make a significant independent contribution to later word reading in any of their analyses. The author concluded that the findings strongly suggest that children's ability to perform orthographic processing tasks is acquired through their reading experience, rather than vice versa (Deacon, Benere, & Castles, 2012).

Research supports that while some individuals with severe-profound hearing impairment rely on phonological awareness, others use an alternate method to achieve reading success. The preferential use of one or the other method may be driven by the child's language and educational history, and the nurtured instruction of reading skills (Easterbroooks, Lederberg, Miller, Bergeron, & Conner, 2008). Koo, Crain, LaSasso, and Eden (2008) conducted a study in

which all of the groups had comparable reading skills. Individuals with severe-profound hearing impairment educated oral only, as opposed to using Cued Speech, demonstrated phonological awareness comparable to their peers with normal hearing. In addition, phonological awareness skills were associated with level of reading comprehension. Despite having comparable reading skills, the participants with severe-profound hearing impairment who were raised using American Sign Language did not show the same association between phonological awareness and reading comprehension seen in the other groups. This finding suggests that students with severe-profound hearing impairment who use sign language rely on a different method to achieve reading comprehension. This finding also suggests that reading ability does not solely depend upon phonological awareness skills (Koo, Crain, LaSasso, and Eden, 2008).

Musselman (2000) suggests that phonological ability predominately develops as a consequence of learning to read in individuals with severe-profound hearing impairment rather than being more of a prerequisite, as in children with normal hearing. This statement is consistent with the conclusion that the strongest evidence of phonological awareness comes from studies involving older adolescents and college students who are deaf. This finding is consistent with the earlier study discussed by Miller (1997).

Briscoe, Bishop, and Norbury (2001) conducted a study comparing phonological skills, language ability, and literacy scores of children with mild-to-moderate sensorineural hearing loss and children with specific language impairments (SLI). The authors included two control groups. One control group was matched to the chronological age of the children with hearing loss, and a second control group was matched on receptive vocabulary level to a subset of the specific language impairment group. Children with mild-to-moderate sensorineural hearing loss were as impaired as children with normal hearing with SLI on tests of phonological discrimination,

phonological awareness, and non-word repetition. However, children with mild-to-moderate hearing loss did not show the pervasive difficulties with language and literacy that characterize SLI. Phonological problems that are strongly linked to language and literacy difficulties in children with normal hearing can be disassociated from other language skills in children with hearing impairment (Briscoe, Bishop, & Norbury, 2001). The authors speculated that the nature of phonological problems is different between the two groups, so that the superficially similar test scores mask important differences in the underlying processes. In short, they felt the challenges children with deafness face with phonological skills do not hinder their overall reading achievement. Further, these challenges are overcome by other cognitive processes

Trends in Skill Level

The language and learning impairments found in children with normal hearing are also common in children who are deaf or hard of hearing. One contributor to these impairments is the child's degree of hearing loss. Depending on the degree of loss and benefit from amplification, certain features of the speech signal may be unidentifiable to the listener with hearing impairment. Speech is generated when air is forced between the vocal folds causing them to vibrate and in turn transforming the vibrations into a fundamental frequency which is then filtered through the vocal tract to produce the speech we hear (Martin & Clark, 2012). It is the intensity, frequency, and duration of this air flow and the shaping of the articulators that produces the phonemes of speech. A significant phonetic identifier is the separation of vowels, which are a lower frequency, and consonants, which are high frequency (Halliday & Bishop, 2005). The strongest sounds in speech are the central vowels which resonate at low frequencies. These vowels are responsible for the sound volume of speech. Vowels cycle at a frequency range between 250-2,000 Hz. In contrast, the weakest sounds are those that restrict the breath flow or

the consonants (e.g., fricatives, stops, affricates). These high frequency phonemes are responsible for carrying the information of speech which vowels cannot. Voiced consonants cycle at a frequency range of 250-4,000Hz, while unvoiced consonants cycle around 2,000-8,000Hz (Halliday & Bishop, 2005).

Kyle and Harris (2010) conducted a 3-year longitudinal study to identify predictors of reading development in children with deafness. Beginning at 7-8 years of age, children in the study were given a battery of literacy, cognitive, and language tasks every 12 months. The authors determined that children who had the most age-appropriate reading skills had less severe hearing losses, earlier diagnoses of hearing impairment, and also preferred to communicate through speech (Kyle & Harris, 2010). These findings were consistent with earlier studies (Paul & Quigley, 1990) in which writing and reading achievements were significantly and negatively correlated with the degree of hearing loss. A final study by Most, Aram, and Andom (2006) found that negative relations emerged between children's degree of hearing loss and performance on general knowledge tasks in kindergartners who were transitioning to first grade.

Not all studies agree regarding the relationship between degree of hearing impairment and reading ability. Tymms, Brien, Merrell, Collins, and Jones (2003) did not find a correspondence between hearing thresholds and composite reading scores among 5- and 6-year-olds. Tymms et al. (2003) assessed 962 children with deafness upon entry to school between 4-5 years of age. Children were assessed using the Performance Indicators in Primary Schools Broad Baseline Assessment and were retested one year later in math and reading to develop data for the prediction of academic achievement of children with varying degrees of hearing loss. The authors concluded that children with mild to profound hearing impairment and children with

normal hearing (with the same levels of language-free attainment on starting school) generally made the same progress in reading and mathematics during their first year of school.

Among older students who are deaf or hard of hearing, Allen (1986) found that degree of hearing loss had little impact on academic achievement, as measured by the Stanford Achievement Test. Powers (2003) later replicated the findings of Allen (1986) in a reanalysis of a data set from high school students with severe-profound hearing impairment from postsecondary education programs in England. A final study by Convertino, Marschark, Sapere, Sarchet and Zupan (2009) found no significant relationship between hearing thresholds and reading performance in a sample of 568 deaf and hard-of-hearing college students, using students' scores on either the California Reading Comprehension Test or the Michigan test of English-Language Proficiency.

Higher Level Functions

Many students who are deaf or hard of hearing continue to struggle with lower-level literacy skills. Consequently, reading strategies such as self-questioning, activating prior knowledge, summarizing the main idea, constructing representational images, predicting what text will follow, drawing inferences, monitoring for misunderstanding, and re-reading difficult passages of text are lacking (Andrews & Mason, 1991; Strassman, 1992). Marschark and Wauters (2008) argued that one reason for the lack of progress in this area might be that the reading challenges are not specifically related to reading. The researchers suggest that an overall deficit in general language comprehension and cognitive factors are the source of poor literacy achievement. Marschark and Wauters (2008) observed that weaknesses exhibited by students who are deaf in many of the sub-skills involved in reading are paralleled by similar weaknesses in understanding sign language. In their view, students who are deaf would benefit from a focus

on reader variables and considering differences in higher-level language and cognitive processes, lexical knowledge, metacognition, and information-processing strategies and habits in the context of language.

Just and Carpenter (1987) proposed a cognitive theory of reading based on the view that the reading process involves several levels of representation and processes that occur in parallel and must be coordinated in order to result in an appropriate interpretation of the text. The processes involved in reading include perceptual processes that allow the encoding of words, lexical processes that access word meaning, syntactic and semantic processes that organize word meanings into larger units, inference processes that integrate information, processes that construct a representation of the text structure, and processes that construct the representation of events and objects required in the interpretation of the text. These processes therefore must work in unison and become automatic components that are coordinated and integrated for the successful interpretation and comprehension of written text.

Continuing in this belief, Ewoldt (1981) argued that students who are deaf may compensate for their lack of syntactic knowledge of English with their world knowledge and inference processes. However, Quigley and Paul (1994) reviewed the experimental evidence that shows that vocabulary, syntax, and figurative use of language are key difficulties in the reading process for students who are deaf or hard of hearing. Furthermore, Quigley and Paul (1994) concluded that the reading difficulties that students who are deaf experience may be attributed to experiential (e.g., world knowledge), cognitive (e.g., inferencing), and linguistic (e.g., word knowledge) variables.

Brown and Brewer (1996) investigated whether inferences about predictable events are drawn in similar ways by readers who are hearing and readers who are deaf, and whether this

drawing of inferences varied as a function of reading level. Despite the study finding no qualitative differences in inference processes or in the encoding of information for hearing and deaf skilled and less skilled readers, a quantitative difference was found in both the speed and accuracy of the lexical decision task. The skilled deaf readers were not differentiated from hearing readers and were in fact faster and more accurate in rejecting non-words. Less skilled deaf readers were slower and made more errors. This finding supports that students who are deaf are capable of becoming skilled readers. It also highlights the differences in cognitive processing between those who are quick, fluent, and accurate readers and those who are not. Brown and Brewer (1996) concluded that good readers who were deaf were quicker and more correct than readers who were hearing and that their somewhat effortless word recognition may serve to free up cognitive resources for higher level processing. In contrast, the less skilled readers place a higher demand upon resources toward text-driven processing as opposed to preexisting conceptual processes. In turn, these students allot less attention toward tasks such as handling difficult linguistic contexts or integrating a text with world knowledge (Brown & Brewer, 1996).

These studies support the idea that the root issue surrounding the poor literacy skills of students who are deaf or hard of hearing may not be the direct result of reading itself. Other factors such as higher level language and cognitive processing play a dominant role in early literacy development prior to school age.

Relationship to Developmental Factors

Diverging from the traditional perspective regarding literacy development for children who are deaf or hard of hearing, the identification of correlations between reading skills and developmental factors is crucial in structuring a more adequate approach to intervention. Many factors contribute to the development of fundamental reading skills (Harris & Moreno 2004). Of

these, language one acquisition and primary mode of communication have a significant impact on the achievement in reading comprehension of a child who is deaf or hard of hearing. The ability and strength of language understanding and manipulation will aid or hinder reading comprehension as this would serve as the child's critical connection with written language. Freel et al. (2011) hypothesized a significant positive relationship between a measure of ASL proficiency and a measure of reading skills. The results provided support for the idea that establishing ASL as a complete first language is related to skills in English as a second language (Freel, Clark, Anderson, Gilbert, Musyoka & Hauser, 2011). In this study, 23% of the variance in reading skills was explained by ASL proficiency. Further Allen, Hwang, and Stansky (2009) found that individuals' ASL scores explained 68% of the variance in reading scores. In addition, there is an extensive database indicating that the literacy outcomes of children who are deaf or hard of hearing are related to their underlying language skills (Lederberg, Schick, Spencer 2012). This association is found even when that language is a sign language or a signed system. In a meta-analysis of reading studies of children who are deaf or hard of hearing, Mayberry, del Giudice, and Lieberman (2011) found that the language abilities (both signed and spoken) of children who are deaf or hard of hearing predicted 35% of the variance in their reading ability.

When comparing children who are deaf who have parents who are deaf or parents who are hearing, research has found that children who are deaf with parents who are deaf generally outperform children who are deaf with parents who are hearing in future linguistic and academic success related to their ASL abilities (Meadow, 1968; Strong & Prinz, 1997). Additionally, parental hearing status has been found to have an effect on ASL and English abilities, indicating that parents who are deaf are more likely to aid in the development of ASL. In an interview study of parents and teachers of successful readers who are deaf, all respondents focused on the

importance of ASL as a bridge to written literacy (Freel, Clark, Anderson, Gilbert, Musyoka & Hauser, 2011).The familiar statistic stating that 90% of all children who are deaf are born to parents who are hearing causes one to question the quality of language that these children have. Mitchell and Karchmer (2004) studied this statistic to analyze its accuracy and determine if these parents were either deaf or hard of hearing and if this applied to one or both parents. Mitchell and Karchmer (2004) reviewed the 1999-2000 Annual Survey to investigate school records regarding the parental hearing status of students who are deaf or hard of hearing in K-12 programs in the United States. Unfortunately, no specifics were given to identify the degree of hearing loss of the parents. However, the authors concluded that the Annual Survey revealed a more appropriate statistic of 96% of children who are deaf being born to parents who are hearing within the United States. This statistic is limited to those identified for educational purposes. This finding may explain why so many children who are deaf have difficulty, not only in developing English, but also sign language, and further demonstrates the importance of early language exposure and use.

Primary Mode of Communication

How does a parent decide whether their child will use a signed language or spoken language as their primary mode of communication? Lederberg, Schick & Spencer (2012) conclude that the nature of language development within each context is not solely the result of that context. Parent fluency and the presence of other adults and children who use the system of communication clearly influence rate and patterns of learning. Children's functional hearing also correlates with their language learning context and their ability to learn from it. Comparisons of the reading strategies of children educated orally and those whose preferred language is a signed language suggest that communication mode has a profound effect on the extent to which children

who are deaf make use of phonological coding in reading (Harris & Moreno, 2005). Miller (2002) argues that children who are native signers do not engage in phonological recoding. Easterbrooks et al. (2008) found that 95% of children who are deaf or hard of hearing in oral programs had good speech perception skills, compared to 60% of children in simultaneous communication programs and 40% in bilingual programs. These comparisons reflect matching the characteristics of the child to the appropriate program—with those with more functional hearing tending to be in programs emphasizing spoken language.

Harris and Beech (1998) report two different profiles were evident in their longitudinal study of reading progress. The best reader, who did not sign, had good spoken English and did well on a test of phonological awareness. The child with the second highest score was a native signer, of Deaf parents, who had poor phonological skills. Harris and Beech (1998) concluded that children who are deaf may become successful readers by more than one route.

Harris and Moreno (2005) studied the characteristics of children with prelingual, profound hearing impairment who were successful readers. They found that speech reading (i.e., visual cues available on the face) and the use of a phonological code were core skills that influenced syllabic representation and orthographic awareness. In addition, these were the only measures that separated good and poor readers. Out of the 9 children who were considered good readers, 5 were native signers with deaf parents while the other 4 received cochlear implants. Their findings suggest an additional skill that may need to be addressed for improved reading ability.

Cochlear Implants

There are other contributing factors that influence both language acquisition and literacy development in children who are deaf or hard of hearing. Amplification is a traditional option for

individuals who are deaf or hard of hearing. The cochlear implant provides access to the speech signal for those who are severe to profoundly deaf. Geers and Hayes (2011) conducted a study to research the outcomes of implanting children early in life. These authors sought to document the literacy skills of early implanted deaf adolescents, determine whether students who demonstrated age-appropriate reading skills in elementary school were able to keep up with their hearing peers in high school, and determine the degree to which phonological processing skills and demographic characteristics play a role in literacy achievement among high school students with cochlear implants. Between 47% and 66% of the high school students with cochlear implants (CI) scored within or above the average range for hearing peers on two tests of reading. Thirty-six percent of the students read at the 9th grade level or above on the Peabody Individual Achievement Test-Revised (PIATR) with only 17% reading below the 4th grade barrier that characterized the performance of students who are deaf before the advent of the CI. The authors stated that the students with cochlear implants performed better on literacy measures while phonological processing tasks were not as high. They concluded that other strategies provided an alternate route to successful reading acquisition. Earlier studies (Geers, 2002) showed that students with cochlear implants had higher levels of phonological awareness than peers who were deaf without cochlear implants, but they remained lower than that of peers with normal hearing. Geers (2002) concluded by stating that some factors affecting the reading of cochlear implant users were important to hearing children as well, such as general knowledge, parent education, and family income. Marschark, Rhoten, and Fabich (2007) cautions that while cochlear implants have improved the reading ability of individuals who are deaf, their skills are not commensurate with their peers—where in the United States a 10^{th} -11^{th} grade reading ability to be a functional participant in society.

Bimodal Bilingualism

Recent research suggests that children who are deaf learn to read best when they are exposed to both signing and oral language (Kushalnagar et al., 2010). Kushalnagar et al. (2010) studied early intervention involving children who are deaf and provided with good linguistic models in both a sign and a spoken language. Their findings supported that if both sign and spoken language are provided that the child will have at least one language in which to feel at ease when communicating. Further this model will better assure language and higher-order cognition and mental flexibility (Kushalnagar et al., 2010). Sign-bilingual education programs in the United States are based on the premise that a focus on improving sign language skills, thus promoting general language knowledge, leads to better reading skills of the spoken language. These programs acknowledge that the latter will be acquired as a second language via print. In fact, it is assumed that a fluent natural, sign language can serve as the primary language of instruction and be used to support learning of the second language (Lederberg, Schick & Spencer, 2012). The suggestion is that good signing skills provide children with a secure language base, whereas knowledge of the oral language provides them with an understanding of the sounds that occur in the words they will encounter in reading (Goldin-Meadow & Mayberry, 2001). Proponents of bilingualism encourage the bilingual use and equal value of ASL and English. One important aspect in ensuring a successful bilingual program is ensuring the quality of ASL in bilingual programs (Evans, 1998; Cummins, 1979).

Research supports that native signers of ASL have significantly higher bilingual abilities in ASL and written English, implying that having control of ASL as a native language can serve as a bridge to stronger reading abilities. As a result, children who are deaf who are raised in an ASL environment and develop ASL as a native language have been found to possess stronger

reading skills than children who are deaf who are raised by parents who are hearing and do not develop ASL as a native language (Freel, Clark, Anderson, Gilbert, Musyoka & Hauser, 2011).

Conclusion

The purpose of this paper was to identify the problematic areas surrounding reading comprehension within the school aged (6-11 year old) population of children who are deaf or hard of hearing and to explore the aspects of literacy that are the most challenging for this group of children. The patterns of reading development for children who are deaf or hard of hearing were reviewed and compared with peers with normal hearing.

Research indicates that factors which predict reading include: phonological awareness, cognitive ability, and the primary mode of communication and its level of complexity (Goff, Pratt & Ong, 2005). It is important to note that phonological skills did not hinder overall reading achievement as deficits can be overcome by other cognitive processes. Furthermore, phonological skills can be developed as a byproduct of improved reading, and thus cannot be considered a reading prerequisite as they are in children with normal hearing. Research supports that some individuals who are deaf rely upon phonological awareness, while others use an alternate method (Koo, Crain, LaSasso, and Eden, 2008). Orthography is a strategy that some children who are deaf or hard of hearing use to make judgments of phonological similarity. Other findings suggest that children's ability to perform orthographic processing tasks is acquired through their reading experiences rather than it being an underlying skill for reading development (Deacon, Benere, & Castles, 2012). Either way, phonologic or orthographic, processing is believed to be a preferential, use driven by the child's language and educational history and the instruction provided for reading skills.

No significant relationship was found between hearing thresholds and reading performance (Tymms, Brien, Merrell, Collins, and Jones 2003, Convertino, Marschark, Sapere, Sarchet and Zupan 2009). Instead, research suggests an overall deficit in general language comprehension and cognitive factors to be the reason for poor literacy achievement (Marschark and Wauters 2008). Higher level language and cognitive processing are considered to be dominant influences in early literacy development prior to school age. The lack of complex language and cognitive skills places a higher demand upon resources toward text-driven processing as opposed to preexisting conceptual processes (Brown and Brewer 1996). This text-driven process will result in students allotting less attention and cognitive resources toward handling difficult linguistic contexts or integrating a text with world knowledge.

A key area that distinguished skilled readers from poor readers was the strength of their primary language (Mayberry, del Giudice, and Lieberman 2011). When there is a mismatch between parent and child primary language it can be difficult for the child to develop fluent language. Even when children receive amplification via hearing aids or cochlear implants, phonological awareness and reading profiles may still fall below that of peers with normal hearing (Geers, 2002). Deaf children of Deaf adults who were raised in an ASL environment and develop ASL as a native language were found to possess stronger reading skills than children who are deaf with parents who are hearing and who do not develop ASL as a native language (Freel, Clark, Anderson, Gilbert, Musyoka & Hauser, 2011). These findings emphasize the need to appropriately match a child's communication modality and educational program to suit the child's needs and family's resources.

As a whole, these findings suggest the need for openness to instruction and intervention for children who are deaf or hard of hearing. An underlying theme that emerged from the

research was that other strategies provide an alternate route to successful reading acquisition, and that there may be multiple ways to achieve these fundamental reading skills. Understanding that the trajectory of literacy development for students who are deaf or hard of hearing is altered from that of children with normal hearing will aid the transition from traditional intervention that is phonology based to other alternate interventions. Research supports that higher-level language and cognitive processes as well as information processing strategies strengthen reading and reading comprehension skills in students who are deaf or hard of hearing. Future research investigating literacy abilities in children who are deaf or hard of hearing could be geared toward intervention strengthening these alternate routes to reading comprehension. In addition, developing a fluent, primary mode of communication, whether sign or oral, could support the bridge to written language. Identifying cognitive influences could potentially provide strategies for students to decipher and code multiple aspects of written language.

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Research Paper Title:
Challenges with Literacy Development in Children Who are Deaf or Hard of Hearing.

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