The Effects of Digital Video Quality on Learner Comprehension in an American Sign Language Assessment Environment

Advancements in computer processing power, coupled with the widespread availability of high bandwidth, have increased the use of video-based media over the Internet. However, technical

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factors continue to limit the quality of transmitted video files, with the result that designers often sacrifice media quality to create smaller file sizes that increase download speed.

Questions about the importance of video quality are generally subsumed under the category of image clarity. Several factors may affect video clarity, including image size, frame rate (i.e., the number of frames displayed per second), the number of colors associated with an image (i.e., bit depth), use of codecs (i.e., application of different video compression–decompression algorithms), dynamic range (i.e., fixed vs. variable bit rates), and the form of frame scan (i.e., interlaced vs. progressive scan) (Library of Congress 2005).

Although video quality may have little impact on some uses of digital video (e.g., streamed cybercasts, brief animations that illustrate a web page) (ibid.), reduced video quality may create significant barriers in other applications. Video quality is especially important for tasks involving detailed visual communication such as the use of American Sign Language (ASL). Reducing quality may interfere with the communication process, obstruct learner comprehension, or influence performance assessment.

For more than fifty years ASL has been accepted as a world language and valued as an approach to encourage cultural diversity (Wilbers 1987). During this period ASL has become the third most widely used language in the United States, preceded only by English and Spanish. As a result, more than five hundred colleges and universities in the United States now offer ASL instruction (Wilcox 2004): Enrollment in higher-education ASL classes has increased 433 percent nationally in the last four years (Welles 2004).

The increasing demand for ASL training and linguistic study has created diverse instructional challenges, including assessment and measurement of learner progress (Deno 1985; Kemp 1998). This creates a considerable need for efficient, effective, and technically valid systems to assess student performance and monitor student progress (Schick and Williams 2005). The most widespread method of assessing ASL fluency involves evaluating video recordings of interviews with individual students (Newell and Caccamise 1992). To record such an exam, a student locates a video camera, captures a self-performance on videotape, and submits the tape for evaluation. An in-
structor then reviews the video, evaluates the student's performance, assigns a score, and writes brief comments for each student. The evaluation process often delays feedback to the students for an average of two to three weeks, thereby causing the loss of valuable opportunities for students to reflect on their performances and detracting from the instructor's ability to modify classroom instruction based on learners' current performance needs. In addition to being time consuming and unreliable, the process fails to improve student learning.

We are presently developing a computer-based software environment to resolve and extend ASL assessment. The environment includes an application for students to capture, submit, and archive ASL performances, an application for instructors to evaluate and report student performance, and an electronic portfolio where students can monitor personal progress and practice. Our goals are to enhance the efficiency of the traditional assessment process and to improve learning.

Early in the design process we realized that it was important to establish a set of standards (i.e., video size and frame rate) for capturing and presenting digital video. Instructional designers often face the problem of maintaining a balance between manageable file size and suitable quality when using videos in a software environment (Schwier and Misanchuk 1998). Although widely accepted standards have yet to be established, the online video deployment software used in the present study (i.e., Macromedia Flash) supports a standard video size of $320 \times 240$ pixels and 12–15 frames per second (fps) for web delivery (Macromedia 2003).

Schwier and Misanchuk (ibid.) examined the effects of frame rate and video size on the perceived quality of digital video and images among an adult population. They hypothesized that lowering the video size and reducing the number of frames per second may diminish the perceived quality of the movie. However, their results indicate that recordings made at lower frame rates (i.e., 10 fps and 15 fps) were preferred to higher frame rate videos (i.e., 30 fps). Participants also favored larger movie windows ($320 \times 240$ pixels) over smaller ones ($160 \times 120$ pixels).

Schwier and Misanchuk's research presents important findings for multimedia developers concerned with optimizing the perceived qual-
ity of digital video capture and deployment. However, their findings were not intended for capturing or displaying ASL video performances. Research examining the effects of video quality on ASL learners is scarce and tends to focus on the surface-level characteristics of ASL learning (e.g., vocabulary recognition), as opposed to context-based learner comprehension (i.e., fluency, linguistics, and expression).

One study determined whether reductions in frame rate affect the perceptual recognition abilities of ASL novice learners (Johnson and Caird 1996). Participants were asked to match ten signs with their English equivalents. The signs were presented using a video size of 320×240 pixels and frame rates of 1, 5, 15, and 30 fps. It was suggested that ASL novices are more likely than ASL experts to be affected by frame rate changes because novices lack the mental schemata to recognize ill-formed signs. Although empirical results suggest that sign-performance recognition decreases at lower frame rates, no significant effect was found for frame rate. For recognition tasks, the authors claimed that “lower frame rates, specifically 1 and 5 fps, appear to be sufficient to learn ASL in a multimedia application” (ibid., 122).

Although the effects of video size and frame rate on sign recognition and general perceived video quality have been examined, little research has investigated the effects of video quality on ASL learners’ comprehension. Johnson and Caird's (ibid.) claim concerning low frame rate sufficiency may be relevant for ASL recognition tasks but may not accommodate the intricacies needed for ASL communication or assessment. Keating and Mirus (2003) explain that sign language communication is more than a manual system of hand orientations and movements that symbolize words and ideas. In actuality, ASL communication involves the transmission of imperative grammatical and affective information through essential nonmanual expressions (e.g., head movement, eye movement, specific facial expressions) in addition to the manual communication of words through finger spelling. With an average speed of five to seven letters per second (Reed et. al. 1990), finger spelling adds further complexity to signed transmissions. Higher quality video is needed to capture and represent subtle kinesthetic details of signed communication in a software assessment environment. The primary goal of this study was to examine the effects of frame rate...
and video size on ASL learners’ comprehension. Specifically, we asked the following primary research questions:

1. Will students provided with a larger video size to display ASL testing media demonstrate higher levels of fluency than participants who are presented with smaller video sizes?
2. Will students provided with a faster frame rate to display ASL testing media demonstrate higher levels of fluency than participants who are presented with slower frame rates?
3. Will intermediate level ASL students demonstrate higher levels of fluency than beginner level participants on video-based assessments?

Method

Participants

A sample of 85 students who were enrolled in one of four ASL courses at a large Midwestern university participated voluntarily. Each course covered a different level of ASL instruction (i.e., ASL 1–4). Although 85 students participated in this experiment, a server failure on the second day of testing partially corrupted thirty-four instances of participant data. Therefore, complete data from only 51 participants were used for analyses.

Materials

The materials used in the study consisted of three ASL story-retell tests, ASL assessment software, and a curriculum-based measures (CBM) rating system.

ASL Story-Retell Tests. The story-retell tests required participants to watch an ASL video narrative and then sign the story to a video camera. Each retell test consisted of a short story (approximately thirty seconds in length) signed by an expert ASL actor. The authors developed a script for each narrative and included a broad selection of vocabulary and grammar currently being taught in the four ASL courses. A transcription of each story-retell video is included in
Appendix A. All of the tests and students’ responses were stored on a computer server.

**ASL Assessment Software.** The story-retell test was administered to participants using a prototype software program designed to help instructors assess students’ ASL performances efficiently and reliably. Participants were given instructions that outlined the tasks they were to complete during the study. The software displayed each story-retell video (video size and frame rate were randomly determined). After the video finished playing, the software provided five seconds for participants to align themselves in front of the video camera (i.e., they were instructed to align their head, chest, and arms with an outline of a human figure to ensure that the video camera captured the full signing space). Finally, the participants were given sixty seconds in which to retell the story in ASL to the camera before moving on to the next video. Upon completion of the three story-retell tests, the participants logged out of the software.

**ASL-CBM Rating System.** Fluency, as defined in this study, was determined by assessing a participant’s movement from one sign to the next, ease of use of the language, connected thoughts and patterns of signs used, and accurate placement of signs. An ASL-CBM fluency scoring paradigm was given to each ASL evaluator prior to scoring the participant video performances. The ASL-CBM rating scale used for this study, a Likert scale with scores ranging from 1 to 10, was adapted from the Sign Communication Proficiency Inventory (SCPI) developed by Newell and Caccamise (1992). For example, a low fluency rating of 1 or 2 was assigned to participants who demonstrated very limited sign vocabulary, used no grammatical structure, demonstrated great difficulty in comprehending signed communication, lacked prosody, and made frequent errors, resulting in almost incomprehensible performance. A high fluency rating of 9 or 10 was assigned to those who demonstrated a broad and fluent use of vocabulary with strategies for creating and communicating new words, used complex grammatical constructions with ease, and exhibited correct prosody for grammatical, nonverbal markers, and affective purposes. Participants who received a high fluency rating also communicated all of the
details of the original message in the story-retell narrative. See Appendix B for a complete description of the fluency ratings used in this study.

Experimental Design and Treatments
The study employed a $2\times3\times3$ mixed factorial design. The three experimental factors were participant ASL level, video size, and frame rate. The first factor, ASL level, signified the participant's current placement in the four-course ASL progression (i.e., 1, 2, 3, or 4). Due to corrupt data from groups 1 and 3, ASL level was reduced to two categories to maintain a balanced design: beginner (i.e., Level 1 and 2 students) and intermediate (i.e., Level 3 and 4 students). The ASL level was a between-subjects factor. The second factor, video size (i.e., the horizontal by vertical pixel count of the displayed video), consisted of three levels (i.e., $240\times180$, $320\times240$, or $480\times360$ pixels). Since each participant received only one video size throughout the experiment, video size was also a between-subjects factor. Figure 1 displays the relative dimensions for each video size. The third factor, frame rate (i.e., the number of video frames played per second), consisted of three levels (i.e., 6 fps, 12 fps, and 18 fps). Frame rate was a within-subjects variable.

The bit rate for each video was held constant at 700 kbps to produce fewer compression artifacts (i.e., higher bit rates increase the number of encoding bits/pixel, which improves image quality) and to avoid the risk of introducing potentially confounding effects of variable image quality.

![Figure 1. A comparison of video size treatments (dimensions relative to 480x360 size).](image)
Dependent Measures
The quantitative measure used in this study was learner comprehension, which was indicated by a score of ASL fluency. Two external evaluators and one internal evaluator viewed and rated each participant’s video performance and provided a fluency score using the ASL-CBM rating system. The mean of the three evaluators’ scores provided an overall fluency rating for each story-retell test. The evaluators, all ASL communication specialists, received training before they evaluated the students’ performances. Training continued until an interrater reliability of .90 was reached on five sample video performances.

Data Analysis
A three-way mixed analysis of variance (ANOVA) was used to evaluate the learner comprehension scores from each story-retell test. Estimated marginal means and Tukey tests were used for follow-up study. For all quantitative analyses, alpha was set at .05.

Procedures
Participants were randomly assigned to one of the three video size treatments for the entire test. They completed three story-retell tests using the ASL assessment software. The testing software generated a random order in which the three test videos were played (i.e., at each of the three frame rate treatments) (see figure 2) and students’ performances were captured and archived for evaluation.

<table>
<thead>
<tr>
<th>Student A</th>
<th>6 frames per second</th>
<th>12 frames per second</th>
<th>18 frames per second</th>
</tr>
</thead>
<tbody>
<tr>
<td>240x180 pixels</td>
<td>test video 2</td>
<td>test video 3</td>
<td>test video 1</td>
</tr>
<tr>
<td>320x240 pixels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>480x360 pixels</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Results
In this section we report the results of the learner comprehension scores generated within each treatment. Table 1 presents the means and standard deviations for each of the video size and frame rate treatment groups.
Table 1. Means and Standard Deviations by Treatment

<table>
<thead>
<tr>
<th>Frame Rate</th>
<th>ASL Level</th>
<th>Video Size</th>
<th>n</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 fps</td>
<td>beginner</td>
<td>240x180</td>
<td>10</td>
<td>0.60</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td></td>
<td>320x240</td>
<td>10</td>
<td>0.20</td>
<td>0.42</td>
</tr>
<tr>
<td></td>
<td></td>
<td>480x360</td>
<td>8</td>
<td>0.75</td>
<td>1.16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>28</td>
<td>0.50</td>
<td>0.79</td>
</tr>
<tr>
<td></td>
<td>intermediate</td>
<td>240x180</td>
<td>6</td>
<td>1.50</td>
<td>2.35</td>
</tr>
<tr>
<td></td>
<td></td>
<td>320x240</td>
<td>7</td>
<td>3.29</td>
<td>1.80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>480x360</td>
<td>10</td>
<td>3.50</td>
<td>3.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>23</td>
<td>2.91</td>
<td>2.61</td>
</tr>
<tr>
<td>12 fps</td>
<td>beginner</td>
<td>240x180</td>
<td>10</td>
<td>0.90</td>
<td>1.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>320x240</td>
<td>10</td>
<td>0.70</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>480x360</td>
<td>8</td>
<td>1.13</td>
<td>1.46</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>28</td>
<td>0.89</td>
<td>1.07</td>
</tr>
<tr>
<td></td>
<td>intermediate</td>
<td>240x180</td>
<td>6</td>
<td>3.17</td>
<td>2.04</td>
</tr>
<tr>
<td></td>
<td></td>
<td>320x240</td>
<td>7</td>
<td>4.43</td>
<td>1.81</td>
</tr>
<tr>
<td></td>
<td></td>
<td>480x360</td>
<td>10</td>
<td>4.40</td>
<td>3.03</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>23</td>
<td>4.09</td>
<td>2.43</td>
</tr>
<tr>
<td>18 fps</td>
<td>beginner</td>
<td>240x180</td>
<td>10</td>
<td>1.00</td>
<td>0.94</td>
</tr>
<tr>
<td></td>
<td></td>
<td>320x240</td>
<td>10</td>
<td>0.90</td>
<td>0.88</td>
</tr>
<tr>
<td></td>
<td></td>
<td>480x360</td>
<td>8</td>
<td>1.75</td>
<td>1.67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>28</td>
<td>1.18</td>
<td>1.19</td>
</tr>
<tr>
<td></td>
<td>intermediate</td>
<td>240x180</td>
<td>6</td>
<td>3.67</td>
<td>2.42</td>
</tr>
<tr>
<td></td>
<td></td>
<td>320x240</td>
<td>7</td>
<td>5.14</td>
<td>2.41</td>
</tr>
<tr>
<td></td>
<td></td>
<td>480x360</td>
<td>10</td>
<td>4.60</td>
<td>2.80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>23</td>
<td>4.52</td>
<td>2.54</td>
</tr>
</tbody>
</table>

Main Effects

The ANOVA indicated a significant effect for frame rate $F(2, 90) = 25.80, MS = 18.50, MS_e = 0.72, p < .01$. Follow-up contrasts (i.e., paired t tests) comparing the means of Treatment 1 (6 fps) and Treatment 2 (12 fps), the means of Treatment 1 and Treatment 3 (18 fps), and the means of Treatment 2 and Treatment 3 were all significantly different. Participants scored higher at 18 fps ($M = 2.69$) than at 12 fps ($M = 2.33$), and participants scored higher at 12 fps than at 6 fps ($M = 1.59$).

A significant effect was found for ASL level $F(1, 45) = 33.37, MS = 301.27, MS_e = 9.03, p < .01$. Participants scored higher in the intermediate ($M = 2.91$) than in the beginner level ($M = 0.5$). No significant difference was found for video size $F(2, 45) = 1.10, MS = 9.91, MS_e = 9.03, p = .34$. 

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Interaction Effects

The interaction between frame rate and ASL level was also significant $F(2, 90) = 5.00, MS = 3.59, MS_e = 0.72, p < .01$. For both the intermediate and the beginner levels, participants scored higher at 12 fps than at 6 fps and higher at 18 fps than at 6 fps; however, the contrasts between 12 and 18 fps were not significant. The interaction between video size and frame rate $F(4, 90) = 0.21, MS = 0.15, MS_e = 0.72, p = .93$ and the interaction between video size and ASL level $F(2, 45) = 0.99, MS = 8.97, MS_e = 9.03, p = .38$ were not significant. The three-way interaction between frame rate, video size, and ASL level $F(4, 90) = 1.14, MS = 0.81, MS_e = 0.72, p = .35$ was not significant.

Table 2. ANOVA Performed on Story-Retell Test Scores

<table>
<thead>
<tr>
<th>Effect</th>
<th>df</th>
<th>MS</th>
<th>$MS_e$</th>
<th>$F$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fps</td>
<td>2</td>
<td>18.50</td>
<td>0.72</td>
<td>25.80</td>
<td>.001</td>
</tr>
<tr>
<td>Video size</td>
<td>2</td>
<td>9.91</td>
<td>9.03</td>
<td>1.10</td>
<td>.342</td>
</tr>
<tr>
<td>ASL level</td>
<td>1</td>
<td>301.27</td>
<td>9.03</td>
<td>33.37</td>
<td>.001</td>
</tr>
<tr>
<td>Fps $\times$ video size</td>
<td>4</td>
<td>0.15</td>
<td>0.72</td>
<td>0.21</td>
<td>.933</td>
</tr>
<tr>
<td>Fps $\times$ ASL level</td>
<td>2</td>
<td>3.59</td>
<td>0.72</td>
<td>5.00</td>
<td>.009</td>
</tr>
<tr>
<td>Video size $\times$ ASL level</td>
<td>2</td>
<td>8.97</td>
<td>9.03</td>
<td>0.99</td>
<td>.378</td>
</tr>
<tr>
<td>Fps $\times$ video size $\times$ ASL level</td>
<td>4</td>
<td>0.81</td>
<td>0.72</td>
<td>1.14</td>
<td>.345</td>
</tr>
<tr>
<td>Error (within subject)</td>
<td>90</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error (between subject)</td>
<td>45</td>
<td>9.03</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Discussion

In this section we summarize the primary findings from the study, consider the implications for designing and developing ASL assessment environments, and recommend future research of digital-video-quality standards for ASL assessment and communication. Understanding the variables that influence people's ability to comprehend information transmitted by video is clearly important, especially in ASL, where media quality may obscure important information. Two findings from this study are particularly noteworthy. First, the main effect for frame rate suggests that higher frame rates are important for learners who are attempting to understand ASL. Students scored higher when the frame rates increased from 6 fps to 12 fps and again when they increased from
12 fps to 18 fps. However, the interaction between frame rate and ASL level was also significant, which suggests that the relationship was mediated by ability. Yet, follow-up contrasts failed to shed light on the nature of this relationship: Although students from both beginning and intermediate levels performed better at 12 fps than at 6 fps, and better at 18 fps than at 6 fps, contrasts for both ability levels were not significantly higher at 18 fps than at 12 fps. These findings differ from Johnson and Caird’s (1996) conclusion that frame rate does not significantly affect learner sign recognition and performance. We suggest that the findings vary according to the nature of the task. Whereas Johnson and Caird examined people’s ability to recognize individual signs that were presented devoid of context, in our study participants were asked to comprehend more complex messages that require deeper levels of comprehension. Video frame rate appears to be particularly important when contextual details (i.e., classifiers, transitions, etc.) are more essential to the communicated message than surface-level information (i.e., vocabulary).

Second, we did not anticipate the nonsignificant finding for video size. Despite the preference that users have for larger video sizes (Schwier and Misanchuk 1998), those used in the current study did not affect performance: Students’ performances were equivalent at screen sizes of 240×180, 320×240, and 480×360 pixels. Our rationale that larger video sizes would enhance comprehension was based on the assumption that interpolation algorithms used to scale down video size would distort subtle linguistic artifacts (e.g., eye blinks, finger spelling, facial gestures) that are often considered essential to perceiving ASL, resulting in reduced learner comprehension. Similarly, studies have suggested that compression may introduce factors such as blockiness, blurring, ringing, color bleeding, and motion compensation, which cause video quality degradation (Winkler 1999) and comprehension loss (Ciaramello, Cavender, Hemami, Riskin, and Ladner 2006). When video size was modified, we suggest that the essential elements of the instructional message were available in all treatments, in contrast to the information loss that occurred when the frame rate was reduced. However, messages that include higher levels of subtle gestures may be more susceptible to differences in video size.

It is also interesting to consider the design implications of video
quality. From a psychological perspective, decisions concerning video use are often made according to whether video quality affects learner comprehension and frequently attempt to identify a point of diminishing return (i.e., whether the added cost of improving video quality can be justified by associated improvements in comprehension). However, from an aesthetic perspective, designers may extend technology capability to its capacity to create environments that are not simply effective from a cognitive perspective but are also highly motivating for the learner. Designers often include the fastest frame rate and largest video size available to create environments that are both engaging and aesthetically pleasing to students as well as instructors. This interplay between psychological need and aesthetic want represents a relatively new interaction in the field of instructional design (cf. Kirschner et al. 2004; Norman 2004), but it is one that has important implications for how users will use technology.

We suggest recommendations for future research. The present study used a mixed-effect design that employed both within- and between-subjects factors. Video size was used as a between-subjects factor to avoid the face-validity problem of using different video sizes for a single research participant for different experimental treatments. In contrast, frame rate was used as a within-subjects variable because we anticipated that the loss of information associated with lower frame rates would not be as immediately apparent to the participants. However, the potential benefit of the between-subjects factor may not be worth the loss of experimental power. Further, researchers should include a control group of native signers, given that the independent variables in this study, as well as video compression artifacts, are critically important to deaf communication.

Schwier and Misanchuk (1998) suggested that video size and frame rate are interdependent, synergistic attributes of perceived video quality (i.e., changing the frame rate or video size independently affects the overall nature of the aesthetic experience beyond what one would expect from altering a single variable). Thus, although our research suggests that frame rate affects video quality independently of video size, we suggest that further research on both frame rate and video size is needed to clarify and inform the development of standards suitable for ASL.
References


Appendix A. English Translations of Story-Retell
Video Transcriptions

Story 1

One day I was walking across the Washington Avenue bridge on my way to the student union. I saw something floating in the water. I looked more closely. I could tell it was moving very quickly. It was very large, gray with green and red stripes. It moved from one side of the river to the other. Back and forth . . . and then it was gone!

Story 2

Yesterday I was walking to the library. I was not thinking about anything, just walking. Suddenly I stepped on something. I looked down. It was a thick brown bag. I picked up the bag, opened it carefully. Guess what! I thought maybe it was money. No, it was a banana and a peanut butter and jelly sandwich.

Story 3

My friend is interested in applying to the university. She will graduate from high school in the spring. I told her the U of M is very large—three campuses in the TC: St. Paul, East Bank, and West Bank. We can choose from many different colleges and majors. I think my friend would really enjoy studying at the U of Minnesota.
Appendix B. ASL-CBM Ratings

Two external evaluators and one internal evaluator used a Likert scale to assess specific skills displayed in each participant’s story-retell test. Learner comprehension scores ranged from 0 (i.e., no skills demonstrated) to 5 (i.e., advanced nativelike skills) and were averaged to generate an overall fluency rating for each test (Schick and Williams 2005).

Rating 0
Uses no signs.

Rating 1–2
Demonstrates very limited sign vocabulary with frequent errors in production. At times, production may be incomprehensible. No grammatical structure. Individual is able to communicate only very simple ideas and demonstrates great difficulty comprehending signed communication. Sign production lacks prosody (i.e., patterns of stress and emphasis), and use of space is minimal.

Rating 3–4
Demonstrates basic sign vocabulary. Sign production errors are common as if searching for vocabulary. Frequent errors in grammar although basic signed sentences appear intact. More complex grammatical structures are typically difficult. Individual is able to read signs at the word level. Some use of prosody and space, but use in inconsistent.

Rating 5–6
Demonstrates knowledge of basic vocabulary but may lack vocabulary for more technical, complex, or academic topics. Able to sign in a fairly fluent manner using some consistent prosody, but pacing is still slow with infrequent pauses for vocabulary or complex structures. Sign production may show some errors. Grammatical production may still be incorrect, especially for complex structures, but is generally intact.
for routine and simple language. Comprehends signed messages but may lack the original message.

Rating 7–8

Demonstrates broad use of vocabulary with sign production generally correct. Demonstrates good strategies for conveying information when a specific sign is not in the subject’s vocabulary. Grammatical constructions are generally clear and consistent, but complex information may still pose occasional problems. Prosody is good, with appropriate facial expression most of the time. Fluency may deteriorate when rate or complexity of communication increases. Uses space consistently most of the time, but complex constructions or extended discourse comprehension may still pose problems. Comprehension of most signed messages at a normal rate is good, but translation may lack some of the complexity of the original message.

Rating 9–10

Demonstrates broad and fluent use of vocabulary, with strategies for creating and communicating new words. Sign production errors are minimal and never interfere with comprehension. Prosody is correct for grammatical, nonverbal markers, and affective purposes. Complex grammatical constructions are typically not a problem. Comprehension of signed messages is very good, and subject communicates all details of the original message.
ABSTRACTS

A Look at Teaching Standards in ASL Teacher Preparation Programs

As an American Sign Language instructor working with ASL majors at Gallaudet University for twenty years, I became piqued by a few questions: Are there enough ASL teacher preparation programs in the country, and how prepared are their graduates? This article addresses these topics.

The Effects of Digital Video Quality on Learner Comprehension in an American Sign Language Assessment Environment

The effects of digital video frame rate and size on American Sign Language (ASL) learner comprehension were investigated. Fifty-one students were randomly assigned to one of three video-size treatment groups: 480×360, 320×240, and 240×180 pixels. Within each treatment, three 30-second videos of signed narratives at frame rates of 6, 12, and 18 frames per second were presented to students. Participants used ASL to retell each story, while a digital video camera captured their performances and archived them for evaluation. Three ASL experts evaluated the video performances and generated a fluency score for each student. The results indicate that frame rate and the interaction between frame rate and ASL level had significant effects on learner comprehension, but video size did not significantly affect comprehension. These results were used to generate frame rate and video-size recommendations for displaying and recording student performance and instructor feedback videos in an ASL performance assessment software environment.