A Case Study on Accessible Reading with Deaf Children

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Abstract

The concept of accessible reading for deaf students is new and worthy of exploration. In the face of the reading difficulties often experienced by deaf students, the lack of a specialized reading methodology that works for them must be addressed. Central to the paper is a research case study undertaken with two young deaf students, proficient in American Sign Language (ASL) and learning to read. The students participated in a tutorial with a tutor knowledgeable in a specialized reading methodology called ASL Gloss. The participating students demonstrated progress in reading skills over time. Two reading measures were adapted from English to ASL for use with deaf students. Some important features of ASL Gloss are included in the study report. The manipulated English text that closer resembles ASL and the use of the ASL-phabet, are designed to facilitate deaf students' needed transition from ASL to English literacy (Supalla, 2017; Supalla & Cripps, 2011; Supalla et al., 2001). These deaf students engage in oral reading (in ASL) and are also given a different task. That is, to identify ASL-phabet letters that represent the phonological structure of signed words. The reading measures under development appear to promote the process of learning to read as informed by the quantitative and qualitative data. These findings support the need and promise of pursuing an alternative theory and applied research for deaf students' reading that accounts for their ability to become fluent readers.

Introduction

For years, achieving English literacy has been problematic for deaf students in schools, and recently traditional curriculum, instruction, and assessment models have been targeted for improvement. This trend indicates that scholars and researchers are thinking about the underlying systemic restrictions for deaf students regarding reading instruction. The view of reading education is broadening to tailor best practice instruction to all students in all their diversity. Reading is a crucial skill for academic success. Effective reading instruction is no longer limited to students who can hear. What this shift suggests is that deafness should not be used as a rationale for reading difficulties. The historical view of teaching deaf students using a methodology similar to hearing students cannot continue. Deaf students must have their effective methodologies for learning to read. The crux of the matter is that effective reading strategies and measures must be accessible for deaf students to facilitate their learning. Only then can deaf students experience progress while learning to read and become fluent readers.

This changing mindset and outlook for American education is part of the underpinnings of the Universal Design for Learning (UDL) framework. UDL means that "all four components - goals, media and materials, teaching methods, and assessment – need to apply to all students" Hitchcock et al., 2002, p. 10). Flexibility with the curriculum is a key concept as it can help facilitate deaf students' learning to read (see Supalla & Byrne, 2018 for the connection of the UDL framework to the education of deaf children). Thus, the UDL framework is evidence-based and

supported by multiple scholars (e.g., Hitchcock et al., 2002; Ralabate, 2011; Rose 2000; see also Elliott et al., 2001 and Roach et al., 2008 for the importance of curriculum, instruction, and assessment alignment). The UDL framework offers the opportunity for a fresh look at the education of deaf children.

At the same time, the UDL discussions are limited to general education settings (such as a local public school) where students with disabilities are enrolled. For this paper, the UDL scope is broadened to include schools for the deaf where American Sign Language (ASL) is frequently employed as the language of instruction (see Cripps & Supalla, 2012 for the identification of schools for the deaf as signed language schools that achieve the least restrictive environment status). It is encouraging to consider those modern educators who work with deaf students and understand that their students may know and use ASL. However, it is more critical now than at any time in the 200 plus years of deaf education's history to recognize the promise of using ASL in the classroom on reading instruction and measurement. While most educators understand the importance of measuring and monitoring deaf students' progress with reading, it is difficult to achieve. The field of deaf education is riddled with flaws that impact language and literacy instruction (see Supalla & Byrne, 2018 for further discussion on the traditional practices being poor); these must be remedied one way or another.

Some scholars and researchers (e.g., Grushkin, 2017; Hopkins, 2008; Miller, 2001; Reagan, 2006; Turner, 2009; van der Hulst & Channon, 2010) have proposed that deaf students are entitled to learn to read in ASL. They posit that written ASL will need to be embraced and promoted in schools for the deaf. Any discussion that includes signed language reading is new for the field of deaf education (see Supalla, 2017 for a formal distinction between signed language reading and spoken language reading). However, this paper does not focus on deaf students learning to read in ASL exclusively but instead learning an intermediary way to maneuver from ASL to English literacy. Deaf students can benefit from such a cross-linguistic construct in order to thrive as readers. The students in this alternative model learn to read in the signed language with the intention of transitioning to English literacy (Supalla, 2017; Supalla et al., 2017).[1]

The research case study outlined in this paper aims to demonstrate how deaf students' progress with reading skills is made possible through a specialized reading methodology that accounts for ASL and English as two languages. With a significant amount of alignment to the curriculum, instruction, and assessment, deaf students will have an accessible reading program. Special tools and procedures are part of this program. In any case, the data will shed light on how deaf students develop authentic reading skills over time. For the full appreciation of the research study undertaken, it is essential to address reading measurement for deaf students. This includes an understanding of how reading measures developed initially for English can be adapted for ASL with the specialized reading methodology in mind.

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[1] The alternative model for signed language reading with ASL Gloss is comparable to 'hitting two birds with one stone' (i.e., deaf students are learning to read with ASL and then move towards English literacy at the same time). The authors of this paper are not against the idea of deaf students learning to read in ASL exclusively, but it will not address the pressing pedagogical problems associated with how these students can learn to read in English effectively.

Background to the Study

First, it is necessary to examine how deaf education addresses the task of measuring deaf students' reading skills. While hearing students' reading can be effectively measured by the Dynamic Indicators of Basic Early Literacy Skills (DIBELS, Good & Kaminski, 2002; the University of Oregon Center on Teaching and Learning, 2009), this measure poses a challenge for deaf students. The deaf education expert, Dr. John Luckner of the University of Northern Colorado (2013), acknowledged that DIBELS is "the most widely used screening and progress monitoring assessments for reading in [American] preschools and elementary schools" (p. 9). Therefore, it is necessary to look more closely at Luckner's discussion regarding the measurement in question:

> The DIBELS subtests were developed to prevent reading failure by targeting early literacy skills that are predictive of later reading success (Torgesen, 2002). This targeting is accomplished by focusing on three essential areas: (a) phonological awareness, (b) phonetic skills related to the alphabetic principle, and (c) automaticity (National Reading Panel, 2000; National Research Council, 1998). These areas have been derived from the contention that reading in alphabetic orthographies such as English is mediated by phonology (i.e., access to the meaning of written words is mediated by the readers' knowledge of spoken words). (p. 15)

According to Luckner's description above, it is easy to understand that the DIBELS is well-regarded among educators. The idea that the DIBELS subtests are designed to help prevent students from becoming reading failures is attractive. Luckner himself devoted a section in his article to how deaf students experience reading difficulties. The deaf education expert explained that "research done over the past 90 years has documented the fact that most individuals who are deaf or hard of hearing complete their educational programs without being able to read well…" (p. 7). Therefore, something must be done about deaf students' reading situation. These students also have the right to become fluent readers.

As intriguing as the title of Luckner's article, *Using the Dynamic Indicators of Basic Literacy Skills with Students Who are Deaf or Hard of Hearing: Perspectives of a Panel of Experts* may be, the findings are perplexing and not helpful. Luckner relied on a panel of deaf education experts to help determine the DIBELS's appropriateness for use with the children in question. Please understand that the prevailing perspective holds that the DIBELS will help *all* students at risk with reading skills. Luckner's concluding remarks on the reading measurement for deaf students are as follow:

> While there is disagreement about whether this perspective is applicable to students who are deaf or hard of hearing (e.g., Allen, et al., 2009; Wang [et al.], 2008), to date, alternative theory or research demonstrating that deaf students who are deaf or hard of hearing develop reading skills differently from typical hearing students has not been produced (Paul & Lee, 2010). (p. 15)

Luckner's writing indicates that 'a ball is being dropped' in the investigation of DIBELS and the question of reading measurement for deaf students. There are two important considerations

here. First, Luckner only accepted DIBELS at face value, meaning that English is the target language and students are hearing. It is no wonder that the deaf education experts could not agree on whether to use the DIBELS with deaf students. What deaf education experts, including Luckner, should have done is explore avenues that will ultimately make DIBELS applicable for deaf students. Deaf students' reading can be monitored when a measurement system such as the DIBELS considers their language, ASL, for example. Ironically, Luckner mentioned that a Spanish version of the DIBELS is available. Nevertheless, Luckner did not mention ASL by name in his article. He only vaguely referred to signed communication (using terms such as *sign* and *signing*) used by deaf students. Unfortunately, when discussing the use of DIBELS with deaf students, Luckner appears to evade the vital language issue for reading measurement altogether.

Interestingly, experts in deaf education have thought about the differential needs that deaf students may have with reading (with their reference to the alternative theory and research for deaf students' reading), yet they are in limbo with no provision of support. Should there be an explanation for the situation described here, it would be about the long-held view that deafness is a severe form of deficiency. Deafness or hearing loss viewed in this manner has caused many experts to pursue and maintain a negative outlook. Thus, over the years, deaf education experts find themselves explaining to society why deaf students do not perform like hearing students, especially with learning to read.

Consequently, any deaf education experts are bound to the "deafness as deficient" mindset preventing them from pursuing alternatives that could help change the view of disability for the better. Andrews et al. (2016) explained that the ideology of deficiency had shaped the education of deaf children in a profound way, which is unfortunate and requires systematic reform. Such a deficiency outlook is opposed to viewing deaf students as fully capable with different needs with a positive outlook for their education. If more educators adopt this new and progressive mindset, the challenges for deaf students' education would be better addressed.

Second, a correction must be made regarding Luckner's statement on the lack of an alternative theory and research on deaf students' reading differences from hearing students. In 1998, fifteen years before Luckner's publication (in 2013), the first paper on a new paradigm for understanding and promoting deaf students' reading was released. The second author of this paper collaborated with Jenny Singleton, Sharon Litchfield, and Sara Schley in writing *From Sign to Word: Considering Modality Constraints in ASL/English Bilingual Education* published in the Topics in Language Disorders Journal.[2] For comparison, Luckner had his paper published in the American Annals of the Deaf, the journal that represents the field of deaf education. At the same time, there have been scholars and researchers who may not have a direct affiliation with deaf education, but they developed a strong interest in the education of deaf children. This circumstance led to the publication of the 1998 paper in a journal outside the field of deaf education.

In any case, Singleton et al. clarified that English is a spoken language. The scholars took advantage of the fact that English literacy is a challenge for deaf students to learn and master (and many fail to become fluent readers). This understanding is well documented in the deaf education

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[2] For the record, other publications support the alternative theory and research for deaf students' reading during the years before Luckner's 2013 publication. They are Cripps & Supalla, 2012; Supalla & Blackburn, 2003; Supalla & Cripps, 2011; Supalla et al., 2001. The other publications after 2013 are Rosen, 2017; Supalla, 2017; Supalla & Byrne, 2018; Supalla et al., 2014, 2017, 2019.

literature. All educators who work with deaf students must recognize that their students do not benefit from access to spoken English. These students do not develop or internalize spoken language knowledge for reading development purposes (see McQuarrie & Parrila, 2009; 2014 for further discussion of this topic). Please understand that the conventional reading instruction practices assume that students have access to spoken English either as a first or second language (Supalla et al., 2017). It is easy to understand that deaf students have trouble with English literacy when the barriers are formidable. Teachers who work with deaf students are seemingly powerless to correct this situation.

The formal distinction that Singleton, Supalla, Litchfield, and Schley made in their paper with English as a spoken language and ASL as a signed language is helpful. The term used in the paper includes the modality-constrained bilingualism that emphasizes the modality differences and language differences. The equation for the two languages in question for deaf students is complex and must be addressed accordingly. The learning of ASL and English cannot continue to be viewed as simply bilingualism. The unique experiences that deaf students have with language is something to embrace and should serve as a basis for reading programming.

Another relevant publication made before Luckner's 2013 publication is Supalla and Cripps (2008), in which the scholars introduced readers to the concept of linguistic accessibility and the special status of ASL as a signed language. What this suggests is that deaf students must learn to read in ASL. These students are known for thinking and processing in the signed language (e.g., Lane et al., 1996). This realization is where reading becomes authentic with deaf students who can make connections between ASL and print. English literacy is not accessible to deaf students for the simple reason that they do not have access to the spoken language. Having heard (and acquired) spoken English is a requirement for reading development purposes (see Supalla, 2017 and Supalla et al., 2017 for the rationale and importance of signed language reading).

The authors of this paper wish to emphasize that the status of English as a spoken language can be addressed for deaf students learning English literacy (see Caldwell-Harris, in press for difficulties faced when English literacy is introduced to deaf students with the expectation that they become fluent readers). The path to learning is just a matter of how a specialized reading methodology must be created, including an awareness that teachers will need to be appropriately trained to teach reading strategies and skills effectively to deaf students (Supalla, 2017). The crucial concept for best practices lies in tapping into deaf students' linguistic strengths in ASL to become literate in an otherwise inaccessible language, English. It is Singleton et al. who stated that "specific ASL-based methods must serve as a bridge to print English" (p. 21). This publication is where the scholars made the first reference to 'glossing' that formally known as American Sign Language Gloss. All deaf students are entitled to undergo the reading instruction developed from this perspective, including their foundation of proficiency in ASL.

The ASL Gloss methodology mentioned above and seen in this study is a direct product of a charter school in Arizona. This school's name was the Laurent Clerc Elementary School, established in 1996. The school's mission was to implement and test ASL Gloss. The charter school was affiliated with the University of Arizona (where the second author of this paper, Dr. Supalla, is employed as a professor). The fact that Singleton, Supalla, Litchfield, and Schley had their paper published two years later in 1998 is not a coincidence. This paper and ASL Gloss result from university-led research and development work with the participation of teachers and students in a school setting. Teachers at the charter school appreciated the tools and teaching procedures

related to ASL Gloss, as they have substantial implications for the curriculum, instruction, and assessment.

ASL Gloss promotes the integration of reading skills from ASL and deaf students' learning of English vocabulary and grammar. The cross-linguistic set-up of ASL Gloss results in deaf students crossing the bridge from ASL to English literacy. ASL Gloss would be phased out as a reading instruction program around the 4th grade as typical academic standards transition students from 'learning to read' to 'using reading to learn' (see Supalla & Blackburn, 2003 for a comprehensive description of the ASL Gloss programming from kindergarten through the 3rd grade). The highly desirable outcome includes how these students develop reading comprehension and fluency while learning an adequate amount of English language knowledge.

Furthermore, curriculum-based assessment alignment using ASL Gloss allows for test adaptation. An adapted form of the Dynamic Indicators of Basic Early Literacy Skills or DIBELS (Deno, 2003) serves as an answer to deaf education's struggle with reading measures. According to Haug and Mann (2007), test adaptation is common with different languages worldwide. It is noteworthy that these scholars had some experience with test adaptation concerning signed languages. Haug and Mann discussed how the signed language proficiency measures for ASL and British Sign Language are subject to adaptation for use with various European signed languages (see Enns & Herman, 2011 for a more recent example of how a test developed initially in British Sign Language was subject to test adaptation to ASL). While Haug and Mann did not address ASL Gloss specifically or discuss that ASL and English are two languages (with the associated modality-constrained bilingualism), but their understanding of test adaptation is insightful.

Haug and Mann explained that the test adaptation "incorporates the notion of developing a test for the target language which remains as close as possible to the source language while, at the same time, continues to meet the specific needs of the target language" (p. 139; see Oakland & Lane, 2004 for more information concerning the test adaptation efforts with hearing populations and spoken languages). Haug and Mann went on to discuss the test adaptation in more detail as follows:

> ...[the] parallel test (i.e., target test) ... acknowledges the linguistic, cultural, and social conditions of those who will be taking the adapted test while retaining the measurement of the constructs found in the original (i.e., source) test. The ultimate goal is to have two tests that measure the same trait in fair, equitable, and somewhat equivalent fashion. (p. 139)

The implications for the DIBELS become evident, including how ASL could be the target language and English as the source language. A parallel test could be developed, that could be called the DIBELS-ASL Gloss, for example. Haug and Mann emphasized that "such a process [referring to the creation of a parallel test] needs to be approached with great caution" (p. 139). This process includes addressing "how well psychometric measures transfer from one instrument to another" (p. 138). The parallel test for the DIBELS will also need to be re-standardized. Haug and Mann noted in their own words that "lack[ing] a thorough documentation of psychometric properties" in their own words (p. 145) is the situation described for most of the signed language proficiency test development work worldwide. It is important to understand that signed languages have been accepted as part of the world's human language family in the last few decades. This

finding suggests test adaptation work needs to be done with various signed languages. ASL Gloss is new and not yet widely accepted as a reading methodology for deaf students.

Educators in the United States must acknowledge that a review of research studies on ASL Gloss shows its promise (see Supalla, 2017). Deaf students can learn to read when it comes to signed language reading, for example. These students know ASL and mediate with the signed language in ways that authenticate the reading process. It is essential to understand that the various studies cover deaf students' reading with ASL Gloss at one point in time or another, not over time. Yet, the research findings continue to be significant as signed language reading is actual and comparable to what is known for spoken language reading with hearing students. The adaptation of DIBELS for ASL Gloss is thus a top priority and an appropriate undertaking. DIBELS has seven measures for English that are listed as Letter Naming Fluency, Initial Sound Fluency, Phoneme Segmentation Fluency, Nonsense Word Fluency, Oral Reading Fluency, Retell Fluency, and Word Use Fluency. As part of including ASL Gloss as a reading methodology, all seven measures will need to be adapted for deaf students.

The Study

For this paper, an exploratory research study on test adaptation to measure deaf students' reading through ASL Gloss was undertaken. The authors of this paper recognize the importance of a parallel test development with all seven subtests of the Dynamic Indicators of Basic Early Literacy Skills or DIBELS for the education of deaf children. Included here is the creation of a normatively rare database that accounts for deaf students' accessible reading development. It will be part of a long-term study with many deaf students. For now, it is imperative to shed light on the feasibility of the test adaptation idea for the education of deaf children. Two reading measures underwent the adaptation process to document and evaluate deaf students' progress with signed language reading skills.

The fundamental research question for the current study is: How do deaf students perform with reading skills over time when taught through ASL Gloss, and what indications are there to support the measures' face validity? The setting for this research was a tutorial where ASL Gloss was used for teaching reading skills to deaf students. The research study for this paper has its roots in the doctoral dissertation that the first author of this paper completed in 2008. It is the second and third authors who initiated the test adaptation project for ASL Gloss.

Participants

The students who participated in the tutorial were two females, aged 7 and 9. Both were profoundly deaf since birth. Pseudonyms have been developed for these students for reasons of confidentiality. Renee is the younger student, and Pat is the older student. The ASL Gloss background was different between the two students. The younger student, Renee, enrolled in the Laurent Clerc Elementary School (where ASL Gloss was first developed and implemented as a reading methodology) at pre-Kindergarten and remained there until the end of 1st grade. At the time of the tutorial, Renee was scheduled to enter 2nd grade in the fall. The older student, Pat, had attended a school for the deaf but transferred to the charter school in 3rd grade. Her exposure to

ASL Gloss was for one year. Thus, Renee had a more extended experience using ASL Gloss for learning to read.

Both Renee and Pat were ranked highly proficient in ASL via the American Sign Language - Proficiency Assessment (Maller et al., 1999). However, Pat's parents were concerned about their child's reading skills. The parents understood Pat disliked reading and struggled with reading comprehension tasks. This difference explains, in part, why Pat was transferred from a school for the deaf to the charter school. Therefore, the tutorial with ASL Gloss was determined to be an appropriate action plan for Pat.

The situation with Renee was different. There was no urgent need for this student to undergo the tutorial, but she was eager to participate to avoid the boredom of staying home during the summer. Renee's parents saw that the tutorial would be a good opportunity for their child to review ASL Gloss. In any case, the setting for the participating students' learning to read via ASL Gloss is a tutorial during a summer break from school. The tutor was a native signer, well-versed in ASL Gloss, and saw a benefit in having two students for the tutorial. The learning dynamics for the tutorial were thought to improve with two students rather than just one.

Since Renee and Pat were subject to learning to read via ASL Gloss, it is important to discuss what was involved with the tutorial. A children's book entitled "The Lady and the Spider" (McNulty, 1987) was selected to teach reading skills and strategies to Renee and Pat. The text's readability is gauged for children aged 6 through 9. This story's protagonist is a spider who lived in a woman's garden. The story is told from the spider's perspective as it lived inside a lettuce head in its world. The woman takes a lettuce head from her garden and starts cleaning it with running water in the sink. At this point, the reader sees conflict when the spider's life is disrupted with chaos and its world verges on being destroyed. However, the lady soon rescues the spider and returns it to the garden on a different lettuce head, and life for the spider was restored.

Moreover, "The Lady and the Spider" originally written in English, was glossed for use with Renee and Pat. The English text underwent manipulation and became ASL-like. The English words or roots that had equivalence with ASL signs were fully capitalized and arranged according to ASL's morpho-syntactic structure. For example, special writing conventions were used to mark the glossed sentences for ASL's inflectional morphology, facial markers for topicalization and other syntactic operations, and classifier constructions. The resulting glossed sentences are a product of interlinear translation from English to ASL (see Supalla et al., 2017 for a detailed discussion on how a glossed text is written; also see Ralabate, 2011 and Rose, 2000 for the value of text manipulation for all students as part of the Universal Design for Learning framework).

The glossed book "The Lady and the Spider," was then divided into seven parts, and these parts delineated the instructional design for reading instruction over time. The Resource Book or RB (a bilingual dictionary) had also been developed for each section to use it to help identify English words in the glossed text as needed (Supalla et al., 2001). The RB has English words from each part of the glossed book paired with the ASL equivalents written in the ASL-phabet. The ASL-phabet uses 32 symbols for writing signed words. The signs are written based on the phonological structure of ASL, comprised of the handshape, location, and movement parameters (Supalla et al., 2001; see Supalla et al., 2014 for a detailed description of the ASL-phabet and how it is an alphabetic type of writing for ASL). It is essential to keep in mind that the ASL-phabet is designed for writing and reading at the word level only. Deaf students read sentences or text through the glossed text.

During the tutorial, Renee and Pat participated in a wide range of activities using the glossed book "The Lady and the Spider" for eight days from 9:00 AM to 1:30 PM Monday through Thursday over two weeks. The tutor considered the guided reading sessions as the primary activity for the students. However, substantial time was provided to explore ASL songs, conduct homework reviews, story structure analysis, and English language lessons. English language lessons are one major component of ASL Gloss alongside the RB and glossed text components. This reading methodology integrates all three components that define ASL Gloss (Supalla, 2017; Supalla & Cripps, 2011; Supalla et al., 2001, 2019; see Supalla et al., 2017 for the emphasis on ASL Gloss as a process).

With the English language lessons, Renee and Pat had the opportunity to conduct comparative analysis of the glossed text with the original English for "The Lady and the Spider" with their tutor. This is where the students learned about English's grammar to help ensure their transition to English literacy. Please keep in mind that the same students also learned English vocabulary via reading the glossed text and using the RB when needed. However, for the reason of limited space in this paper, the English language lessons are not part of the current research study. Only use of the RB and the reading fluency with glossed text were subject to examination.

Method

The research with the two participating deaf students, Renee and Pat, is best described as a case study. Test adaptation (with reading measures) plays an important role in this study. Both types of data, quantitative and qualitative, were collected and subject to analysis. The quantitative data was collected through the administration of the adapted reading measures with both students. The examination of the students' reading skills is based on the three-time intervals of the tutorial: Initial, Middle, and Final. The initial period refers to the first day of the tutorial, the middle period was a day halfway through the two-week tutorial, and the final period was during the last day of the tutorial.

The adapted measures are called the ASL-phabet Letter Naming Probe and Glossed Running Records. The first measure is modeled on the DIBELS's English subtest called Letter Naming Fluency. The ASL-phabet probe is designed to assess the participating students' letter naming fluency for the signed language. The probe relies on the 32 ASL-phabet letters scrambled on a chart with 130 letters (with some letters showing up once and others multiple times).

The tutor instructed Renee and Pat to go through the chart and identify the letters as quickly as they could for the assessment procedure. Then each ASL-phabet letter read would be signed from one to another. The time limit for the task was two minutes. Please note that the procedure as described is identical to the DIBELS's Letter Naming Fluency. The computation for the ASL-phabet letter naming scores is also like those developed for the English version. The formula for scoring the ASL-phabet letter naming probe computes the numbers of correct letters/number of letters reached multiplied by 100.

The transcribed ASL-phabet letter naming data over the three assessment periods for Renee and Pat are included in Appendixes 1a, 1b, 1c, and 2a, 2b, 2c, respectively. √ refers to the correct responses that the students made with the individual letters (e.g., signing ∿ for the symbol of ∿). When the students self-corrected, their responses were marked as SC. In this case, the students misread one letter for another letter but quickly realized the error and came up with the correct

response (please note that SC responses were counted as a correct response according to this study).

Concerning errors, three types were considered for deeper investigation. First, when Renee or Pat misnamed a letter with an alternative letter, the error was transcribed as an X. This transcription symbol also represented a few occasions where the students mimicked the shape of an ASL-phabet letter by tracing the letter with their index finger in the air. Although the students were aware of the need to sign the letters, they did air tracings with the hope of providing a partially correct answer, rather than making a complete error. Finally, X also represented any time that that the students skipped a letter in the probe.

Test adaptation with the glossed running records is a bit more complicated. The DIBELS has a subtest named Oral Reading Fluency, including text that hearing students read English aloud. One option considered for this test adaptation was to gloss the DIBELS story and ask Renee and Pat to read it using signed language. However, for this study, the DIBELS text option was not pursued because the tutor wanted to use the ASL Gloss text from "The Lady and the Spider" (used for instruction) as a formative measure and more authentic curriculum-based assessment. The tutor had instructed Renee and Pat to read aloud parts of the glossed book, "The Lady and the Spider," in ASL during the tutorial time. The students' performances were all videotaped in their entirety for transcription and analysis. This valuable data was submitted for analysis in this paper.

Clay's (1993) running records and calculations were adopted to examine how Renee and Pat performed using oral reading in ASL of "The Lady and the Spider." The adoption of Clay's calculation chart for this study is supported by the fact that Clay's measure provides more detailed information related to measuring the participating students' oral reading performances (in ASL) than what is provided through the separate DIBELS oral reading assessment. Clay's formula charts define three areas of reading behavior: error rate, accuracy, and self-correction rate. Figure 1 below show the formula for each area.

CALCULATIONS

(RW = Running words; E = Errors; SC = Self-corrections)

ERROR RATE	ACCURACY	SELF-CORRECTION RATE
$\dfrac{\text{Running words}}{\text{Errors}}$	$100 - \dfrac{E}{RW} \times \dfrac{100}{1}$	$\dfrac{E + SC}{SC}$
e.g. $\dfrac{150}{15}$ = Ratio 1:10	$100 - \dfrac{15}{150} \times \dfrac{100}{1}$ = 90%	$\dfrac{15 + 5}{5}$ = Ratio 1 : 4

Figure 1: Clay's Calculations Chart

At the same time, the glossed running records include a one-minute cut-off, which is borrowed from the Oral Reading Fluency subtest of the DIBELS. Thus, Clay's calculations were computed according to the one-minute read-aloud performance of Renee and Pat in ASL. Nersesian's formula (2002) was used for tallying the word count. An accurate word count is critical for the success of a valid glossed running record. The word count does not just address 'regular

signs' but is applied for other ASL features such as classifier constructions (that require their own counting in sub-morphemes, for example). Readers of this paper are encouraged to read Nersesian's groundbreaking research on how to best count 'words' in ASL.

There are symbols to consider when it comes to scoring the participating students' performances with the glossed running records. Some are borrowed from Clay's running records for English, and others are unique to ASL Gloss. √ refers to the correct responses that the students made with the individual words read. When the students made self-corrections, they were transcribed as SC. An SC is recognized when the students misread one word for another word but quickly recognize their production as an error and then read the correct word (and SC is counted as a correct response according to this study, in the same way as for the ASL-phabet probe count).

When Renee or Pat read a word with an erroneous sign, it is marked with a slash or –. This symbol (–) is also used any time the participating students skipped a word in the running records. Any time the students used the RB to help identify unknown English words in the glossed text, the transcription symbol used for coding is RB in parentheses or (RB). (RB) is written next to either correct or erroneous responses to indicate that not only do the students use the RB but that they make a correct or erroneous response when doing so. The transcribed running records over the three assessment periods for Renee and Pat are included in Appendixes 3a, 3b, 3c, and 4a, 4b, 4c, respectively.

Moving to the qualitative component of the research study, the fact that all the tutor's guided reading activities with Renee and Pat were videotaped proved valuable for research purposes. This data was once again turned over to the research study team for this paper. The analysis focused on finding all tutorial episodes that demonstrate the students' learning behaviors corresponding to what was measured through the ASL-phabet probe and the glossed running records. The criteria as developed helps with locating the appropriate learning behaviors with Renee and Pat. The identified tutorial episodes were subject to detailed descriptions.

Results

The research findings with Renee and Pat and the test adaptations for ASL Gloss are substantial and insightful. Results are presented here with the first part covering what the measures reveal and the second part on the students' tutorial experiences.

Part 1: Reading Skills Subject to Measurement

For this part, the participating students' reading performances are laid out over the three assessment periods, first with the ASL-phabet letter naming probe and then with the glossed running records. Thus, in addition to measuring what Renee and Pat learned internal to ASL Gloss, research reveals the effects of the students' backgrounds on their reading performances. Information is also provided for the tutor's decision to change the assessment procedure for the third and last period. These considerations are important for confirming any reading measure's sensitivity to the external variables.

Letter Naming Skills with the ASL-phabet. Table 1 shows the results of Renee and Pat's performances with the ASL-phabet probe. The students correctly name a great proportion of letters with their corresponding signs by a significant proportion during the three periods of the tutorial

Table 1 – Letter Naming Performances Over Three Assessment Periods

Students	Initial	Middle	Final
Renee	51/66 = 77.3%	66/75 = 88%	73/74 = 98.6%
Pat	91/101 = 90%	107/117 = 91.5%	121/130 = 93%

(i.e., initial, middle, and final). The data suggests that the students had already known the letters before their participation in the tutorial. Renee and Pat attended Laurent Clerc Elementary School before the tutorial.

At the same time, Renee and Pat do have some letter naming skills for ASL-phabet letters that need to be developed. In this sense, the tutorial was helpful. The students steadily improve with their letter naming skills over time, according to the data above. Initially, Pat had a better standing with the letter naming skill than Renee. However, Renee made the most improvement and scored better than Pat by the final assessment. The fact that Renee had more schooling with ASL Gloss (as compared to Pat) suggests that she recovered and became fluent with the letters at 95% or higher. Pat stopped short of achieving the fluency level at 93%.

The effects of maturation concerning the two participating students can be seen with the ASL-phabet probe as well. Pat had more letters named within the two-minute limit for all three periods (ranging between 101 and 130 letters) in comparison to Renee (ranging between 66 and 75 letters). Thus, Pat had an age-related cognitive advantage enabling her to go through the ASL-phabet probe faster than Renee. However, it is important to keep in mind that this outcome does not have a direct relationship to improved letter naming skills.

Measurement of the Oral Reading Fluency. Table 2 shows how Renee and Pat perform over time when they read aloud the glossed rendition of "The Lady and the Spider." With the initial assessment, the running words/errors calculation results indicate that Renee produced four errors out of 41 running words. With the error ratio being 1:10.3, she produced one error out of every ten words. Renee's self-correction ratio is 1:2, which means that she self-corrected once per two errors on average. With the instructional level at 90% or better, Renee achieves this level with a 90.2% accuracy.

Pat produced seven errors, thus creating an error ratio of 1:9.4. The average of one error out of every 9.4 words is higher than what was reported for Renee. Pat's self-correction ratio is 1:8, which means that she self-corrected once per 8 errors. Thus, Pat engaged in self-corrections less frequently than Renee. With a 89.4% accuracy rate, "The Lady and the Spider" is ranked at the difficult level for Pat (please note this child had never demonstrated a 90% or better accuracy rate even for the later assessment periods).

Table 2 - Oral Reading Performances Over Three Assessment Periods

Students	Initial	Middle	Final
Renee			
Running Words/Errors	41/3	77/7	54/6
Error Ratio	1:10.3	1:11	1:9
Accuracy Rate	90.2%	90.9%	88.9%
Self-correction Ratio	1:2	1:3.33	1:3
Pat			
Running Words/Errors	66/7	108/14	61/7
Error Ratio	1:9.4	1:7.7	1:8.7
Accuracy Rate	89.4%	87%	88.5%
Self-correction Ratio	1:8	1:15	1:8

By the middle assessment, a total of four parts of "The Lady and the Spider" had been read. Both Renee and Pat experienced a boost in their reading confidence, evident by the increased number of running words (i.e., from 41 to 77 for Renee and from 66 to 108 for Pat). The tutor's engagement in guided reading appears to have helped the students becoming more comfortable with reading.

In addition to reading more words, Renee's error ratio was stable, if not slightly improved (from 1:10 to 1:11). With the self-correction ratio of 1:3.33, Renee engaged in self-correction once every three errors rather than two. Thus, this student continued to be at the instructional level at 90.9%. The fact that Renee not only sped up her reading, but also became less prone to making errors and self-corrections, is interpreted as a positive outcome for the tutorial.

The situation with Pat is different. This student seemed overly confident with reading, and she rushed to read. This hurried reading behavior caused a higher proportion of errors (i.e., 1:7.7 as compared to 1:9.4 during the initial assessment). Self-corrections became far less frequent (i.e., 1:15 as compared to 1:8 during the initial assessment). In comparison, Renee performed as if she knew more about what the task of reading involved. She was able to increase her reading speed

without increased error. Once again, recall that Renee had more schooling with ASL Gloss compared to Pat must have played a role in oral reading skills using ASL Gloss.

It is important to note that Pat became a more careful and focused reader by the end of the tutorial. Pat's error ratio was better than the score she achieved during the middle period (i.e., 1:8.7 vs. 1:7.7). Pat demonstrated the same self-correction ratio as reported for the initial period, suggesting that she picked up with her performance after the middle period. After reading more parts in "The Lady and the Spider" with the tutor's guidance. Pat must have realized that speed is not the most crucial factor when reading. This student started to pay closer attention to what was read and no longer viewed reading as a timed race.

During the final assessment, the tutor faced an unexpected circumstance. Time had run out for Renee and Pat to read through the seventh and last part of "The Lady and the Spider" with the tutor's guidance. Instead of following the previous tutorial schedule, the tutor asked the students to read the part for assessment purposes only. This task was more challenging than reading a section with the tutor's guidance, and then rereading the part again for assessment purposes. Thus, the impact on the reading process is understandable, including how Renee and Pat slowed down and the running words fell from 77 to 54 and 108 to 61, respectively. It is noteworthy, however, that Renee's error and self-correction ratios remained stable, suggesting that her reading skills are well-established.

Similar to what was discussed for the letter naming skills with the ASL-phabet, the maturational effect prevailed for oral reading with ASL across all three assessment periods. Pat being the older student, consistently produced more running words than the younger student, Renee. That is, 66 words as opposed to 41 for the initial period, 108 vs. 77 for the middle period, and 61 vs. 54 for the final period.

Finally, there is no indication in the data over the initial, middle, and final periods that Renee or Pat used the RB while reading the glossed text of "The Lady and the Spider." The RB was left untouched when these students participated in the running records. The tutor made it clear to the students that they could use the RB when needed, but they chose not to. Essentially, some of the errors that the students made with the individual words may not have occurred had they used the RB. Let us consider Renee as the most accomplished reader of the two. When this student uses the RB for unknown English words, her performance with the running records is likely to go beyond the highest accuracy rate of 90.9%, for example.

Part 2: Tutorial Experiences for the Participating Students

For the qualitative data of the research study, three tutorial episodes were identified that confirmed a relationship between what the participating students learned and what skills were measured. In addition, the tutor's engagement in guiding Renee and Pat in using the RB is noteworthy (given that the students did not use the RB as they should, according to the first part of the research study). The fact that both Renee and Pat learned new English words through ASL (with the tutor's guidance, of course) should be appreciated. Finally, please consider that the ASL Gloss skills taught during the tutorial with Renee and Pat are comparable to what occurs with hearing students in letter identification, word decoding, and oral reading.

The Learning of Reading Skills #1. On the first day of the tutorial, the tutor led a flashcard activity to help prepare Renee and Pat for reading the glossed rendition of "The Lady and the

Spider." The flashcards used for the tutorial had an English word written on one side and the ASL equivalent on the other. The tutor drew on the first part of "The Lady and the Spider" to provide English words for inclusion in the flashcards. The teaching procedure required the tutor to show Renee and Pat English words on the flashcards, one after the other. When the students failed to correctly read an English word, the tutor flipped the flashcard and had them read the ASL equivalent. Consequently, the tutor had the opportunity to closely monitor the students' reading of the written signs and provide assistance whenever necessary.

According to the videotaped discourse data, Pat responded the most to the English words during the flashcard activity (by providing ASL translations). Renee sat next to Pat, observing and throwing in signs occasionally. While Pat was able to sign and identify a sizable number of English words on the flashcards, there are some words that she did not know. For example, Pat could not identify the word INSIDE. The tutor flipped the card and showed the ASL equivalent to her: ⋇₁⋇₁↲ ≋ℕ. The first two letters (i.e., ⋇₁⋇₁) represent two identical handshapes produced in the sign, whereas the third letter (i.e., ↲) designates the location. The last two letters (i.e., ≋ℕ) represent the movements internal to the sign.

Although Pat could have tried to read and identify ⋇₁⋇₁↲ ≋ℕ as a whole word in ASL (so that she could know the meaning of INSIDE through her knowledge in the signed language), the tutor did something more fundamental. The tutor asked Pat to identify the individual letters in the written sign, and the student did. There is a reason for this, as the tutor wanted to know how well Pat knew the ASL-phabet's 32 letters. Having fluency in letter naming is critical for success in reading written signs as whole words.

In any case, Pat's letter naming performance with ⋇₁⋇₁↲ ≋ℕ is informative, including how she successfully named the handshape and location letters of the word. However, the movement letters were a different story for Pat.[3] When Pat produced an error by signing ⟩ for the ≋ letter, the tutor stepped in and discussed the difference between ⟩ and ≋. Similar assistance by the tutor occurred for the other movement letter ℕ .

Of interest to this case study, Renee happened to not be paying attention to the interaction between Pat and the tutor regarding the distinction between the letters ⟩ for ≋. The impact of missing this instructional information was significant for Renee. The reading measurement under development reflects this. Upon taking the ASL-phabet probe later the same day after the tutorial, Renee had trouble identifying the movement letter ≋ (she did not reach the ℕ letter in the probe yet; see Appendix 1a for a review). On the other hand, Pat named ≋ and ℕ correctly (see Appendix 2a for a review), representing successful learning during the tutorial.

The Learning of Reading Skills #2. The tutorial's attention moved on to oral reading. The setting included Renee and Pat taking turns reading the sixth part of "The Lady and the Spider" with the tutor's guidance. In this part of the story, one event has the spider scrambling inside the lettuce head as the lady washed the vegetable in her sink. The spider's perception of 'rain' falling on him is a direct result of the lady's washing. The water drops are described as huge in the eyes of the spider.

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[3] Readers need to acknowledge a report that Supalla (2017) made regarding "the handshape-location/ symbol relationships [are] easier to learn as compared to the movement/symbol relationships, thus the former [is] seen as involving consonants and the latter vowels" (p. 46). The ASL linguistics community has a similar view in regard to how consonants and vowels prevail in the signed word structure.

When Renee read aloud the glossed text in ASL, she stalled at the word: HUGE. Renee did not voluntarily use the RB. For this reason, the tutor gently reminded Renee to use the RB. The student, however, rejected the tutor's guidance and tried to decipher HUGE by rereading the sentence again, this time, silently. The child tried to figure out the word's meaning through the context of the story. This reading strategy was a good choice but was insufficient for what was needed. Consequently, Renee could not think of a sign that matched the target word. The tutor once again encouraged her to use the RB. Renee then used the RB and was quick to identify HUGE upon reading the ASL equivalent: ⎸, ⎸, ϶ ϟ ≋. According to the video discourse data, Renee was visibly elated that she now enjoyed full comprehension with what she was read. Renee then proceeded to read subsequent events in "The Lady and the Spider" with success.

Please recall that Renee scored as fluent with letter naming skills according to the ASL-phabet probe. Renee being able to read and identify ⎸, ⎸, ϶ ϟ ≋ without any struggle during the tutorial falls in line with this measurement outcome. Equally important is how the tutor was teaching Renee about the use of multiple reading strategies. If relying on the glossed text's context to help identify a word's meaning does not work, Renee needs to use the RB.

The Learning of Reading Skills #3. The third and final tutorial episode covers oral reading during the final tutorial period with the sixth part of "The Lady and the Spider." The student is Pat this time. The event that Pat read is about the spider becoming afraid of the fact that her home, the lettuce head, had been shredded. The spider was now floating on a leaf in the sink. The lady watched the spider trying to escape from this situation. The glossed text looks like this:

<u>LADY</u>   LOOK>DOWN,   MOTION>TINY   (2h)�-EYE>FOCUS.   SEE

SMALL   SPIDER   [⋔-SURFACE   ∨-ADRIFT],   TRY+   ESCAPE.

Pat read the first glossed sentence correctly. Please understand that the English translation of the glossed sentence in question is: The lady looked down and a tiny motion caught her eye. This sentence is complex and embedded with many ideas. The same holds true for the glossed version. Pat's successful reading performance at the sentence level is significant (see Figure 2 below for the ASL recitation of the child's oral reading).

However, Pat still needed more development in reading skills as she experienced some difficulty with the second glossed sentence.[4] She did not recognize the last word in the sentence: ESCAPE and paused. Pat chose to rely only on context to help identify the meaning of the unfamiliar word. She did not choose to look up the word in the RB. This strategy is comparable to what Renee chose, as discussed earlier. Instead, Pat reread the sentence again, this time silently, then looked at the tutor and articulated the sign: CONTACT. Based on Pat's word choice, the spider was trying to contact the lady or get her attention to ask for help.

However logical, the sign CONTACT does not fit well with what took place in the story. The tutor explained to Pat that in the first sentence, the lady was already looking down at the spider. Therefore, it was inaccurate to say that the spider was trying to make contact with the lady. The tutor then asked Pat to look up the word (i.e., ESCAPE) in the RB. This student went through the RB to locate ESCAPE and read the ASL equivalent: ⋔, ⎸ ⋃ ⋋ ≋.

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[4] The original English sentence is: She saw a small spider, adrift on a raft of lettuce, trying to escape.

Figure 2: Recitation of Pat's successful oral reading performance in ASL
(https://youtu.be/ucXtoNc33qQ)

Pat's word decoding effort with the ASL equivalent for ESCAPE was not successful because she did not recognize the movement letter: ∂. The fact that Pat did not master this letter according to the ASL-phabet probe (see Appendix 2c) serves as an excellent example for the correspondence between what took place during the tutorial and the measurement. Before presenting a detailed discussion about the student's multiple efforts to identify the correct sign when reading ∩ⁱ Ɩ ↵ ∂≈, it is important to understand that the ASL equivalent to ESCAPE has a fourth letter in the movement position of the word. The first two letters of ∩ⁱ Ɩ ↵ ∂≈ refer to the two distinctive handshapes used in the sign, and the third letter refers to where the signed word is formed (i.e., location). The fifth and last letter refers to the additional movement information about the sign for ESCAPE.

A total of six decoding attempts were made before Pat signed ESCAPE as the correct response. This child had a problem reading ∂. Pat can be seen to put effort into reading the word as best she could; however, she got caught up with several signs that are written similar to the ASL-phabet version of ESCAPE. Also, Pat added the repeated movement information or ∨, which is not part of the print form. The combination of adding information to what is read and failing to recognize a letter led to the child's signing of the wrong words. With the first attempt, Pat quickly learned that she was incorrect based on the tutor's correction. Her subsequent production of a gibberish sign (her second attempt; see Figures 3 and 4 below for the signing of ESCAPE and how closely it resembles the recitation of Pat's gibberish sign). The second attempt prompted the tutor to point to the individual letters of the written sign for ESCAPE in the RB. The purpose of this guidance was to help Pat pay attention to word decoding information available. Pat reread the word and responded with signs that are close to ESCAPE phonologically yet erroneous (fourth, fifth, and sixth attempts).[5] By the time of Pat's sixth attempt, the tutor resorted to using the context of

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[5] Readers of this paper are encouraged to see Supalla et al. (2014) for a similar outcome with a different written sign with a more detailed description for the multiple word decoding attempts.

Figure 3: Signed word for ESCAPE
(https://youtu.be/-IpyCq6qQ4U)

Figure 4: Gibberish sign resembling
ESCAPE (https://youtu.be/fpTh8HgiRBE)

the glossed text to help her with decoding the ASL equivalent to ESCAPE. The tutor took over and read aloud the sentence that ends with ESCAPE. The equivalent to what the tutor signed, "She (the lady) saw a small spider, adrift on a raft of lettuce trying to..." The tutor stopped short of signing ESCAPE, asking Pat to 'fill in the blank' or use a Cloze reading strategy. Given this prompt, the student quickly signed ESCAPE. Right before this, Pat was trying to decipher the phonological information pertaining to the ASL equivalent of ESCAPE and how it could help fill in the word in the sentence. Although Pat did not have accurate phonological information (for the ASL word) at that time, she had enough information to narrow down choices and produce the correct sign. As described for Renee earlier, Pat's face was visibly elated over her successful reading of the sentence.

DISCUSSION AND CONCLUSION

To answer the original research question, the two participating students involved in this tutorial did make progress, most notably with the ASL-phabet letter naming skills and to some degree with oral reading in ASL. Understanding that the reading measures are under development, they are sensitive to what took place during the tutorial. The different variables associated with the fact that the students were learning to read with ASL Gloss, the students having their distinctive backgrounds, and the change that the tutor made for the assessment procedure at the end of the tutorial are significant. More support for this comes from how the students' learning during the tutorial corresponds with what the measures have to say on three different occasions. The two measures, the ASL-phabet letter naming probe and the glossed running records, demonstrate their face validity for the performance and progress of the two students, Renee and Pat.

Regarding the Universal Design for Learning framework, it is important to note that the tutor was flexible regarding the introduction and use of instructional strategies (concerning the goals, media and materials, teaching methods, and assessment). The primary goal was for Renee and Pat to learn to read based on the accessible language of ASL (and for transitioning to English literacy when it comes to the larger picture of ASL Gloss). To help achieve this flexible instruction, materials such as glossed books and The Resource Book or RB were created. The tutor then guided the students by reading with them at the word and sentence levels. The teaching method includes having students develop fluency with the letters representing the phonological structure of ASL

words. The same holds true for reading the glossed text that is consistent with ASL's morpho-syntactic structure. Finally, the tutor used the ASL-phabet letter naming probe and the glossed running records (based on those developed for English) to measure the students' progress with reading skills.

According to the data, Renee and Pat deciphered the English words INSIDE, HUGE, and ESCAPE through The Resource Book or RB. This finding suggests the fulfillment of the cross-linguistic reading instruction intention of ASL Gloss. Please understand that those English words are the same in orthography and spelling as the glossed words (i.e., inside/INSIDE, huge/HUGE, and escape/ESCAPE). Therefore, the transfer from ASL to English should occur here, at least theoretically (see Supalla & Cripps, 2011 for further discussion of this topic). Please also understand that Renee and Pat had the opportunity to learn about English' morpho-syntactic structure through comparative analysis with the glossed text and the original English text of "The Lady and the Spider." The impact on reading comprehension at the word and sentence levels with English needs to be confirmed through future research.

Considering the research study detailed here, it can be said that an instructional baseline was established for Renee and Pat regarding their signed language reading skills. When thinking about these students going back to the Laurent Clerc Elementary School in the fall, the assessment information as provided through the research study would be beneficial. Renee is ready to integrate the RB into her daily reading with glossed books (given that she is fluent with the ASL-phabet letters and performs at the instructional level when reading a glossed text). This student can be described as on the verge of becoming a spontaneous user of the RB (see Cripps & Supalla, 2004 for a report on a deaf child who succeeded in using the RB spontaneously, helping with the child's reading process). Renee must understand both that the RB is connected to her improved reading comprehension capacity and about the importance of multiple reading strategies. More guided reading activities in the classroom at the Arizona charter school are expected to accomplish this. The teacher will need to closely monitor Renee for her reading development feature with the RB to maximize her reading skills.

With Pat, the situation was pressing due to her age. Pat was not as fortunate as Renee, owing to her limited schooling experience with ASL Gloss. However, this situation does not spell doom for Pat. Remedial reading instruction could be implemented to emphasize additional one-on-one instructional strategies using guided reading and ASL Gloss. Pat's teacher would need to see that she achieves fluency with the ASL-phabet letters, allowing her to read written signs in the RB with fluency. The glossed books will also need to be 'easier to read' for some time before Pat gets better with reading (and can then start reading more advanced books). Pat needs to integrate the RB into her regular reading of glossed books, but it will take time.

The fact that the tutorial was set up initially for Pat (because her parents were concerned about her reading skills) is something to consider. This case study confirms that Pat had more to learn as a reader when compared to Renee. According to the data, Renee is decidedly the better reader of the two students. The other important consideration lies in the value of the distinctive data. All the scores presented in this paper are part of that data, not through conventional reading measures. It is clear that deaf students, in general, deserve the kind of detailed assessment information as provided for Renee and Pat. Teachers can be empowered to teach reading to deaf students when having the means to assess through ASL Gloss. Thus, the relevance of the

alternative theory and research for deaf students' reading and the UDL framework has become paramount.

The scenario for reading measurement for the education of deaf children can be described as changing from bleak to bright with possibilities unfolding in the evidence presented in this paper. The adaptation of reading measures initially developed for English becomes an important direction to pursue, including the needed standardization with a large population of deaf students. For now, the tutorial's results stand as a platform for a dialogue on how deaf students can demonstrate a variety of reading skills (such as word identification, word decoding, and oral reading), some learned over time and some still needing to be learned. Accessible reading as provided through ASL Gloss is an exciting avenue to pursue for the research and development work with deaf students. This methodology includes consideration for a signed language education model that accounts for ASL Gloss, among others (Cripps & Supalla, 2012; Supalla et al., 2019). The case study covering the two participating deaf students with ASL Gloss achieved its purpose, demonstrating how developmental patterns can occur with signed language reading.

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Appendix 1(a): Initial ASL-phabet Probe – Renee

General ASL-phabet Probe

Student Name: _Student #1_   Date: _7/21/03_

CBA #1 - Researcher #1   end here

[01:53:19:27 - 01:55:20:00]

2 minutes

Total: _51/66_

Appendix 1(b): Middle ASL-phabet Probe – Renee

General ASL-phabet Probe

Student Name: _____Student # 1_____   Date: __7/24/03__

CBA #2 – Researcher #1

[00:11:37:24 – 00:13:38:10]
2 minutes

Total: _66/75_

Appendix 1(c): Final ASL-phabet Probe – Renee

General ASL-phabet Probe

Student Name: _Student # 1_   Date: _7/29/03_

CBA #3 – Researcher #1

[00:13:42:14 – 00:15:46:12]

2 minutes

Total: _73/74_

Appendix 2(a): Initial ASL-phabet Probe – Pat

General ASL-phabet Probe

Student Name: _____Student #2_____   Date: __7/21/03__

CBA #1 - Researcher #1

start here

end here

[01:50:22:22 - 01:52:22:24]
2 minutes

Total: __91/101__

Appendix 2(b): Middle ASL-phabet Probe – Pat

General ASL-phabet Probe

Student Name: _Student #2_   Date: _7/24/03_

CBA #2 – Researcher #1

Total: _107/117_

end here

[00:08:13:05 – 00:10:13:05]

2 minutes

Appendix 2(c): Final ASL-phabet Probe – Pat

General ASL-phabet Probe

Student Name: _____Student #2_____   Date: __7/29/03__

CBA #3- Researcher #1

[handwritten grid of ASL-phabet symbols with "Start here" noted at bottom left and "end here" noted at top right]

[00:10:50:21 – 00:12:48:06]
2 minutes.

Total: __121/130__

Appendix 3(a): Initial Running Records – Renee

Appendix 3(b): Middle Running Records – Renee

CBA #2 - Researcher #1   **RUNNING RECORD SHEET** [00:14:41:15 - 00:15:41:15]
1 minute

Name: Subject # 1 _____   Date: 7/24/03 D. of B.: _____ Age: ____ yrs ____ mths

School: Tutorial Program _____   Recorder: Researcher #1 ____

Text Titles	Errors / Running Words	Error Ratio	Accuracy Rate	Self-correction Ratio
Easy _____	_____	1: ____	____ %	1: ____
Instructional The Lady and the Spider	77/7	1: 11	90.9 %	1: 3:33
Hard _____	_____	1: ____	____ %	1: ____

Directional movement _____

Analysis of Errors and Self-corrections
Information used or neglected [Meaning (M), Structure or Syntax (S), Visual (V)]

Easy _____

Instructional _____

_____

Hard _____

Cross-checking on information (Note that this behaviour changes over time)

Nersesian's formula

			Count		Analysis of Errors and Self-corrections	
					Information used	
Page	**Title**		E	SC	E MSV	SC MSV
	✓ ✓ ✓R ✓ ✓ ✓ **NIGHT** LETTUCE WET (2h)✵-SPHERE>FORM. HAVE		1	0		
	✓ SC ✓ end here INSIDE (2h)HOLLOW	BESIDE SPIDER HOME.		0	1		
	WATER (2h) |-DROP+ (2h)∩-FILL>UP (2h)Co-CIRCLE>		7	3		
	TINY. **MOON** [∩-SURFACE Co-MOON>RISE]. **GARDEN**					
	fs-MOTH WAKE (2h)∩-FLY (2h)∩-FLY>ABOUT SEARCH					
	FOR OTHER fs-MOTHS. **ONE** SEE>IX=2 WATER					
	(2h)Co-CIRCLE HAVE MOON [∩-SURFACE Co-MOON>					
	ON]. (2h)∩-FLY>DOWN INTO WATER. **WING** BECOME					
	WET. UNABLE FLY, DROWN. **MORNING SUN**					
	[∩-SURFACE C-SUN>RISE] SPIDER LOOK>IX=2					
	WATER (2h)Co-CIRCLE SEE>IX=2 [∩-SURFACE					
	v-FLOAT]. (2h)✵-WALK TO WATER (2h)Co-CIRCLE					
	[∩-EDGE ✵-STOP] EAT EAT+MORNING.					

Appendix 3(c): Final Running Records – Renee

Appendix 4(a): Initial Running Records – Pat

CBA #1 – Researcher #1   **RUNNING RECORD SHEET** [00:31:35:18 – 00:32:35:18] 1 minute

Name: Student #2   Date: 7/22/03   D. of B.: _____   Age: _____ yrs _____ mths

School: Tutorial Program   Recorder: Researcher #1

Text Titles		Errors Running Words	Error Ratio	Accuracy Rate	Self-correction Ratio
Easy	_____	_____	1: ____	____ %	1: _____
Instructional	_____	_____	1: ____	____ %	1: _____
Hard	The Lady and the Spider	66/7	1: 9.4	89.4 %	1: 8

Directional movement _____

Analysis of Errors and Self-corrections
Information used or neglected [Meaning (M), Structure or Syntax (S), Visual (V)]

Easy _____

Instructional _____

Hard _____

Cross-checking on information (Note that this behaviour changes over time)

Nersesian's Formula

Page	Title	Count E	Count SC	Analysis of Errors and Self-corrections — Information used E MSV	SC MSV
	HAPPEN ONE SUMMER DAY LADY POS=3	0	0		
	GARDEN HAVE LETTUCE (2h)✳-SPHERE, INSIDE	0	0		
	SPIDER [Ⴖ-SURFACE ᐯ-STAND>ON]. (2h)LOOK>ABOUT	1	0		
	SEE GREEN (2h)HILL# GREEN VALLEY#.	0	1		
	BETWEEN TWO LETTUCE CREVICE SEE>IX=2	0	0		
	GREEN fs-CAVE. EIGHT (2h)h-LEG#	1	0		
	(2h)✳-WALK>DAINTY [ᴄ-HALF-CYLINDER ✳-GO>INSIDE].	0	0		
	WITH TIP FRONT (2h)h-LEG>LONG FEEL [WALL	1	0		
	(2h)h-LEG>FEEL#] [CEILING (2h)h-LEG>FEEL#]	0	0		
	[FLOOR (2h)h-LEG>FEEL#]. fs-CAVE IX=3 SUIT.	1	0		
	[ᴄ-HALF>CYLINDER IX=3] RIGHT fs-SIZE FOR	3	0		
	POS=3 HOME.	7	1		

Appendix 4(b): Middle Running Records – Pat

CBA #2 - Researcher #1   RUNNING RECORD SHEET   [00:19:02:00 – 00:20:01:03]
                                                                    1 minute

Name: Student #2   Date: 7/24/03   D. of B.: _____   Age: ____ yrs ____ mths

School: Tutorial Program   Recorder: Researcher #1

Text Titles	Errors Running Words	Error Ratio	Accuracy Rate	Self-correction Ratio
Easy _____	_____	1: _____	____ %	1: _____
Instructional _____	_____	1: _____	____ %	1: _____
Hard The Lady and the Spider	108/14	1: 7.7	87 %	1: 15

Directional movement _____

Analysis of Errors and Self-corrections
Information used or neglected [Meaning (M), Structure or Syntax (S), Visual (V)]

Easy _____

Instructional _____

Hard _____

Cross-checking on information (Note that this behaviour changes over time)

Nersesian's formula

		Count		Analysis of Errors and Self-corrections	
Page	Title	E	SC	Information used E MSV	SC MSV
	HAPPEN ONE SUMMER DAY LADY POS=3	0	0		
	GARDEN HAVE LETTUCE (2h)✳-SPHERE, INSIDE	0	0		
	SPIDER [�-SURFACE ∨-STAND>ON]. (2h)LOOK>ABOUT	0	0		
	SEE GREEN (2h)HILL# GREEN VALLEY#.	0	0		
	BETWEEN TWO LETTUCE CREVICE SEE>IX=2	0	0		
	GREEN fs-CAVE. EIGHT (2h)ʜ-LEG#	2	0		
	DAINTY (2h)✳-WALK>DAINTY [ᴄ-HALF-CYLINDER ✳-GO>INSIDE].	1	0		
	fs-LEG WITH TIP FRONT (2h)ʜ-LEG>LONG FEEL [WALL	2	0		
	(2h)ʜ-LEG>FEEL#] [CEILING (2h)ʜ-LEG>FEEL#]	0	0		
	[FLOOR (2h)ʜ-LEG>FEEL#]. fs-CAVE IX=3 SUIT.	1	0		
	IX=3 [ᴄ-HALF>CYLINDER IX=3] RIGHT fs-SIZE FOR SIZE	2	0		
	POS=3 HOME.	0	0		

CBA #2 - Researcher #1   **RUNNING RECORD SHEET**   [00:19:02:00 – 00:20:01:03]
1 minute

Name: _Student #2_   Date: _7/24/03_   D. of B.: _____   Age: _____ yrs _____ mths

School: _Tutorial Program_   Recorder: _Researcher #1_

Text Titles		Errors ⁄ Running Words	Error Ratio	Accuracy Rate	Self-correction Ratio
Easy	_____	_____	1: _____	____ %	1: _____
Instructional	_____	_____	1: _____	____ %	1: _____
Hard	_The Lady and the spider_	108 ⁄ 14	1: 7.7	87 %	1: 15

Directional movement _____

Analysis of Errors and Self-corrections
Information used or neglected [Meaning (M), Structure or Syntax (S), Visual (V)]

Easy _____

Instructional _____

_____

Hard _____

Cross-checking on information (Note that this behaviour changes over time)

Nevsesian's formula

		Count		Analysis of Errors and Self-corrections
				Information used
Page	**Title**	E	SC	E MSV ⁝ SC MSV
	✓ ✓ ✓ ✓ ✓ **NIGHT** LETTUCE WET (2h)✳₁-SPHERE>FORM. HAVE	0	0	
	✓ ✓ ✓ **INSIDE** (2h)HOLLOW BESIDE SPIDER HOME.	0	0	
	✓ ✓ ✓ ✓ ✓ **WATER** (2h)I-DROP+ (2h)ꓵ-FILL>UP (2h)Cₒ-CIRCLE>	1	0	
	✓ ✓ ✓ ✓ ✓ TINY. **MOON** [ꓵ-SURFACE Cₒ-MOON>RISE]. **GARDEN**	2	0	
	✓ ✓ ✓ ✓ ✓ fs-MOTH WAKE (2h)ꓵ-FLY (2h)ꓵ-FLY>ABOUT SEARCH	1	0	
	fs-MOTH — SCV ✓ ✓ end/here FOR OTHER fs-MOTHS. **ONE** SEE>IX=2 WATER	2	1	
	(2h)Cₒ-CIRCLE HAVE MOON [ꓵ-SURFACE Cₒ-MOON>	14	1	
	ON]. (2h)ꓵ-FLY>DOWN INTO WATER. **WING** BECOME			
	WET. UNABLE FLY, DROWN. **MORNING SUN**			
	[ꓵ-SURFACE C-SUN>RISE] SPIDER LOOK>IX=2			
	WATER (2h)Cₒ-CIRCLE SEE>IX=2 [ꓵ-SURFACE			
	V-FLOAT]. (2h)✳₁-WALK TO WATER (2h)Cₒ-CIRCLE			
	[ꓵ-EDGE ✳₁-STOP] EAT EAT+MORNING.			

Appendix 4(c): Final Running Records – Pat

CBA #3 - Researcher #1 **RUNNING RECORD SHEET** [00:09:28:28–00:10:28:28]
1 minute

Name: Student #2   Date: 7/30/03   D. of B.: _____   Age: ____ yrs ____ mths
School: Tutorial Program   Recorder   Researcher #1

Text Titles	Errors Running Words	Error Ratio	Accuracy Rate	Self-correction Ratio
Easy		1:	%	1:
Instructional		1:	%	1:
Hard The Lady and the Spider	$\frac{61}{7}$	1: 8.7	88.5 %	1: 8

Directional movement _____

Analysis of Errors and Self-corrections
Information used or neglected [Meaning (M), Structure or Syntax (S), Visual (V)]

Easy _____

Instructional _____

Hard _____

Cross-checking on information (Note that this behaviour changes over time)

Nersesian's formula

Page	Title	Count E	SC	Information used E MSV	SC MSV
	DAY# GROW HOT, LADY KNOW IT-IS-TIME	2	0		
	(alt)✲₁-PICK LETTUCE. EACH DAY IX=3 I -COME	1	0		
	GARDEN WITH BASKET KNIFE [✲₁-LETTUCE	0	0		
	∩-CUT] FOR EAT+NOON. EACH DAY LETTUCE	1	1		
	PICK# (2h)✲₁-LETTUCE>ROW [✲₁-LETTUCE	1	0		
	∩-CLOSE+ER>AND>CLOSE+ER] LETTUCE THAT POS=3	0	0		
	SPIDER LIVE. ONE DAY SUN ᑕ-MOVE>UP	1	0		
	✲₁-SHINE>IX=3 SPIDER HOME (2h)∩-DOME BECOME	0	0		
	WARM, SPIDER GO-OUT (2h)✲₁-WALK>DOWN TO	1	0		
	WATER (2h)ᑕ-CIRCLE (2h)SPARKLE TO-SEE WHAT	0	0		
	FOR EAT+MORNING. HAPPEN THAT !MOMENT!	7	1		
	LADY I -COME GARDEN. (2h)I -BEND>DOWN				
	(2h)✲₁-GRASP LETTUCE. THAT POS=3 SPIDER				
	HOME. [✲₁-LETTUCE>HOLD ᑕ-CUT]. (2h)✲₁-LETTUCE>				
	SHAKE WET [✲₁-SPHERE I -DROP#]. LETTUCE WITH				