

Using an Animation-based Technology to Support Reading Curricula for Deaf Elementary Schoolchildren

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Literacy is an essential skill for success in life. Higher literacy leads to improved employment opportunities and greater earnings (Kelly, Montigny, O'Neill & Sharpe 1992), but unfortunately, as a group, deaf children in the United States have poor reading skills (Musselman 2000). The median reading comprehension score for deaf 17- and 18-year-old high school students is at the 4th grade level (Stewart & Kluwin, 2001).

Fingerspelling is often used to improve reading skills in deaf education programs. Fingerspelling is a method for representing the symbols of a written alphabet as signs (Valli & Lucas 1995). It is an essential part of American Sign Language (Battison 1978). Deaf¹ children of Deaf parents will fingerspell as part of expressive sign production by the time they are two years old (Padden & LeMaster, 1985). It is also an important bridge to English print comprehension (Nover & Andrews, 2000). Fingerspelling is used in both bilingual-bicultural (“bi-bi”) approaches (Schimmel & Edwards, 2003), as well as in teaching approaches that use Total Communication (Lowenbraun, Appelman, & Callahan, 1980) and/or systems of Manually Coded English (Schick & Moeller, 1992).

However, there are many difficulties in using fingerspelling to support curriculum plans. Instructors who use fingerspelling in the classroom face several challenges. Some hearing instructors are not as confident of their fingerspelling skills as they would like to

¹ The term “Deaf” refers to a minority group which has a common preferred language of American Sign Language and a shared culture. The term “deaf” refers to the audiological condition of “not hearing.”

be. For hearing people, fingerspelling fluency is typically the last skill acquired when learning sign language (Grushkin, 1998). Another challenge is fatigue. Producing the same fingerspelling combinations over and over is tiring.

In addition, classroom management while fingerspelling poses its own issues. Students have a wide range of fingerspelling abilities, and it can be difficult to address the needs of all skill levels. In some situations, an instructor will fingerspell a word, and then ask a specific student for the corresponding sign. If the student hesitates, then other students may produce the sign, thus removing the challenge.

Outside the classroom, there are few opportunities for mainstreamed deaf students to practice fingerspelling. Ninety percent of children born deaf have hearing parents (Mitchell, 2004) and most hearing parents are not fluent in sign language or in using fingerspelling.

For the above reasons, fingerspelling does not always achieve its potential effectiveness in supporting the acquisition of reading skills.

Previous technologies attempting to support fingerspelling in the classroom have had several limitations. There have been only two choices and both have drawbacks. Videotapes offer realistic fingerspelling, but no interaction for students. Further, the words on the videotape are fixed and never change. On the other hand, computer programs with “flash-card” style fingerspelling (Vision, 1993) (ASL University, 2006)(Gay, 2001) (Institute 2003) offer interaction but poor realism.

To address these problems, we have developed a new technology called “Fingerspelling Tutor,” which combines the best aspects of previous technologies with realistic fingerspelling motion and a user interface that supports students of all levels. The

goal of this technology is to facilitate more effective use of fingerspelling in the classroom.

Fingerspelling Tutor

Fingerspelling Tutor is software that displays fingerspelling in true-to-life 3D motion. One of the unique features of this software is animation that closely resembles the actual motion of fingerspelling (Wolfe 2006). Instead of a series of static image “flashcards”, Fingerspelling Tutor displays the natural transitions made by the fingers and thumb as the hand moves from one letter to another. See Figure 1.

Fingerspelling Tutor accommodates skill levels ranging from beginner (learning the manual alphabet) to advanced (fastest fingerspelling humanly possible). There are four levels to choose from: “Alphabet”; “My First Fingerspeller”; “Intermediate”; and “Advanced.” Each level includes opportunities to practice or to take a quiz.



Figure 1: True-to-life transitions of Fingerspelling Tutor

Figure 2 through Figure 8 show the screens for the Intermediate level. From the Intermediate main screen (Figure 2), students can choose the Demonstration (Figure 3), where they can type any word and see it fingerspelled. The opening Practice screen (Figure 4) offers a list of categories (animals, first names, last names, etc.). The category

choice determines the words that will appear in the Practice session (Figure 5). After seeing the word fingerspelled, students can choose the answer from one of four possibilities, or click “Repeat” to see the word fingerspelled again. Students can click “Repeat” as often as they like. They can also adjust the speed of the fingerspelling.

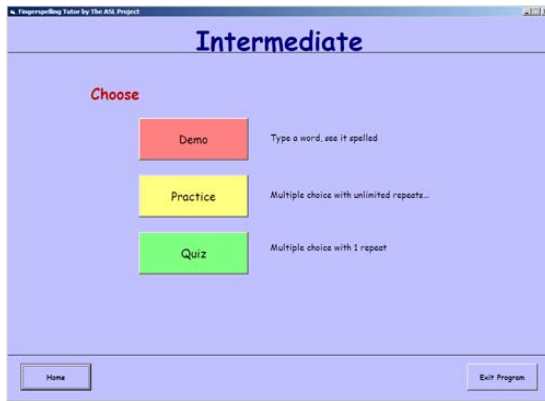


Figure 2: Intermediate level main screen

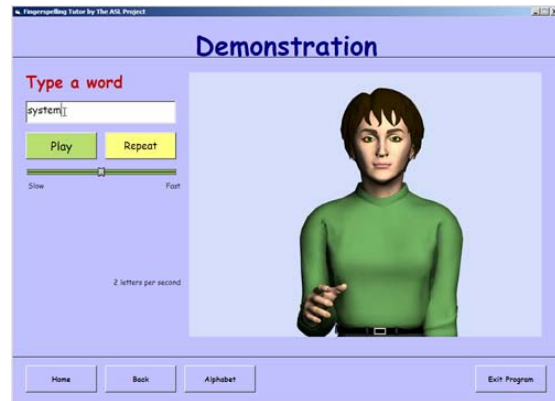


Figure 3: Demonstration screen

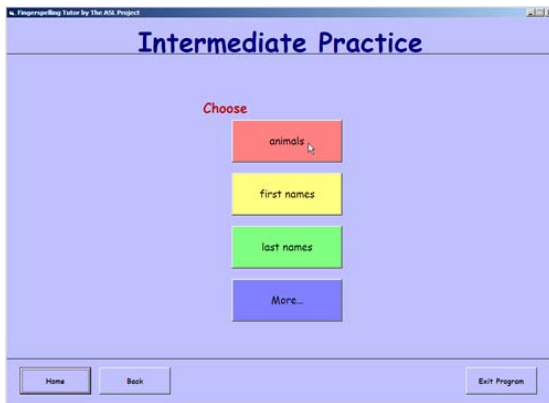


Figure 4: Starting a practice session at the Intermediate level

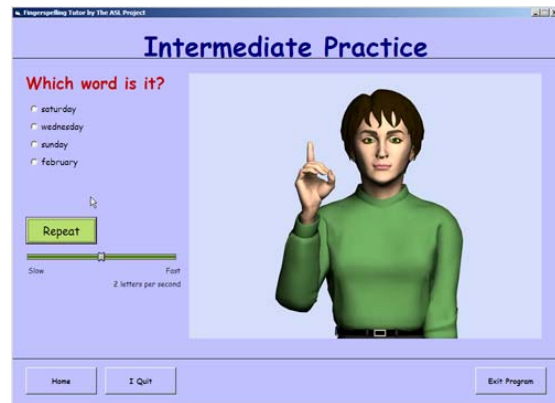


Figure 5: A practice session at the Intermediate level

After the student clicks “Enter”, feedback immediately appears on the screen (Figure 6). At this point, students can either choose to see the word again, or go on to the next word.

At any time, the student can click the “How am I doing” button to see how many words they’ve correctly identified as well as a list of those that were incorrect (Figure 7).



Figure 6: Feedback in a practice session at the Intermediate level



Figure 7: "How am I doing" display

The most important differences between a practice session and a quiz are that a quiz will have a specific number of questions (Figure 8) and the “Repeat” button only works once.

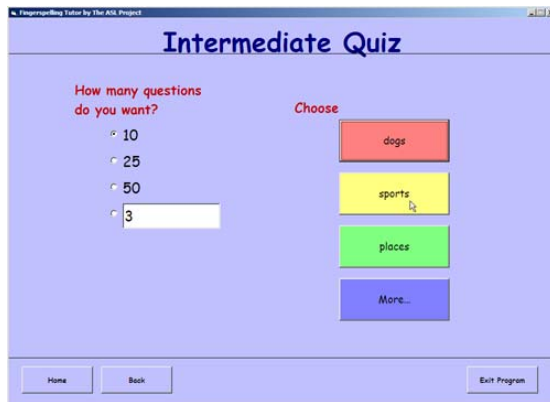


Figure 8: Starting a quiz at the Intermediate level

Classroom testing

Fingerspelling Tutor was classroom tested in a Deaf program at a public elementary school in a large metropolitan area. The testing took place during the winter

and spring terms of 2005. During that time, students in K through 8 used Fingerspelling Tutor several times a week as part of their classroom activities.

The school uses the Fairview method (Schimmel, Edwards & Prickett, 1999) for their reading curriculum. As part of this approach, students learn to fingerspell Dolch words (Dolch, 1948) and to recognize Dolch words when they are fingerspelled. Another important part of the Fairview approach is word analysis, where students cover parts of a word to look for the “words in a word.” The Fingerspelling Tutor was used in conjunction with all of these activities.

Results

In the classroom, Fingerspelling Tutor was extremely effective for individual practice because it served as a motivator for students, who spent more time studying/practicing than with any previous technology. The students were interested the novelty of seeing the motion of fingerspelling, and liked the individual, private feedback that they received when they were using the “Practice” or “Quiz” portions.

Fingerspelling Tutor proved helpful for classroom management. Each student could use Fingerspelling Tutor for practice without another student volunteering the answer and removing the challenge, which can happen when an instructor asks an individual student for an answer in a group setting.

Fingerspelling Tutor also facilitated individualized instruction in two ways. Each student could tailor the learning challenge by choosing the speed and level (Alphabet, My First Fingerspeller, Intermediate, or Advanced) that is most appropriate. Secondly, Fingerspelling Tutor gives teachers additional options for individualizing instruction. For

example, teachers can divide a class into two groups, and have one group use Fingerspelling Tutor while giving small-group instruction to the other. Fingerspelling Tutor captured student interest effectively enough that the teacher could focus attention on the individualized instruction.

Future work

Feedback from the classroom testing suggested adding an option to change the vocabulary lists, so the instructors could present new words as part of a teaching module. For example, when studying the Civil War, it would be useful to use Fingerspelling Tutor to practice and review vocabulary words related to the Civil War. Additionally, an option to print the “How Am I Doing” page would be useful for recording student progress and serve as part of ongoing student assessment. We plan to address both of these issues in the next version of Fingerspelling Tutor.

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