

The Signed Reading Fluency of Students Who Are Deaf/Hard of Hearing

Susan R. Easterbrooks

Georgia State University

Sandra G. Huston

Atlanta Area School for the Deaf

Reading fluency in deaf children whose primary mode of communication is visual, whether English-like or American Sign Language, is difficult to measure since most measures of fluency require a child to read aloud. This article opens the discussion of a new construct, namely, signed reading fluency (i.e., rendering of printed text in a visually fluent manner) in children with hearing loss whose primary means of expressive language includes some form of sign. Further, it describes the development of an assessment rubric to measure signed reading fluency. A comparison of fluency scores and scores on tests of vocabulary and text comprehension of 29 middle school students who attended a school for the deaf indicated that signed reading fluency, as defined and measured by this instrument, correlates highly both with word and passage comprehension.

The National Reading Panel (NRP) defines fluency as the ability “to read orally with speed, accuracy, and proper expression.” (NICHD, 2000, html version). A considerable body of literature exists delineating the relationship between spoken language and literacy (Perfetti & Sandak, 2000), oral reading fluency, and reading comprehension (Fuchs, Fuchs, Hosp, & Jenkins, 2001; Grossen, 1997). Much attention has also been paid to the relationship between fluency and reading curricula through curriculum-based measurement of fluency (Fuchs & Deno, 1991; Fuchs, Fuchs, & Compton, 2004; Shinn, 1989). Because the ability to read by speaking out loud is so critical to fluency assessment and because reading optimally builds on spo-

ken language (Perfetti & Sandak, 2000), then what are the implications for literacy when a child does not speak? This is the case for those children who are deaf and hard of hearing and are not sufficiently skilled in spoken communication but instead use sign language. “No one knows yet how deaf children learn to read” (Musselman, 2000, p. 25), and current constructs of reading in deaf children are not sufficient to answer the question. Because average deaf readers have slower reading rates than skilled deaf readers (Kelly, 1995), is it possible to teach them to become fluent readers? If so, then the definition of fluency must expand to include forms of visual expression, in particular, sign language. Presently, there are no available definitions of signed reading fluency, no formal or informal assessment tools to measure signed reading fluency, and no research to indicate whether signed reading fluency is a viable concept in relation to the reading comprehension of signing deaf children.

The purposes of the research reported herein are to present a new construct regarding the components and definition of signed reading fluency, to describe the development of an assessment rubric for signed reading fluency, and to contribute to the knowledge base regarding the relationship between signed reading fluency and reading comprehension in signing children who are deaf or hard of hearing. To that end, we present information regarding the development of an assessment rubric that examines signed reading fluency as defined by this new construct, provide indicators of its reliability and validity, and present data on

No conflicts of interest were reported. Correspondence should be sent to Susan R. Easterbrooks, Pryor Street, Department of Educational Psychology and Special Education, Georgia State University, Atlanta, GA 30302-3979 (e-mail: seasterbrooks@gsu.edu).

the correlation between signed reading fluency as measured by the new assessment tool and reading comprehension scores.

Fluency in Hearing Children

As previously stated, the NRP defined fluency as the ability “to read orally with speed, accuracy, and proper expression.” (NICHD, 2000, html version). Speed is measured as words per minute or words correct per minute (Carnine, Silbert, Kame’enui, & Tarver, 2004). Reading rate is positively related to reading comprehension (Jenkins, Fuchs, van den Broek, Epsin, & Deno, 2003; Swanson & Howell, 2001), and children who are poor readers have been shown to improve their reading comprehension skills upon direct instruction in fluency (Mercer, Campbell, Miller, Mercer, & Lane, 2000). Accuracy is measured through miscue analysis or tallies of decoding error types (Johns, 2004). In addition to decoding errors, automaticity of processing is a component of accuracy. “Automaticity refers to fast, effortless recognition of words in isolation or in lists. Fluency refers to fast, effortless reading of words in sentences and passages. Automatic word recognition is a necessary, but not sufficient, condition of fluency” (Carnine et al., 2004, p. 182).

The third component of reading fluency is proper expression, referred to also as prosody (Schreiber, 1987), which includes pitch, stress, and juncture of the spoken word. Fluency connects directly to comprehension at the level of prosody (Rasinski, 2004). The prosodic component of reading fluency stresses the appropriate use of phrasing and expression (Dowhower, 1991; Schreiber, 1987; Schreiber & Read, 1980). “When readers embed appropriate volume, tone, emphasis, phrasing, and other elements in oral expression, they are giving evidence of actively interpreting or constructing meaning from the passage” (Rasinski, 2004, p. 3). For hearing children, fluency is related to spoken language. Prosody allows readers to group phrases of information, rather than to read discrete words. When children read word for word, their memory capacities becomes overburdened and they are unable to make sense of the material they have read (LaBerge & Samuels, 1974). Slower readers may be less able “to hold extended segments of text in

their memories and may be less likely to integrate those segments with the meaning of other parts of the text” (Mathes, Simmons, & Davis, 1992 as reported by Mastropieri, Linart, & Scruggs, 1999). Grouping of words into phrases is important because the English language has as its basis phrase and clause units. English is comprised of noun phrases, verb phrases, adjectival phrases, adverbial phrases, prepositional phrases, as well as adverbial clauses and relative clauses.

Research documents many benefits for reading aloud by students who have normal hearing. Among these benefits are confidence building, creation of community, improvement of decoding skills, improved fluency, improved comprehension, and practice for real-life situations where children or adults may be called upon to read aloud for an audience (Rasinski, 2003). Although Round Robin Reading (i.e., teachers calling on students one by one to read aloud) is no longer a respected classroom practice (Opitz & Rasinski, 1998), high-quality forms of oral reading (e.g., characterization and reader’s theater) are still a very necessary and integral part of a comprehensive reading fluency program. However, the primary reason that teachers ask children to read out loud is that it allows them to view the child’s reading process. The literature is very clear regarding the relationship between reading fluency and reading comprehension in students with normal hearing.

Reading Fluency in Children Who Are Deaf or Hard of Hearing

There is a critical dearth of empirical research on reading development and instruction in children who are deaf and hard of hearing. Two recent studies (Easterbrooks & Stephenson, 2006; Luckner, Sebold, Cooney, Young, & Muir, 2005) reported extensive reviews of the literature in the area of literacy. Both studies found fewer than a couple dozen articles that met standards of rigor as defined by the Washington Institute on Public Policy (Aos, Phipps, Barnoski, & Lieb, 2001) or the National Center for Education Statistics (2006). Most of the literature available on reading fluency in children who are deaf or hard of hearing compares the skills of deaf readers to

those of hearing readers (Kelly, 2003; Easterbrooks & Stephenson, 2006).

We do, however, know several things about the reading of students who are deaf and hard of hearing. We know that temporary storage capacity, or working memory, and the ability of the student who is deaf or hard of hearing to process the separate bits of information found in each reading passage are important precursors to the literacy success of the population (Garrison, Long, & Dowaliby, 1997; Kelly, 1993; King & Just, 1991). We also know that influences on reading comprehension such as syntax (Kelly, 1996; King & Quigley, 1985) and vocabulary knowledge (Davey & King, 1990; deVilliers & Pomeranz, 1992) have been documented, and approaches to improve reading rate have been suggested (Ensor & Koller, 1997). In addition, we know that proficiency in American Sign Language (ASL) contributes positively to deaf children's development of written English, the other side of the literacy coin (Litchfield, 2002).

Although tangential to the topic of this paper, a full treatment of literacy in students with hearing loss must include mention of phonological coding, which includes the skills of phonemic awareness, phonological processing, and phonics. Phonemic awareness involves listening to and recognizing alphabetic sounds that make up words. Phonological processing involves manipulating sounds in words. Phonics involves an understanding of the sound-grapheme relationship of words in print. Although phonemic awareness skills correlate with overall reading ability (Dyer, MacSweeney, Szczerbinski, Green, & Campbell, 2003) and deafness in and of itself does not preclude phonemic awareness ability (Miller, 1997), there is debate regarding its place in the reading process. Whereas some studies have found that phonemic awareness does not relate to reading ability in students who are deaf or hard of hearing (Izzo, 2002), others identify aspects that do (Luetke-Stahlman & Corcoran-Nielsen, 2003). The same may be said for phonological processing. Some students with hearing loss tend to acquire phonological processing skills more readily than others, and some aspects of phonological skill are easier to master than others (Sterne & Goswami, 2000). Conversely, some researchers have found that phonological processing does not contrib-

ute much to the reading skills of deaf children (Harris & Moreno, 2004). Whereas some students may benefit from traditional phonics instruction, others are unable and may benefit from instruction through Visual Phonics (Trezek & Malmgren, 2005; Trezek & Wang, 2006). Yet, here we also find concern regarding the paucity of research (Woolsey, Satterfield, & Roberson, 2006). At minimum, the individual interested in phonological coding skills of students with hearing loss should consult available overviews of the topic such as Kyle and Harris (2006) and Paul (2005).

In the area of fluency, the available literature is even sparser. In preparation for this article, a comprehensive search of the Academic Search Premier, ERIC, Linguistics and Language Behavior Abstracts, PsychINFO, Psychological and Behavioral Sciences Collection, and PubMed databases yielded only 88 nonduplicated articles where "deaf" or "hearing impaired" or "hard-of-hearing" and "fluency" were cross-referenced to the text level. Of these, the preponderance related to cultural and signing fluency, spoken or written fluency, or unrelated topics (e.g., interactions between plants) with only about a dozen relating specifically to reading fluency. Of these, about half related to spoken reading fluency, and few met the basic standards of research rigor.

The concept of processing automaticity in hearing students is also being investigated in students who are deaf and hard of hearing. Processing automaticity is:

the ability to complete certain basic operations of reading, such as word recognition and syntactic analysis, with a minimum of mental effort. Fluent completion of these operations is commonplace among skilled readers, deaf and hearing alike, but readers with low automaticity must devote relatively large amounts of attention to them. When this occurs, a cognitive bottleneck often takes place and comprehension suffers (Kelly, 2003, p. 231).

Kelly further indicated that processing automaticity pertains to "the ability to complete certain basic reading operations without investing significant mental effort for prolonged durations" (Kelly, 2003, p. 232). In other words, a fluent reader is one who has mastered basic reading operations such as vocabulary knowledge, grammar knowledge, and decoding to an

automatic level. “[P]rocessing automaticity is a primary source of the difference in comprehension between skilled and less skilled readers” (Kelly, p. 240). What this means is that reading fluency is a significant contributor to the reading proficiency of students who are deaf and hard of hearing and deserves a closer look from the field.

Reading fluency in signing deaf children involves the automatic rendering of print into a spoken or signed form (Chrosniak, 1993; Easterbrooks & Huston, 2001). This is not unlike the process experienced by hearing children who see the text, form a mental image, and render it in spoken form. In other words, it requires the child to go beyond the simple reading of words at an appropriate rate, but in addition requires him or her to form a mental visualization of the printed English text and then render it expressively, whether through spoken English, English-like signing, ASL, or a combination thereof.

Even young deaf children engage in these dual-language behaviors (Bailes, 2001). According to the Gallaudet Research Institute (GRI, 2005), 50.7% of the students who participated in the annual survey of children and youth identified as hard of hearing or deaf across the nation are in school environments where the communication mode used in teaching is either a combination of speech and signs (39.5%) or signs only (11.2%). LaSasso and Lollis (2003) surveyed 71 day and residential schools, 19 of which self-identified as following a bilingual–bicultural model. They found that 37% reported the use of some form of manually coded English. In programs where ASL was reported, its use varied, with 47% reporting that no more than half of the instructional staff was fluent in ASL. What this means is that most students who are in environments where signing is used are most likely exposed by their teachers to a hybrid mix of ASL and English, further complicating the challenges they face when rendering English print into a fluent, signed production.

Fluent Readers Who Sign and the Need to Measure Fluency

Schleper (1997) was among the first to point out that deaf adults can be good models of reading fluency.

Signing deaf adults negotiate between the English language and ASL while reading “out loud” through the use of signs. Among the many things that adults who are deaf do when reading to deaf children, they translate stories using ASL, making sure that the child can easily see both the English print and the ASL signs at all times. They elaborate on the text to ensure meaning, especially making explicit meanings that are implicit. They adjust the size, style, and locations of their signs to fit the meaning conveyed in the story, and they reenact where possible implicit and explicit action. Rendering print visible, then, involves a combination of speech, gestures, English-like signing, and components of ASL in order to make sure that the richness of a story is conveyed in its entirety. “Measuring the rendering of English print into ASL in a fluent manner defines fluency for signing deaf children. [R]esidential and bi–bi programs analyze reading in this way, expecting to see higher skilled readers start to “translate in their heads” before they “sign aloud” the text. Although we know that this impacts the rate portion of a traditional fluency rating, it drastically improves their flow, accuracy, prosody, and comprehension” (Scogin, 2006, personal communication).

For children who have usable residual hearing, prosodic aspects of verbal expression related to various literacy components such as the phrase and clause envelope or tone of voice of characters are available through the auditory pathway. For children who do not have usable residual hearing, sign language provides a visual representation both of concepts and of various aspects of prosody, allowing the student to read and then represent information in meaningful phrases and segments. As with hearing students (Rasinski, 2004), prosody, or fluent expression, may provide the link between the English print form and reading comprehension, assisting students with and without usable residual hearing to improve reading fluency. Even when deaf adults sign in a more English-like mode, similar to what is described as transliteration in the interpreting field (Kelly, 2001), ASL conceptual and grammatical elements are present that lead to fluent visual rendering of the printed text. ASL features support English-based signing, and “ASL principles should be incorporated into English

signs for more effective simultaneous communication” (Gustason & Zawolkow, 1993, p. xvii).

For students who are learning to negotiate meaning between their conversational language and language in print form, metalinguistic awareness of the structure of ASL has been found to be a useful tool. Schirmer, Bailey, and Lockman (2004) found that deaf students benefit from metalinguistic strategies but that their repertoire of strategies is limited. Sometimes called “bridging” (Schimmel, Edwards, & Prickett, 1999), using ASL metalinguistically provides the student with a new strategy for attacking groupings of print information. For example, knowledge of classifiers in ASL helps the reader understand English prepositional and adverbial phrases. Knowledge of verbs of location (Gustason & Zawolkow, 1993, p. xvii, items 7 and 8) and motion (Gustason & Zawolkow, 1993, p. xvii, items 9 and 10) help deaf students understand concepts such as direct object–indirect object relations and prepositional phrases (Hoffmeister, Philip, Costello, & Grass, 1997).

Fluency is a contributor to reading comprehension in students who are deaf and hard of hearing, but we know little about signed reading fluency processes in signing deaf children. Because the use of descriptive rubric scales (for expression, phrasing, and pace) is common in the measurement of reading fluency among hearing students (Rasinski, 2003), it follows that a similar model might be developed to gauge the signed reading fluency of students who use sign language to render text. In so doing, we can, like those evaluating the reading fluency skills of hearing students, get a picture of the reader’s ability to make sense of text (Rasinski, 2003). The development of such a tool to measure signed reading fluency and demonstration of its relationship to comprehension is described herein. As stated above, there are many benefits to teaching students who are deaf and hard of hearing to read out loud (Rasinski, 2003). First and foremost is the fact that the process of reading occurs largely in the head of the reader, and the best way to know what a student is doing in his head is to ask him to demonstrate it orally or in sign. An examination of his skills allows the teacher to provide appropriate intervention to improve fluency, leading to improved reading comprehension. Second, all individuals are

at some time called upon to read aloud whether in a social situation, at work, or in a school setting. For students who are deaf, this presents challenges because they must translate printed English to a visual form. Whether they are reading for a deaf audience alone or using the services of an interpreter, they must present a fluent, signed representation of the written material or the meaning of the content is lost to the viewer. Though some components of reading fluency in students who are deaf can be evaluated by hearing standards, the majority cannot, due to the unique components that are added when the student is rendering text to a visual mode, whether in an English-like mode or in ASL. Even when using an English-like mode, such as Conceptually Accurate Signed English (CASE) or Signing Exact English (SEE), signers should incorporate the fluent grammatical principles of ASL to provide a clear and expressive message (Gustason & Zawolkow, 1993). Aspects such as negation, nonmanual grammatical features, use of space, eye gaze, and directional verbs are as critical to meaning as vocal inflection and prosody are to spoken English.

Development of a Definition of Signed Reading Fluency

Until recently, the only tools available to examine reading fluency have been based on oral reading, primarily because no adequate definition of signed reading fluency relating to text translation was available. In order to remedy this, we constructed a definition of signed reading fluency. The list of aspects included in the definition came from two sources: (a) information from references relating specific communication characteristics that were known to be associated with either signed communication proficiency or proficiency in literacy (e.g., Cassell & McCaffrey, 1995; French, 1999; Gennaoui & Chaleff, 2000; Gustason & Zawolkow, 1993; Hoffmeister, 2000; Kelly, 2001; Lupton, 1998; Padden & Ramsey, 2000; Schleper, 1997; Smith, Lentz, & Mikos, 1988; Valli & Lucas, 1995) and (b) our knowledge of the reading process and of ASL.

We gathered a list of aspects from which we eliminated several (e.g., topic grammar, question grammar, and making the implicit explicit) during the course of

Table 1 Sources of fluency rubric aspects

Aspects	Source
Fluency envelope	
Speed	Lupton (1998); Zutell and Rasinski (1991)
Facial expression	Gustason and Zawolkow (1993); Lupton (1998); Schleper (1997)
Body movement	Lupton (1998)
Sign space	Gustason and Zawolkow (1993); Schleper (1997); Valli and Lucas (1995)
Sign movement	Lupton (1998); Schleper (1997)
Finger spelling	Brentari (1998); Gustason and Zawolkow (1993); Lupton (1998)
Visual grammar	French (1999); Hoffmeister (2000); Litchfield (2002)
Use of space	Valli and Lucas (1995)
Role taking	Opitz and Raskinsk (1998)
Eye gaze	Schleper (1997)
Negation	Gustason and Zawolkow (1993); Lupton (1998)
Directionality	Brentari (1998); Gustason and Zawolkow (1993); Valli and Lucas (1995)
Use of classifiers	Anthony (1999, 2003)
Pronominalization	Valli and Lucas (1995)

the assessment rubric development described later in this paper. Table 1 summarizes the research base for the aspects retained. We organized these aspects under the headings of cherology (phonology of ASL), morphosyntactics, semantics, and the ability to answer simple comprehension questions, and brainstormed possible elements that would go into a definition. For example, Anthony (2003) determined that the ability to use ASL classifiers to form a “conceptual whole” in story narratives has an effect on English literacy. We also incorporated aspects of visual grammar that are used not only in ASL but also in English signing (Gustason & Zawolkow, 1993).

We defined signed reading fluency in signing deaf children as containing three components: accuracy, fluency envelope, and visual grammar. Accuracy is the ability of the signer to render the concepts in English print text into a signed format that has equivalent conceptual meaning. The ability to decode words is a key piece to reading, and teachers can measure accuracy by using miscue analysis, either while com-

pleting a running record or by available formal and informal means. Because various means exist to measure accurate decoding, including phonological and semantic skills, we did not include this in the assessment rubric. However, measurement of phonological and vocabulary skills are components of a complete literacy assessment. Our task was to attempt to fill in the missing elements of signed reading fluency. Therefore, the rubric is designed to be used in conjunction with other assessment tools.

The “fluency envelope” is the overall visual appearance of an individual who is signing while reading, with or without voice, which gives the visual impression that he or she is a good reader or not a good reader. In other words, to the novice eye, they look fluent, much as hearing children sound fluent to the novice ear. Fluency envelope includes those elements of visual prosody that convey mood, intention, and affect, conveying the pragmatic aspects of literacy. The aspects associated with fluency envelope are speed, facial expression, body movement, sign space, sign movement, and finger spelling. “Visual grammar” refers to those key elements of signing, whether in an English-like mode or ASL, that demonstrate to the observer that the reader is visualizing the meaning of the story, conveying syntactic aspects of literacy. Visual grammar is an important feature of a signed reading fluency examination because when one reads, one is reading a language, and in the case of signing deaf children, they mediate printed English through the visual grammar of sign language along a continuum of more English-like signing to more ASL-like signing. Table 2 lists the definition of

Table 2 Definitions of fluency envelope and visual grammar

Terminology	Definition
Fluency envelope	The overall visual appearance of an individual who is signing while reading, with or without voice, which gives the visual impression that he or she is a good reader or not a good reader
Visual grammar	Those key elements of signing, whether in an English-like mode or ASL, which demonstrate to the observer that the reader is visualizing the meaning of the text

Table 3 Guiding questions for fluency rubric aspects

Terminology	Definition
Fluency envelope	
Speed	Does the student's speed of signing enhance or detract from the visual presentation of meaning?
Facial expression	Do the student's facial expressions match the affect of the characters and mood of the text?
Body movement	Do the student's body movements give a clear picture of the movements of the people, places, and things in the text?
Sign space	Does the student's sign space accurately represent the mood and content of the text; neither too small nor too large?
Sign movement	Does the student produce signs on the hands in a steady, relax, smooth manner that provides a fluid, flowing picture that enhances visualization of the story?
Finger spelling	Does the student incorporate finger spelling intelligibly, accurately, and appropriately? Note: Finger spelling used as a placeholder is counted as a miscue.
Visual grammar	
Use of space	Does the student set up the scene spatially in a logical manner and then use this space when reading "aloud"?
Role taking	Does the student demonstrate relationships of the characters in space as well as interactions among characters?
Eye gaze	Does the student's eye gaze represent that which would be associated with the people, places, and things in the text?
Negation	Does the student use headshake and/or body language to indicate negation?
Directionality	Does the student move signs in a manner that presents an accurate picture of the actions within the story?
Use of classifiers	Does the student use classifiers accurately and appropriately for the text?
Pronominalization	Does the student relate pronouns to people, places, and things using appropriate forms such as indexing? (This is not an examination of invented English signs for he, she, them, their, etc., but an examination of visual grammar.)

fluency envelope and visual grammar. Although many of the components included in the fluency rubric are ASL grammatical features, those deaf children who sign in an English-like mode are able to express their visualizations more clearly to the individual to whom they are signing when they incorporate these components (Gustason & Zawolkow, 1993; Kelly, 2001). The aspects associated with visual grammar are use of space, role taking, eye gaze, negation, directionality, use of classifiers, and pronominalization. Table 3 lists the aspects and gives key questions that help define the aspect.

Some of the aspects in the signed reading fluency rubric may appear to be similar to aspects that are examined during story retellings. However, there are many differences between retelling a story and reading a story. For one thing, retellings often are prompted, planned, or elicited in some manner (Gazella & Stockman, 2003; Stoner, Easterbrooks, & Laughton, 2005), whereas reading is done extemporaneously. Retellings are also used to gather a language sample or check comprehen-

sion, whereas signed reading out loud is done to demonstrate extemporaneous comprehension of the printed material. In addition, during retelling, we ask the child to produce the main idea and significant details, which requires the child to evaluate what he read and sift through what he might say. When reading, all concepts are rendered without screening or evaluation, whereas in retelling, only significant details are expected. For these reasons, the application of the aspects to the signed reading fluency process differs from an examination of these aspects for language analysis.

Development of a Rubric to Measure Signed Reading Fluency

According to Schleper (1997), deaf adults translate stories using ASL while keeping both ASL and English visible to the child. To investigate what this means, we searched the literature to develop the list of aspects in Table 2 that are descriptive of ASL visual and grammatical features. To determine whether the list of

aspects in Table 2 were evident in the reading by deaf adults, we asked them to read to children and verified their use of the aspects. After determining that these aspects appeared consistently in deaf adults' reading, we developed a screening rubric and determined its validity.

An examination of the consistent use of the aspects in Table 2 involved observations of the out loud reading of seven skilled adult deaf readers ($N = 7$) as they were signing a story to children. All the readers were deaf. Three were male and ranged in age from 32 to 42, and four were female and ranged in age from 28 to 45. Five of the participants were college-educated and two were high school graduates. Five were prelingually deafened whereas two were postlingually deafened. All report the use of ASL as their primary language. Five started signing in preschool and two started signing in college. They were educated across the range of service options from mainstream classrooms to residential schools for the deaf. One was a clerk with the Internal Revenue Service, one was a civil engineer, and one was a computer technician. Two were teachers of the deaf and two were paraprofessional educators at a school for the deaf. All had English literacy skills sufficient to support their acquisition of an education and all used signed communication for cultural interactions.

The adult readers were asked to read a story to groups of young children, and videotapes were made of their performances. The book, *No No* (Cowley), from The Wright Group series was chosen for this task. This book is written at an early emergent reading level and was chosen from among the books considered because of the easy reading level and the fact that it offered the opportunity for observation of all the aspects identified in the list generated. The book was specifically chosen to be at an easy reading level to ensure the elimination of difficult elements of text comprehension so that fluent reading would be forthcoming from the participants. We wanted to eliminate as many of the nonfluency-related aspects of the task so that we could measure the aspects identified more clearly. In addition, we felt that if an individual possessed a fluency skill at an easy reading level, then he or she should be able to generalize these to more demanding reading levels with instruction, whereas an

individual who did not have the skill even at an easy reading level would require a different type of instruction. We reviewed the videotapes of the seven readers and discussed the aspects revealed in the tapes in detail to determine which aspects did and did not consistently appear across all seven videos or if there were aspects that showed up consistently across all adult readers that we had overlooked. All participants consistently used all aspects in the lists generated while they were reading. After much discussion and numerous trial applications with deaf students at varying ages from early elementary through high school and with several teachers of the deaf during the development of the instrument, we compiled a final list of aspects into an assessment rubric, entitled the *Signed Reading Fluency Rubric for Deaf Children*. Rubric assessment has been used successfully as a measure of fluency with hearing students (Rasinski, 2004).

The fluency rubric contained five possible ratings yielding a point value from zero to four. A rating of zero meant Not Observed. A rating of one meant Emerging. A rating of 2, 3, and 4 meant Beginning, Developing, and Mature/Fluent, respectively. Specific descriptors to anchor decision making were developed. The sum of the points earned was tallied. The rater then consulted a table identifying the wholistic rating associate with the point value. From a teacher's perspective, the wholistic rating is valuable for tracking overall progress in fluency, whereas the information gathered from item rating is useful for providing intervention and instruction.

To administer the fluency rubric, students were asked to read *No, No* into a video camera. At a later time, the rater watched the videotape as often as necessary, circling the correct rating that most accurately described the student's performance related to a particular aspect being measured, using the zero to four rating on each of the fluency envelope or visual grammar. The ratings are tallied, and a wholistic score is designated. For example, for the "facial expression," a rating of one is given if the child *Used as personal response, not to convey information to others* and a rating of four is given for *Appropriate, consistent facial expression. Conveys content*. Students can be poor in envelope and mature in visual grammar or vice versa. They do not always perform at the same level in each. The final

*Signed Reading Fluency Rubric for Deaf Children
Huston and Easterbrooks*

Reader's Name:
Evaluator:

DOB:
CA:

Date of Tape:
Date Tape Analyzed:

PART I FLUENCY ENVELOPE

To analyze *Fluency Envelope*, videotape the student reading a narrative text at his/her independent reading level and rate performance using the rubric below. List points for each trait in far right column. Calculate total points and indicate rating using the scale below the rubric.

General Description of Column	Not Observed (0)	Emerging (1) Poor attempts. Laden with problems of clarity, correctness and consistency.	Beginning (2) Fair attempts. Problems with clarity, correctness and consistency.	Developing (3) Clear attempts. May be incorrect or inconsistent.	Mature/Fluent (4) Clear, correct, consistent.	Points For Row
Speed	Meaning is unintelligible due to speed (too slow/fast)	Too slow/fast. Some text meaning may be obscured due to inappropriate speed.	Attempts to vary speed based on story content. Most signs are not obscured by speed.	Speed of signing usually matches story content and does not impact intelligibility	Speed of signing consistently fits story context.	
Facial expression	No affect or expression associated with story.	Used as personal response, not to convey information to others.	Attempts made to relate facial expression to text. May be stilted.	Attempts are appropriate but may be inconsistent.	Appropriate, consistent facial expression. Conveys content.	
Body movement	No body movement associated with story.	Attempts are made but are not related to the story well.	Attempts are fair. Some may interfere with flow of story.	Good use of body movement. Usually conveys content.	Clear, correct and consistent use of trait to convey content.	
Sign space	No awareness of sign space.	Attempts are made but are inaccurate.	Attempts are fair. Trait interferes with story flow.	Good use of space. Minor errors.	Sign space used accurately at all times.	
Sign Movement	Story unintelligible due to bouncy/stiff/jerky sign movement	Poor control. Signs are primarily bouncy/stiff/jerky	Attempts to control. Inappropriate movement interferes with story flow.	Presentation is steady/relaxed/smooth most of the time.	Consistently steady/relaxed/smooth with appropriate follow..	
Fingerspelling	Unintelligible. Consistently inappropriate placement.	Poor placement and control (stiff/bouncy/jerky).	Some problems with fingerspelling placement and fluency.	Primarily appropriate placement and minimal problems with fluency.	Consistently appropriate placement. Consistently intelligible and fluid (relaxed/steady/smooth)..	

Points earned/Points possible ____/24= ____%
Fluency Envelope Rating _____

Fluency Envelope Rubric Analysis: Poor= 0-24%; Emerging= 25-49%; Beginning= 50-74%; Developing= 75-90%; Mature= 90-100%

PART II VISUAL GRAMMAR

Videotape the student reading a narrative text. To analyze syntactic aspects, watch tape and rate student performance using the rubric below. List points for each trait in far right column. Calculate total points and indicate rating using the scale below the rubric.

ASPECT OBSERVED	Not Observed (0)	Emerging (1) Minimal attempts Less than 30% of the time.	Beginning (2) Fair attempts, aspect observed. At least 50% of the time.	Developing (3) Clear attempts, minimal inaccuracies. Used 50 to 90% of the time.	Mature/Fluent (4) Clear, correct, consistent. Used at least 90% of the time.	Points For Row
Use of Space	No indication of spatial awareness. People, places, and things are "layered" or randomly organized.	Minimal use of space. A few people, places, and/or things are logically placed.	Logical use of space is evident during only 50% of the read aloud.	People, places, and/or things are placed appropriated during most of the read aloud. Makes a picture most of the time.	Placement of people, places, and/or things shows evidence of reader's consistent visualization of text.	
Role Taking	No character interactions are identifiable.	Minimal character interactions are evident through role shift.	At least 50% of character interactions are evident through role shift.	The majority of character interactions are evident through role shift.	All characters are clearly and easily identifiable due to appropriate body shift/role taking.	
Eye Gaze	None evident, shows no evidence of text visualization.	Evident during less than 30% of appropriate instances.	Clear and appropriate during at least 50% of the reading.	Present during most of the text rendering, promotes viewer visualization of text.	Consistently appropriate and promotes visualization throughout the text	
Negation	No appropriate negative headshake observed.	Present in less than 30% of appropriate instances	Present in at least 50% of appropriate instances.	Present in most instances, but not all	Present in all appropriate instances.	
Directionality	No directionality indicated for the any signs.	Observed in less than 30% of appropriate instances.	Present in at least 50% of appropriate instances. Uses directionality inherent in sign but not between signs.	Present in most instances but not all.	Directionality of signs is clear and consistent throughout the text. Observer can visualize action.	
Use of Classifiers	No use of classifiers.	Minimal use of classifiers (one to two instances).	Uses classifiers in approximately 50% of allowable instances (for animal movements, etc).	Uses classifiers to represent concepts most of the time.	Uses classifiers consistently and accurately to portray text content and support visualization.	
Pronominalization	No use of indexing for pronouns	Use of indexing for pronouns is unclear or minimally present	Use of indexing for pronouns is present and clear during at least 50% of appropriate opportunities	Use of indexing for pronouns is present and reference is clear in most appropriate instances	Use of indexing is used consistently in all appropriate opportunities and reference is clear.	

Points earned/Points possible ____/28= ____%
Visual Grammar Rating _____

Visual Grammar Rubric Analysis: Poor= 0-24%; Emerging= 25-49%; Beginning= 50-74%; Developing= 75-90%; Mature= 90-100%

Figure 1 Signed reading fluency rubric for deaf children.

version of this rubric is available by contacting the authors (see Figure 1).

Interrater Reliability Measures

Seven middle school aged students who were deaf/hard of hearing were instructed to pretend that they were reading *No, No* to a pretend child audience. The examiner instructed the students to provide their most clear and expressive signed rendering of the text. The examiner videotaped these signed "readings." Subsequently, three raters viewed the signed readings independently and rated each performance using the assessment rubrics and the protocol devised by the authors. All viewing of tapes and rating occurred independently.

To determine interrater reliability on the fluency rubric, three raters received training in the use of the protocol by the second author. Two raters were experienced teachers of the deaf, both of whom were also sign language instructors. One of the raters held a CSC certification from RID. The other is a graduate of an interpreter training program, has passed the written portion of the RID, and held an advanced level on the Signed Communication Proficiency Interview (SCPI) (Newell, Caccamise, Boardman, & Holcomb, 1983). The third rater was a certified teacher of the deaf who was completing work on a master's degree in deaf education and held an intermediate plus level on the SCPI. We included three different levels of sign proficiency with a minimum being intermediate plus on the SCPI, deliberately to consider whether somewhat less skilled signers could recognize and evaluate the use of common signed reading fluency aspects.

A Spearman's rho correlation procedure for non-parametric data was applied to the responses of the three raters to determine reliability among the raters. On the fluency envelope subtest, the reliability across raters was 1.00, which is an extremely high interrater reliability. Although their scores varied somewhat across individual participants, when taken together, the differences were insignificant. On the visual grammar subtest, the average reliability across raters ranged from .821 to .921. Because of the lower interrater scores from one of the raters on the specific of visual grammar referred to as topic grammar, this aspect was

removed from the fluency rubric because it was confusing to the raters and because the test designers did not feel that it contributed additional information to an understanding of a child's fluency. In addition, it was so uniquely an ASL skill that it would be less likely to be seen in students who signed more on the English-like end of the continuum than the ASL-like end of the continuum. On the total test score, reliability across raters ranged from .975 to 1.00. These scores demonstrate that the *Signed Reading Fluency Rubric for Deaf Children* yields highly reliable results when used by skilled, experienced teachers of the deaf who have sufficient knowledge of the specific aspects of visual grammar and fluency that the instrument measures.

Since this instrument is based on skills demonstrated by fluent adult Deaf readers who were signing while reading to children, it may be said to have face validity. Schleper (1997) pointed out the importance of using deaf adults as role models for literacy in deaf children. The skills identified in the fluency rubric are different from those used by skilled hearing readers because Deaf adults may or may not use their voice but do add important information via signs and other visual forms.

Internal Consistency and Validity Measures

If a reading assessment tool does not provide information that relates to improvements in reading or does not provide implications for instruction, then it is of limited value. The value of the *Signed Reading Fluency Rubric for Deaf Children* is that it correlates with results on reading comprehension.

Participants

The participants in this aspect of the development of the fluency rubric were 29 ($N = 29$) middle school students attending a day school for the deaf/hard-of-hearing in a major metropolitan city. The school serves students from 28 metro school systems. Fourteen students were males and 15 were females. Four students had parents who signed in the home, five came from homes where the language was a Hispanic form, one was Serbian, one was Vietnamese, one was Taiwanese, and the remaining students came from

homes where spoken English was used. No records on age of identification or unaided hearing loss were available on six students, who came without comprehensive files from local school systems. The youngest age of identification recorded was 3 months, the oldest 5 years, 4 months, with a mean age of identification of 23 months. Age of school entry was not available on 10 of the students. The youngest student entered the school for the deaf at age 3 and the oldest at age 11, with a mean age of entry of 6 years, 10 months. All students either had severe, severe-to-profound, or profound bilateral sensorineural hearing losses. None of the students was considered to have “special needs” based on their placements, although many did have typical LD-like behaviors associated with attention, memory, and organization. Three students had at least one deaf parent in the home and the hearing of the parent of one student was unknown; the remainder had hearing parents or guardians. The students ranged in age at time of evaluation from 9 years, 6 months to 16 years, 3 months; the preponderance of students was in the 10- to 13-year age range. One student communicated expressively through speech on some occasions but relied receptively on sign, and the remainder fell along the continuum for more English-like signing to more ASL-like signing, or a combination thereof, as their primary means of communication. Because the students came from any of 28 different school districts, having entered the school for the deaf anywhere from age 3 to 11, a variety of backgrounds and skill levels was found among the middle-school students in this study. By “English-like signing,” we mean various forms of sign/word order that follow spoken English word order (e.g., pidgin, contact signing, Sim-Com, CASE, SEE, etc.). By “ASL-like signing,” we mean various developmental levels of success in ASL depending on age at which the students were first introduced to the language and the number of years in which they have been using the language. Only one student had two deaf parents and was clearly identified as using ASL. In addition, they fell along the continuum from poor communication ability to average communication ability. No direct measures of the language skills were gathered. However, the language skills of the students included may be said to be typical of those found in schools for the deaf, where the

population tends to range widely in availability of a language base (emerging language to average language) as well as in the language used (English, another spoken language, or ASL) and the mode used to express the language (spoken or signed).

Procedures

The participants were tested over the period of an academic year using the *Signed Reading Fluency Rubric for Deaf Children* and the Word Comprehension and Passage Comprehension subtests of the *Woodcock Reading Mastery Test-Revised* (WRMT-R) (Woodcock, 1987). The WRMT-R is a comprehensive assessment of reading ability for individual in grades K through 16 based on a large, stratified sample of school children. The revised norms used in this study included a representative proportion of special education students, although no specific numbers of students with hearing loss were available. The test is comprised of six subtests. Two were used for this study: word comprehension, which measures reading vocabulary at the antonym, synonym, and analogy levels, and passage comprehension, which measures the ability to read a short passage of two or three sentences and identify a key word missing from the passage. The split-half reliability measure for test median was .91. The WRMT-R has been used successfully as a research tool in numerous studies on the reading of students who are deaf and hard of hearing (Dillon & Pisoni, 2004; Hanson, Liberman, & Shankweiler, 1984; Spencer, Gantz, & Knutson, 2004) and is an approved test of the list of tests of academic and readiness skills used with deaf and hard-of-hearing students on the GRI website (<http://gri.gallaudet.edu/~catraxle/ACADEMIC.html#woodcock>). It was chosen for this study because adequate reading comprehension is the intended outcome for all literacy interventions. We do not learn to code phonologically so that we can be good coders. We learn to code phonologically, so we can comprehend what we are reading. Similarly, we improve a student’s fluency not so that they will be fluent but because fluency gives us a glimpse into their comprehension skills.

A trained graduate research assistant videotaped the students reading *No, No*, and administered all

the WRMT-Rs. Test administration was done on an individual basis in a separate testing room within the school facility. Participants were given each test within 0–4 months of the other test. A delay between test administrations was necessary in order to avoid disruption of class time and as a result of the availability of the trained examiner. Students who are deaf and hard of hearing tend to plateau in their reading skills at an annual growth rate of about 0.3 grade levels per year by middle school (Allen, 1986). For this reason, the researchers felt that the amount of time between gathering data on the *Fluency Rubric* and gathering data on the WRMT-R would not contribute significantly to a difference in the scores obtained. In all cases, the fluency rubric data were gathered first and the reading comprehension data were gathered second. The research assistant entered responses on the WRMT-R into the computerized scoring program, and the first author reran the program to verify accuracy of all results. All rubrics were rated either by the second author, by several classroom teachers who had also been trained by the second author to utilize the fluency rubric, or by a second trained research assistant from the same teacher preparation program and who was trained by the second author in utilizing the rubric. Reliability of the scores was verified by a rerating of six of the rubrics by the first author.

Results

To determine internal consistency reliability of the fluency rubric in its final form for internal fit of the items, variables were calculated using Cronbach's Alpha. Gersten et al. (2005) set an alpha of .6 as the "bottom line for reliability" (p. 159) of a new measure. The resulting coefficient alpha reliability for this fluency rubric is .8617, indicating that the rubric possesses high internal consistency.

To determine whether ratings of the fluency rubric were reliable, videotapes from six participants were rerated by the first author and evaluated using a Spearman's rho correlation for interrater reliability. The resulting alpha for the fluency envelope score was .975 and for the visual grammar score was .745. The interrater reliability for visual grammar was lower than for fluency envelope, which differs from the initial

Table 4 Results of scores on the WRMT-R

	Range	Median	SD
WRMT-R word comprehension	14–87	55.76	23.950
WRMT-R passage comprehension	10–94	56.69	27.906
WRMT-R total comprehension	27–87	60.66	15.938

interrater reliability study described earlier in this paper. Since the teachers ranged from average to excellent in their signing skills, this may account for the overall lower rating of scores on visual grammar. In general, however, the reliability of the score for fluency envelope was high while the reliability for visual grammar was somewhat high. Scores were significant at the .01 level.

Raw scores for fluency envelope ranged from 2 to 24 (of a possible 24) with a mean of 11.7. Raw scores for visual grammar ranged from 4 to 17 (of a possible 28) with a mean of 7.9. The students' performances on the signed reading fluency rubric were converted to *z*-scores. Scores for fluency envelope ranged from -1.01 to $+1.69$. Six students scored above 1 standard deviation (SD) and two scored below 1 SD. Scores for visual grammar ranged from $-.75$ to $+0.33$; this indicated that there was greater variability among the students for fluency envelope than for visual grammar, whereas the overall visual grammar scores were poorer than fluency envelope scores. Standard scores on the WRMT-R subtests are reported in Table 4. The average Total Comprehension Score across all students was 55.76, or ~ 3 SDs below the mean. This means that the typical students in this study had poor reading comprehension skills. In addition, they ranged widely in their ability to comprehend printed English (Total Comprehension SS range = 14–87). Correlations between the results of the fluency rubric and results of the WRMT-R were also calculated (see Table 5). There were very strong correlations (for discussion of strength of a correlation see <http://www2.selu.edu/Academics/Education/EDF600/Mod11/sld023.htm>, downloaded 2 February, 2007; Gay & Airasian, 2000) between fluency envelope and visual grammar (.917), fluency envelope and overall signed reading fluency (.990), and visual grammar and overall

Table 5 Correlations between and among fluency rubric and WRMT-R components

Component	Fluency envelope	Visual grammar	Total fluency	WRMT-R word comprehension	WRMT-R passage comprehension	WRMT-R total comprehension
Fluency envelope	1.000	.917**	.990**	.460*	.625**	.496**
Visual grammar		1.000	.964**	.376*	.551**	.434*
Fluency total			1.000	.451*	.636**	.497**
WRMT-R word comprehension				1.000	.559**	.985**
WRMT-R passage comprehension					1.000	.636**
WRMT-R total comprehension						1.000

*Correlation is significant at the .05 level (two-tailed). **Correlation is significant at the .01 level (two-tailed).

signed reading fluency (.964). Both the fluency envelope subtest and the visual grammar subtests can be said to contribute highly to the overall signed reading fluency score. A moderate correlation existed between fluency envelope and word comprehension subtest (.460) and total comprehension (.496). A moderately strong correlation existed between fluency envelope and passage comprehension (.625). Visual grammar correlated weakly level with word comprehension (.376) but moderately with total comprehension (.434) and passage comprehension (.551). The total fluency score correlated moderately with word comprehension (.451) and total comprehension (.497) and correlated moderately high with passage comprehension (.636). Total comprehension represents a combined rating of the word and passage comprehension subtests. Results indicated that within this group of participants whose reading comprehension was typically lower than that of their same-aged hearing peers, there is a positive correlation between scores on the *Signed Reading Fluency Rubric for Deaf Children* and scores on reading and word comprehension of the WRMT-R, with the strongest relationships between fluency envelope and passage comprehension and total fluency and passage comprehension. As signed reading fluency scores increased, so did reading comprehension scores.

Discussion

The Signed Reading Fluency Rubric for Deaf Children appears to be a useful tool in making judgments about the signed reading fluency of students who are

deaf and hard of hearing, especially in terms of the moderately high correlation between the fluency envelope concept and passage comprehension. Struggling readers for whom English is a second language make their largest postinstruction gains in passage comprehension and fluency (as opposed to other skills such as phonemic awareness and decoding), suggesting that fluency and comprehension are highly learnable by second language users (Linan-Thompson, Vaughn, Hickman-Davis, & Kouzekanani, 2003). Across all the students in this study, signed reading fluency correlated with comprehension. It would be of value to know if adding the third component of fluency, accuracy, back to the signed reading fluency rubric would improve the correlation of this measure with comprehension. Until that time, this tool may be used in combination with other tools with moderately high confidence, especially because there are few tests available to evaluate directly the influence of the sign language on reading fluency. The participants in this study represented a range of hearing losses, English proficiency, communication modes, and reading ability. The fluency rubric appears to be a useful measure of signed reading fluency for a variety of students. The rubric also provides a tool to measure those aspects of literacy not measured by traditional tests. Many tests evaluate vocabulary comprehension, text comprehension, decoding skills, and phonics skills, but the authors are aware of no tests that evaluate signed reading fluency or visual grammar from the perspective of rendering printed English into English-like or ASL-like forms. The authors recommend that teachers and

other professionals use the Signed Reading Fluency Rubric for Deaf Children in conjunction with other reading measures such as running records, informal reading inventories, or formal assessments to gain a comprehensive picture of a student's reading ability. Use of a variety of measures in conjunction with the Signed Reading Fluency Rubric for Deaf Children will provide a comprehensive view of present levels of reading performance by deaf children who use sign language to mediate the reading process.

This study has several limitations that have implications for future research. First, the students studied came from one school, albeit representing 28 different public school systems across a large and sprawling metropolitan region. Studying all the individuals from one school in one region rather than a randomized, controlled sample invites possible error. This study needs to be replicated with a larger number of students from multiple states. In addition, because the sample was small, there may have been no examples of participants in some of the rating categories. For example, there may have been several students rated as 2 on one aspect but none rated as 3 on the same aspect. A larger sample would most likely contain members at each level of rating, which would allow a finer tuning of the holistic categories of emerging, beginning, developing, and mature reader. A larger sample would also provide an indication as to whether the fluency rubric is equally as valid for students at the lower end of the rating scale as it is for students at the higher end of the rating scale. An additional limitation is that only middle-school students who were struggling readers were included. This study needs to be replicated on children with hearing losses from kindergarten through high school to determine the extent of its usefulness. Anecdotal information from the use of this fluency rubric with all ages as well as with hearing teachers of deaf children as measures of their ability to render print visually indicates that this tool has potential for broad use; however, we can only make assumptions about its use with struggling middle-school readers based in the results gathered. Another area warranting additional attention is the use of the book, *No No*. Subsequent to the studies reported herein, the authors have used this tool successfully with students who were reading books at their in-

dependent reading level as determined by the Basic Reading Inventory (Johns, 2004). Anecdotal records indicate its usefulness in this manner, but further research is needed to verify this applications.

An additional issue warranting further study surrounds the relationship between language and signed reading fluency from several perspectives. It would be helpful to determine if the reliability of raters who have various degrees of signing skills influences outcomes obtained on the fluency rubric. All the examiners in these studies were sufficiently skilled in ASL, but the teachers who scored the rubrics ranged in skills from average to excellent. This may account for why the interrater reliability for visual grammar was lower than for fluency envelope. Information on the minimal level of signing skill necessary to use this tool in a reliable manner would provide guidance regarding examiner qualifications. Corollaries to this question would be: Do students with better language perform better on signed reading fluency? Do students who have more English-like signing perform differently from those who have more ASL-like signing skills on signed reading fluency as measured by this instrument? In other words, what influence do the language skills of the evaluator and the language skills of the students have on the results of this tool? Next, research should be conducted on whether or not instruction on the aspects associated with signed reading fluency leads to improvements in reading comprehension. This would assist in further elucidating the relationship between signed reading fluency and comprehension. In other words, does fluency predict comprehension or does comprehension predict fluency? In addition, studies of the usefulness of this tool with different populations should be conducted. Based on the authors' experiences, it is a helpful tool for students who are well along the way in the reading process, for those who are older yet are new to the reading process, and for those whose signs fall along the continuum from more English like to more ASL like.

During development of the rubric, we separated the components assessed into fluency envelope and visual grammar to highlight an examination of mood, intention, and affect (pragmatics) versus syntax. Given the internal consistency measures, additional information is needed to determine if these two categories are

really needed or if the rubric items should be considered as one entity. We did eliminate several along the way, such as making the implied explicit, question grammar, and topic grammar; however, we may want to reconsider whether these would be valuable features in a revised edition. As previously mentioned, we may want to include the miscue analysis data on the actual rubric to provide a more complete picture of signed reading fluency and possibly improve the correlation of this measure with comprehension. Finally, we conducted this research on a fiction text. Is a fluency assessment such as this equally viable for nonfiction texts? This is an important area for research because many deaf/hard-of-hearing students struggle with nonfiction texts. Verification of these impressions will determine for whom this is a more useful tool.

Summary

The development of reading fluency in students who are deaf and hard of hearing and who use sign language has an almost nonexistent research base. This may be due to the common belief that fluency is only an auditory process. In fact, deaf readers who use sign language can become fluent readers, incorporating numerous signed reading fluency. Skilled deaf adult readers call upon many visual tools in addition to signs and speech to elucidate the meaning of text (Schleper, 1997).

In this article, a definition of signed reading fluency in signing deaf children was proposed. Signed reading fluency is defined as containing three components: conceptual accuracy, fluency envelope, and visual grammar. These three components comprise skills that parallel the definition of fluency in hearing children: accuracy, speed, and expression. Accuracy is the ability of the signer to translate the concepts in English print text into a signed format that has equivalent conceptual meaning. Fluency Envelope refers to the overall visual appearance of an individual who is signing while reading, with or without voice, which gives the visual impression that he or she is a good reader or not a good reader. Visual Grammar refers to those key elements of signing, whether more English-like or more ASL-like, which demonstrate to the observer that the reader is visualizing the meaning of the

text. The fluency envelope contains the aspects of speed, facial expression, body movement, sign space, sign movement, and finger spelling. Visual grammar contains the use of space, role taking, eye gaze, negation, directionality, use of classifiers, and pronominalization. The *Signed Reading Fluency Rubric for Deaf Children* described herein is a tool for measuring two of the three and uses the skilled reading performances of adult deaf readers as its model as opposed to the oral reading of hearing individuals. Scores on the *Fluency Rubric* correlate with scores on reading comprehension for the 29 participants studied, suggesting that developing readers who are deaf would benefit from instruction in the application of the fluency envelope and visual grammar identified in this article. When used in a comprehensive reading assessment with tools such as an informal reading inventory or other formal, standardized measurement of reading, the *Signed Reading Fluency Rubric for Deaf Children*, may contribute to a comprehensive understanding of the reading skills of children with hearing loss.

References

- Allen, T. (1986). Patterns of academic achievement among hearing impaired students: 1974 and 1983. In A. Schildroth & M. Karchmer (Eds.), *Deaf children in America* (pp. 161–206). San Diego, CA: Little, Brown.
- Anthony, M. E. (1999). The role of classifiers in predicting English literacy among deaf adults. *Proceedings of the Annual Boston University Conference on Language Development*, 23(1), 20–31.
- Anthony, M. E. (2003). The role of American Sign Language and “conceptual wholes” in facilitating language, cognition, and literacy. *Dissertation Abstracts International, B: Science and Engineering*, 64(2), 982B.
- Aos, S., Phipps, P., Barnoski, R., & Lieb, R. (2001). *The comparative costs and benefits of programs to reduce crime, version 4.0*. Olympia, WA: Washington State Institute for Public Policy.
- Bailes, C. (2001). Integrative ASL-English language arts: Bridging paths to literacy. *Sign Language Studies*, 1(2), 147–174.
- Brentari, D. (1998). *A prosodic model of sign language phonology*. Cambridge, MA: The MIT Press.
- Carmine, D., Silbert, J., Kame'enui, E., & Tarver, S. (2004). *Direct instruction reading* (4th ed.). Upper Saddle River, NJ: Pearson.
- Cassell, J., & McCaffrey, E. (1995). *Course 2001: Instructional guide. ASL grammatical aspects: Comparative translation*. Salem, OR: Sign Enhancers.

- Chrosniak, P. (1993). Reading in English as a translation task: Fluent deaf young adults. In D. J. Leu (Ed.), *Examining Central Issues in Literacy Research, Theory, and Practice. Forty-Second Yearbook of the National Reading Conference*. Chicago, IL: National Reading Conference, Inc.
- Davey, B., & King, S. (1990). Acquisition of word meanings from context by deaf readers. *American Annals of the Deaf*, 135, 227–234.
- deVilliers, P., & Pomeranz, S. (1992). Hearing-impaired students learning new words from written context. *Applied Psycholinguistics*, 13, 409–431.
- Dillon, C. M., & Pisoni, D. B. (2004). Non-word repetition and reading in deaf children with cochlear implants. *Elsevier International Congress Series*, 1273, 304–307.
- Dowhower, S. L. (1991). Speaking of prosody: Fluency's unattended bedfellow. *Theory Into Practice*, 30, 165–175.
- Dyer, A., MacSweeney, M., Szczerbinski, M., Green, L., & Campbell, R. (2003). Predictors of reading delay in deaf adolescents: The relative contributions of rapid automatized naming speed and phonological awareness and decoding. *Journal of Deaf Studies and Deaf Education*, 8, 215–229.
- Easterbrooks, S. R., & Huston, S. G. (2001, April). *Examining reading comprehension and fluency in students who are deaf or hard of hearing*. Paper presented at the annual conference of the Council for Exceptional Children, Kansas City, MO.
- Easterbrooks, S. R., & Stephenson, B. (2006). An examination of twenty literacy, science, and mathematics practices used to educate students who are deaf or hard of hearing. *American Annals of the Deaf*, 151(4), 385–397.
- Ensor, A., & Koller, J. (1997). The effect of the method of repeated readings on the reading rate and word recognition accuracy of deaf adolescents. *Journal of Deaf Studies and Deaf Education*, 2(2), 61–70.
- French, M. M. (1999). *Starting with assessment*. Washington, DC: Gallaudet University.
- Fuchs, L. S., & Deno, S. L. (1991). Paradigmatic distinctions between instructionally-relevant measurement models. *Exceptional Children*, 57, 488–500.
- Fuchs, L. S., Fuchs, D., Hosp, M. K., & Jenkins, J. R. (2001). Oral reading fluency as an indicator of reading competence: A theoretical, empirical, and historical analysis. *Scientific Studies of Reading*, 5(3), 239–256.
- Fuchs, L. S., Fuchs, D., & Compton, D. L. (2004). Monitoring early reading development in first grade: Word identification fluency versus nonsense word fluency. *Exceptional Children*, 71(1), 7–21.
- Gallaudet Research Institute. (2005). *Regional and National Summary Report of Data from the 2004-2005 Annual Survey of Deaf and Hard of Hearing Children and Youth*. Washington, DC: GRI, Gallaudet University.
- Garrison, W., Long, G., & Dowaliby, F. (1997). Working memory capacity and comprehension processes in deaf readers. *Journal of Deaf Studies and Deaf Education*, 2(2), 78–94.
- Gay, L. R., & Airasian, P. (2000). *Educational research: Competencies for analysis and application* (2nd ed.). Columbus, OH: Merrill.
- Gazella, J., & Stockman, I. (2003). Children's story retelling under different modality and task conditions: Implications for standardizing language sampling procedures. *American Journal of Speech-Language Pathology*, 12, 61–72.
- Gersten, R., Fuchs, L., Compton, D., Coyne, M., Greenwood, C., & Innocenti, M. (2005). Quality indicators for group experimental and quasi-experimental research in special education. *Exceptional Children*, 71(2), 149–164.
- Gennaoui, M., & Chaleff, C. (2000). Miscue analysis for deaf readers. *Odyssey*, 2(1), 28–33.
- Grossen, B. (1997). *Thirty years of research: What we know about how children learn to read: A synthesis of research on reading from the National Institute of Child Health and Human Development*. Santa Cruz, CA: The Center for the Future of Teaching and Learning.
- Gustason, G., & Zawolkow, E. (1993). *Signing exact English*. Los Alamitos, CA: Modern Sign Press.
- Hanson, V. L., Liberman, I. Y., & Shankweiler, D. (1984). Linguistic coding by deaf children in relation to beginning reading success. *Journal of Experimental Child Psychology*, 37(2), 378–393.
- Harris, M., & Moreno, C. (2004). Deaf children's use of phonological coding: Evidence from reading, spelling and working memory. *Journal of Deaf Studies and Deaf Education*, 9, 253–268.
- Hoffmeister, R. J. (2000). A piece of the puzzle: ASL and reading comprehension in deaf children. In C. Chamberlain J. Morford, & R. Mayberry (Eds.), *Language acquisition by eye*. Mahwah, NJ: Lawrence Erlbaum.
- Hoffmeister, R. J., Philip, M. J., Costello, P. I., & Grass, W. (1998). Evaluating ASL in deaf children: ASL influences on reading with a focus on classifiers, plurals, verbs of motion, and location. In C. Carroll (Ed.), *Deaf Studies V: TOWARD 2000—Unity and diversity*. Washington, D.C.: College for Continuing Education, Gallaudet University.
- LangIzzo, A. (2002). Phonemic awareness and reading ability: An investigation with young readers who are deaf. *American Annals of the Deaf*, 147(4), 18–28.
- Jenkins, J., Fuchs, L., van den Broek, P., Espin, C., & Deno, S. (2003). Accuracy and fluency in list and context reading of skilled and RD groups: Absolute and relative performance levels. *Learning Disabilities Research & Practice*, 18(4), 237–245.
- Johns, J. (2004). *Basic reading inventory: Pre-primer through grade 12—Revised*. New York: Kendall Hunt.
- Kelly, J. E. (2001). *Transliterating: Show me the English*. Alexandria, VA: RID Press.
- Kelly, L. (1993). Recall of English function words and inflections by skilled and average deaf readers. *American Annals of the Deaf*, 138(3), 288–296.
- Kelly, L. (1995). Processing of bottom-up and top-down information by skilled and average deaf readers and implications for whole language instruction. *Exceptional Children*, 61(4), 318–334.
- Kelly, L. (1996). The interaction of syntactic competence and vocabulary during reading by deaf students. *Journal of Deaf Studies and Deaf Education*, 1(1), 75–90.
- Kelly, L. (2003). The importance of processing automaticity and temporary storage capacity to the differences in

- comprehension between skilled and less skilled college-age deaf readers. *Journal of Deaf Studies and Deaf Education*, 8(3), 230–249.
- King, J., & Just, M. A. (1991). Individual differences in syntactic processing: The role of working memory. *Journal of Memory & Language*, 30(5), 580–602.
- King, C., & Quigley, S. (1985). *Reading and deafness*. San Diego, CA: College-Hill Press.
- Kyle, F. E., & Harris, M. (2006). Concurrent correlates and predictors of reading and spelling achievement in deaf and hearing school children. *Journal of Deaf Studies and Deaf Education*, 11(3), 273–288.
- LaBerge, D., & Samuels, S. J. (1974). Toward a theory of automatic information processing in reading. *Cognitive Psychology*, 6, 293–323.
- LaSasso, C., & Lollis, J. (2003). Survey of residential and day schools for deaf students in the U.S. that identify themselves as bilingual-bicultural programs. *Journal of Deaf Studies and Deaf Education*, 8(1), 79–91.
- Linan-Thompson, S., Vaughn, S., Hickman-Davis, P., & Kouzekanani, K. (2003). Effectiveness of supplemental reading instruction for second-grade English language learners with reading difficulties. *Elementary School Journal*, 103(3), 221–238.
- Litchfield, S. (2002). The relationship of ASL proficiency to the written literacy skills of children who are deaf. *Dissertation Abstracts International, A: The Humanities and Social Sciences*, 63(2), 558A.
- Luckner, J., Sebald, A. M., Cooney, J., Young, J., & Muir, S. G. (2005). An examination of the evidence-based literacy research in the field of deaf education. *American Annals of the Deaf*, 150(5), 358–368.
- Luetke-Stahlman, B., & Corcoran-Nielsen, D. (2003). The contribution of phonological awareness and receptive and expressive English to the reading ability of deaf students with varying degrees of exposure to accurate English. *Journal of Deaf Studies and Deaf Education*, 8(4), 464–484.
- Lupton, L. (1998). Fluency in American Sign Language. *Journal of Deaf Studies and Deaf Education*, 3(4), 320–328.
- Mastropieri, M., Linart, A., & Scruggs, T. (1999). Strategies to increase reading fluency. *Intervention in School & Clinic*, 34(5), 278–284.
- Mathes, P., Simmons, D., & Davis, B. (1992). Assisted reading techniques for developing reading fluency. *Reading Research and Instruction*, 31, 70–77.
- Mercer, C. D., Campbell, K. U., Miller, M. D., Mercer, K. D., & Lane, H. B. (2000). Effects of a reading fluency intervention for middle schoolers with specific learning disabilities. *Learning Disabilities Research*, 15(4), 177–187.
- Miller, P. (1997). The effect of communication mode on the development of phonemic awareness in prelingually deaf students. *Journal of Speech, Language, and Hearing Research*, 40, 1151–1163.
- Musselman, C. (2000). How do children who can't hear learn to read an alphabetic script? A review of the literature on reading and deafness. *Journal of Deaf Studies and Deaf Education* (5, pp. 9–31).
- National Center for Education Statistics. (2006). *Statistical Standards*. U.S. Department of Education. Retrieved on 01/13/06 from <http://nces.ed.gov/statprog/2002/glossary.asp#nonresponse>
- National Institute of Child Health and Human Development (NICHD). (2000). *Report of the National Reading Panel. Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction*. Retrieved on November 16, 2004, from <http://www.nichd.nih.gov/publications/nrp/smallbook.htm>
- National Reading Panel. (2000). Findings and determinations of the National Reading Panel by topic areas. Retrieved on January 13, 2005, from <http://www.nichd.nih.gov/publications/nrp/findings.cfm>.
- Newell, W., Caccamise, F., Boardman, K., & Holcomb, B. R. (1983). Adaptation of the Language Proficiency Interview (LPI) for assessing sign communicative competence. *Sign Language Studies*, 41, 311–352.
- Opitz, M. F., & Rasinski, T. (1998). *Goodbye round robin: 25 effective oral reading strategies*. Portsmouth, NH: Heinemann.
- Padden, C., & Ramsey, C. (2000). American Sign Language and reading ability in deaf children. In C. Chamberlain J. Morford, & R. Mayberry (Eds.), *Language acquisition by eye*. Mahwah, NJ: Lawrence Erlbaum.
- Paul, P. (2005). Processes and components of reading. In Marschark, M. & P. Spencer (Eds.), *Oxford handbook of deaf studies, language, and education* (pp. 97–109). New York: Oxford University Press.
- Perfetti, C. A., & Sandak, R. (2000). Reading optimally builds on spoken language. *Journal of Deaf Studies and Deaf Education*, 5(1), 32–50.
- Rasinski, T. (2003). *The fluent reader*. New York: Scholastic Professional Books.
- Rasinski, T. V. (2004). *Assessing reading fluency*. Honolulu, HI: Pacific Resources for Education and Learning.
- Schimmel, C., Edwards, S., & Prickett, H. (1999). Reading? Pah! (I got it!): Innovative reading techniques for successful deaf readers. *American Annals of the Deaf*, 144(4), 298–308.
- Schirmer, B., Bailey, J., & Lockman, A. S. (2004). What verbal protocols reveal about the reading strategies of deaf students: A replication study. *American Annals of the Deaf*, 149(1), 5–16.
- Schleper, D. R. (1997). *Reading to Deaf children: Learning from Deaf adults*. Washington, DC: Laurent Clerc National Deaf Education Center at Gallaudet University.
- Schreiber, P. A. (1987). Prosody and structure in children's syntactic processing. In R. Horowitz & S. J. Samuels (Eds.), *Comprehending oral and written language* (pp. 243–270). New York: Academic Press.
- Schreiber, P. A., & Read, C. (1980). Children's use of phonetic cues in spelling, parsing, and—maybe—reading. *Bulletin of the Orton Society*, 30, 209–224.
- Shinn, M. R. (1989). *Curriculum-based measurement: Assessing special children*. New York: Guilford.
- Smith, C., Lentz, E. M., & Mikos, K. (1988). *Signing naturally*. San Diego, CA: Dawn Sign Press.

- Spencer, L., Gantz, B. J., & Knutson, J. (2004). Outcomes and achievement of students who grew up with access to cochlear implants. *Laryngoscope*, *114*, 1576–1581.
- Sterne, A., & Goswami, U. (2000). Phonological awareness of syllables, rhymes, and phonemes in deaf children. *Journal of Child Psychology and Psychiatry*, *41*(5), 609–625.
- Stoner, M., Easterbrooks, S. R., & Laughton, J. (2005). Handwritten and word-processed story retellings by school-aged students who are deaf and hard of hearing. *Journal of Special Education and Technology*, *20*(3), 35–44.
- Swanson, H. L., & Howell, M. (2001). Working memory, short-term memory, and speech rate as predictors of children's reading. *Journal of Educational Psychology*, *93*(4), 720–734.
- Trezek, B. J., & Malmgren, K. W. (2005). The efficacy of utilizing a phonics treatment package with middle school deaf and hard-of-hearing students. *Journal of Deaf Studies and Deaf Education*, *10*, 256–271.
- Trezek, B. J., & Wang, Y. (2006). Implications of utilizing a phonics-based reading curriculum with children who are deaf or hard of hearing. *Journal of Deaf Studies and Deaf Education*, *11*(2), 202–213.
- Valli, C., & Lucas, C. (1995). *Linguistics of American Sign Language: An introduction*. Washington, DC: Gallaudet University Press.
- Woodcock, R. (1987). *Woodcock reading mastery test-Revised*. Circle Pines, MN: AGS.
- Woolsey, L. M., Satterfield, S. T., & Roberson, L. (2006). Visual phonics: An English code buster? *American Annals of the Deaf*, *151*(4), 452–457.
- Zutell, J., & Rasinski, T. (1991). Training teachers to attend to their students' oral reading fluency. *Theory into Practice*, *30*, 211–217.

Received December 7, 2006; revisions received May 1, 2007; accepted May 6, 2007.