Mathematics and signing using modem technology

Erin Bosley

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Mathematics and Signing Using Modern Technology

MSSE Master's Project

Submitted to the Faculty
Of the Master of Science Program in Secondary Education
Of Students who are Deaf or Hard of Hearing

National Technical Institute for the Deaf
ROCHESTER INSTITUTE OF TECHNOLOGY

By
Erin Elizabeth Bosley

In Partial Fulfillment of Requirements
For the Degree of Master of Science

5/23/07 (date)

Rochester, New York

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Abstract

The purpose of this curriculum development capstone project is to provide a sign language resource for the teachers of mathematics classes in deaf education settings. The project consists of a webpage including the clips of various mathematics signs in American Sign Language (ASL). The webpage includes 45 mathematics vocabulary words, taken from the Algebra I mathematics book by Bellman, Bragg, Charles, Hall, Handlin, and Kennedy (2007). A definition as well as visual illustrations and/or visual examples are provided for each word. After the implementation of the website, several questions were asked in order to improve the quality of the webpage. The feedback was provided by a team of teachers and graduate students. This project serves as the sign language resource to help mathematics teachers in deaf education improve their signing skills and also help them choose the semantically correct signs, which can lead to better results in student learning of mathematics.
Project Overview

The final capstone project is a webpage. On the webpage, viewers will be able to see 45 mathematics words that are used frequently in Algebra books. Once viewers click on the word, it will take them to another page that contains the definition of the mathematics word and if possible a picture as well. Below the picture and the definition, there is a link that viewers can access by viewing a video clip of the sign for that word. QuickTime is the required software application for the viewers to access the video clip.
Importance of the Project

This project is a significant contribution to the field of deaf education, especially in the area of mathematics education. Teaching mathematics classes can be a challenge because teachers might struggle to explain the mathematics terms and its meanings in ASL. Often those teachers would shift to signed English to explain the mathematics concepts linearly and literally, in which this can lead to the disassociation of semantics. This can create confusion for students who use ASL as a means of communication as well as a means of learning. To reduce confusion through teaching and learning, teachers need a good resource on how to explain math concepts in ASL. This is where the website comes into play. This is a resource for teachers and students to use (semantically) correct math concepts in ASL.

As for this project, I designed a website. The website includes mathematical terminologies (signing) in ASL, its meanings, and its application. For example, the first page of the website displays mathematical terminology – “Algebraic Expression.” That word can be clicked into, and then it leads to another page that consists of its definition. On the top of the page displays the word: “Algebraic Expression,” below that it displays definition, example, and video. The definition is displayed as: “Definition: is a mathematical phrase that can include numbers, variables, and operating symbols.” A written visual example is shown as: “Example: 7 + x is an algebraic expression.” Below the definition component, there is a link, it is displayed as: “Video: Click here to view video.” Once the user clicks on that link, it pops up another window which has a video clip of a person signing the mathematical concept in ASL. The users can control the showing option by clicking on the pause, stop, and play buttons. They also can fast forward or rewind to their desire. Again, this website provides as a resource for teachers and students to understand mathematical concepts better.
Project Objectives

The goal of this website is to help teachers who are teaching mathematics to improve their signing by using semantically correct ASL that portrays the correct mathematical concept. The purpose of this whole project is to help enhance students’ learning and understanding of mathematical concepts in their primary language. Since the forty-five mathematic terms are used frequently in basic and more advanced classes, correct ASL signs should include mathematical terms. The website will in turn, assist teachers to be able to explain the mathematical concepts clearly.
Review of Literature

Most subjects are taught in written English which may present a challenge for most deaf and hard of hearing students who have delayed language development. By utilizing clear and effective communication, using current classroom technological tools, and possessing an effective teacher’s characteristics (flexible, ability to change and adapt, understanding of deaf culture and language), teachers of deaf students can improve students’ learning and comprehension greatly. Literature shows that teachers need to teach students in their primary language, this will help them grasp even difficult concepts such as mathematics and science.

This literature discusses the importance ASL has on a student’s learning and development as well as being an effective tool that can be used by teachers. In addition, communication, technology, and characteristics of effective teaching are discussed to examine their impacts on academics performance, especially mathematics performance among deaf students.

Communication

In their study on sign communication in the classroom, Stewart, Akamatu, and Becker (1995) found that teachers have low confidence in their signing skills. They also noted that colleges only offer one to three sign communication classes. The limited number of signing classes neither provides adequate confidence nor practice for teachers to sign fluently. As a result of their study, they developed a program that helped teachers improve their signs and use sign language more in the classrooms (1995). This, they
believed, allowed teachers to become more confident in their signing and as a result, students felt more confident and their motivation to learn increased.

Similarly to his study on the importance of clear communication in the classroom, Caccamise (2001) developed a guideline to help interpreters and teachers properly create new signs when there is no current sign for a word. He (2001) pointed out the importance of keeping “the meaning or concept base of signs” (p. 217). By that, he explained that words have many meanings and it is important to display the right ones. For example, the word, to get (become) sick vs. to get (obtain) a new car (p. 217) have two very different meanings. A tip sheet for people to follow when creating a technical sign was developed by Caccamise:

- One English word may require different signs, depending on context, and vice versa
- The “sign” should not conflict with ASL rules
- The “sign” should not belong to the wrong word class
- Be aware of how signs show spatial or other visual information and make sure that your production does not conflict with it
- Learn non-manual grammar
- Do not conflict with textbook symbolism
- A string of vocabulary items is not enough; go for meaning

(p. 230-231)

Caccamise noted that these tips can help the signers to “deliver a quality message” (2001, p. 231)

In the Puente, Alvarado, and Herrera’s study, the researchers studied the role of sign language and fingerspelling in development of reading and writing of deaf children (2006). The study was done by including 26 deaf participants whose first language is
sign language. Participants were asked to match the fingerspelled words to the commercial logos. The researchers’ hypothesis was that they could replace phonological awareness by using fingerspelling for deaf learners. On one hand, they found that fingerspelling could not replace sign language because too much context was left out; on the other hand they did find that fingerspelling could be used as a strategy for identifying words. Puente, Alvarado, and Herrera found evidence that showed positive correlation between using ASL communication skills and an increase in understanding in reading (2006). They saw that the greater use of ASL in the classroom, the better the students understood the reading.

Adamo-Villani and Beni (2004) conducted an experiment on fingerspelling using 3D animation with fingerspelling. They created a website containing 3D animation for the purpose of using it as a learning tool for new sign language learners (2004). The website allows users to view handshapes from all angles, opt for playbacks, control the speed, and enter in text to show the sign. Adamo-Villani and Beni (2004) believed by creating a 3D model, it would provide rich details in viewing each sign. In many sign language textbooks, each sign is provided with an illustration which this is very difficult to read and learn how to sign correctly at the same time. In addition, the positive note about this webpage is to provide feedback for users to work with and improve signing skills. Adamo-Villani and Beni hoped that creating this website will benefit for who wants to practice on their own (2004).

Kelly, Lang, Mousley, and Davis’ (2002) study focused on challenges that deaf and hard of hearing children face when solving math problems. In the Kelly et al’s (2002) study, it showed that students often struggle when approaching terms like “less
than, more than, faster than, three times as many, or half the number” (p. 120). They noted that deaf students have lack of experience in areas relating to these terms (2002).

The example given in the study was “Which number is 2 less than 3”, some students saw “less than” as a subtraction while majority of others saw it as a comparison and would pick 2 as a lesser number than 3 (p. 121). The study also showed that deaf students have the tendency to focus more on the words rather than “understanding the overall context” (2002, p. 121). The researchers recommended that “Deaf students should receive structured learning... that dialogue and conversations in the classroom need to be carefully structured to enable students to practice and acquire such comparative language” (2002, p. 131).

Long, Stinson, Kelly, and Liu recognizes the importance of clarity of communication (1999). Long, Stinson, Kelly, and Liu (1999) noted that the “adequacy of communication is a critical issue in the education of all students, including those who are deaf and hard of hearing” (p. 354). In their study on the behavior between deaf students and their teachers by examining the way the teachers signing in class and students’ satisfaction of their teachers’ signing skills, the researchers found that when teachers have a higher level of skill in signing, students are able to interact with and learn more from the teachers.

Technology

When it comes to visual illustrations in science and mathematics, Mishra (1999) pointed out an importance of clear conceptionally correct illustrations. He found that by including illustrations, students demonstrate a better understating of an abstract concept.
(1999). However, Mishra cautioned that illustrations can be misleading. He noted that “displaying the wrong illustration will cause misconception in the minds of the students” (p. 178).

In the Lang and Steely’s study on what websites can do to promote students’ learning in science education, using web/technology puts deaf and hard of hearing at a disadvantage (2003). As technology advances, the requirement for literacy increases as well. In Lang and Steely’s study, Marschark, Lang, and Albertini (2002) found that by the time an average deaf person reaches at the age of 18 or 19 years old, their reading ability is no greater than an average 8 or 9 years old normal hearing student (2003).

Lang and Steely (2003) pointed out that many readings found in the current websites are placed at high aptitude of reading level and no alternative visual text is provided to make the connection to the readings. Using the internet is a viable tool to enhance and maintain the literacy skills, they created an alternative way for deaf people which is videostreaming. Videostreaming is a tool used on the internet to allow users to view video clips or allow them to use real-time communication. Videostreaming is ideal because information is expressed and explained in ASL. This is beneficial for students because it allows students to see and use information in their primary language (2003).

Lang and Steely (2003) conducted an experiment by creating a science class using the internet and videoconferencing calls. The research indicated that when given the appropriate web tool learning (videoconferencing calls), students showed high motivation and higher scores were increased in learning. One teacher quoted, “Combined use of videoconferencing calls and asynchronous websites with deaf students has shown some promise” (2003, p. 282).
Similarly, the Barman and Stockton (2002) study conducted a study using videoconferencing calls. They worked with three schools: Model Secondary School for the Deaf (MSSD), Indiana School for the Deaf (ISD), and University High School (UHS) in this project (SOAR-High). SOAR-High is a one year earth science course using the Internet and videoconferencing (2002). All three schools were given the same curriculum where students were to document their findings, post it on the internet, and use videoconferencing calls to share their findings among the three schools.

In this project, Barman and Stockton (2002) concluded that there is an increase in three areas and they are: 1) students' motivation, 2) students' comprehension of science, and 3) students' ability to work independently. As a positive result of the study, teachers were more likely to include SOAR-High into their curriculum. One teacher quoted, "I had shown [the students a] movie at the beginning of the year and they were totally unimpressed and uninterested in it. Now all of a sudden, they were like giant sponges absorbing everything. They were thinking of questions faster than they could ask them. I felt like someone had taken the remote control for the whole class and suddenly set it on fast forward" (2002, p. 8).

In Liu, Chou, Liu, and Yang's (2006) study, the researchers used technology to help improve students' learning. Liu, Chou, Liu, and Yang (2006) found that 88% of teachers (in Taiwan) in self-contained classrooms are taught orally. Deaf students whose primary language is sign language, "frequently have to guess about the content of teachers' lectures in class" (2006, p. 346). The researchers identify that there is a relationship between the language ability between student-teacher and students' learning on mathematical concepts (2006). They reckon the importance of sign language as the
students' preferred mode of communication. When this is not possible, using the wireless technology, such as personal computer tablet closes the communication gap between students and teachers. With the wireless technology, students are able to write and solve problems on the computer screen and the teacher is able to view the problems and give feedback from his or her computer station. Liu, Chou, Liu, and Yang (2006) found that the common errors that are made in mathematics have been reduced drastically with the use of technology.

Teacher's Characteristics

The study by Lang, Dowaliby and Anderson researched on what makes an effective teacher (1994). They conducted an interview among 56 deaf college students on what “critical incidents” they found to be effective and ineffective teaching techniques in both hearing and deaf teachers. Researchers identified seven main categories of critical incidents: teaching strategies, teacher affect, communication, course management, knowledge of subject, understanding of deafness, and quality of lectures/explanation (1994, p. 120).

Lang, McKee, and Conner's (1993) research supports Lang, Dowaliby, and Anderson's study. In their research, teaching faculty, administrators, chairperson and students were asked to define the characteristics of an effective teacher. The finding shows knowledge of the subject, understanding Deafness, Deaf people, and Deaf culture, challenges a student's thinking, using sign language clearly, and communicating expectations and assignments clearly are the defined characteristics. Lang, McKee, and
Conner (1993) concluded, “Effective Communication as a crucial component to effective
teaching was emphasized repeatedly” (p. 258).

Easterbrooks, Stephenson, and Mertens (2006) conducted a study, they sent out
20 questions (10 literacy and 10 math/science) to 74 master teachers (those who have
taught 5-29 years) about what a beneficial/effective tool in teaching practices. Teachers
reported, “Being a skillful communicator” as the most beneficial tool in the classroom.
Easterbrooks, Stephenson, and Mertens (2006) pointed out, “Teacher preparations
programs must continue to stress the importance of clear, consistent, and comprehensible
communication in the classroom” (p. 406).

In another article written by Easterbrooks and Stephenson (2006), they continued
to look at the important teaching practices in literacy, science, and mathematics in the
classroom of deaf and hard of hearing students. They found that the most frequently
cited response of effective teaching practice was the teacher’s communication skills. The
article states, “The evidence in all areas of education is overwhelmingly clear that a
teacher’s ability to communicate is a crucial component of effective instrument” (p. 391).

Easterbrooks and Stephenson found evidence in this study which states that in
children who have access to language at a very young age, the input of language affects
the quality of language development (2006). To enhance language development in the
classroom, teaching practice that Easterbrooks and Stephenson found was that teachers
need to present information in the student’s primary language (2006). They found that
“evidence in the literature supports greater academic achievement in the content areas
when teachers instruct students in their first language” (p. 391).
Pagliaro and Ansell’s study focused on reasons why deaf students have low scores on mathematics (2002). In their study, they found that sign communication has a big impact on students’ learning (2002). The researchers also recognized that most teachers of the deaf (TODs) are not fully knowledgeable in mathematics (2002). As with signing courses, a majority of teachers only had a few classes in math or none at all. Pagliaro and Ansell also pointed out that teachers have no or low self-confidence in their signing since English is usually their first language (2002). They found that students benefited the most when teachers use ASL when presenting story problems (word problems) (2002). Pagliaro and Ansell noted that for students to benefit most of language access, they must have a full range of story problems (2002). The combination of weak knowledge in mathematics, found in both groups: teachers and students and low proficiency of teachers’ signing contribute to producing challenges for teachers and students in both teaching and learning mathematics.

In conclusion, three main themes: communication, technology, and teacher’s characteristics were discussed in this literature. Teachers’ ability to communicate clearly in ASL is the critical contribution to students’ learning. Technology is another aspect that can be effective as well to be included in the instructional curriculum. Furthermore, it can enhance the communication between the teachers and students. In terms of teacher’s characteristics, the studies show that well trained knowledge in any given subject to be taught in school is essential. These three themes are the important parts in creating effective teaching and learning tools. Creating a program that uses ASL and video conferencing could be an asset for both the student and teachers.
Activities/Time Line

Winter Quarter
December - February
- Chose a title for the capstone project, complete proposal and send it in to advisors for feedback
- Created the website (www.rit.edu/~ccv6739/mathsigns/)

Spring Quarter
March – May
- Completed the words and their definitions and visual examples and upload it to the internet
- Filmed myself in the studio lab
- Clipped the film and upload it to the internet
- Had a team of graduate students and staff evaluate the website for improvement
- Redid some video clips by filming myself after receiving feedback from a team of evaluators and advisors
- Completed the project paper (lit reviews) and send it in to advisors
- Completed PowerPoints and presented to the board on May 23rd
- Completed this master’s capstone project on or before May 25th
Implementation

Before posting the video clips on the website, the project must be approved by my advisors first. After approved and posted on the web, and when completing the website, I asked my peers to evaluate my website (at least 2 weeks before the deadline of the project). I collected their feedback and made some necessary changes. I also summarized the feedback given to me about the website. See Appendix B for evaluation form.

The website is built on NoteTab Light program. The software Website Performer (original software to build the website) took too much space for my Grace Account (“DCE” given by RIT). The website was coded in html language. The signing was done by videotaping in the studio lab and then got transferred to iMovies on the Mac computer in the Educational Technology Resource Room (ETRR) lab. After the transfer was completed, the movies got compressed and transferred to another program called QuickTime. The size of the movie after compression went from 7GB to 14MB video clips. QuickTime allowed me to edit the movie and change it into mini-clips which they are displayed on the webpage.

The pictures (visual examples) were scanned from the book, Algebra I by Bellman, Bragg, Charles, Hall, Handlin, and Kennedy to the computer using (Photoshop) software. Then the pictures were clipped and sized to fit the website. Once completed (the visual examples) were all uploaded to the website using File Transfer Protocol (FTP). The first completion of the website was done on April 19th.
Welcome to my page and thanks for visiting! This is my 2007 MSSE Capstone Project.

Click on the words on the left and you will automatically see the word, it's definition, a visual example, and a link to view the video of the sign for that word. I hope you like it.

Enjoy.
Erin
B. Vocabulary Page

Algebraic Expression

Definition: "A mathematical phrase that can include numbers, variables, and operation symbols."

Example:

7 - x is an algebraic expression.

Video: Click here to view video

C. Video Page

[Image of Math Signs, RIT, 2007 MSSE Capstone Project]

**Algebraic Expression**

**Definition:** An algebraic expression is a mathematical phrase that can include numbers, variables, and operations.

**Example:**

7 - x is an algebraic expression.

**Video:** Click here to view video.

Discussion

Doing this project was very demanding and the process was time-consuming. The tasks that I performed were: 1) coding and designing the website, 2) coding in the words/definitions, 3) filming myself, 4) uploading the video, 5) clipping the video, 6) uploading to the webpage, 7) scanning the pictures and/or visual examples 8) uploading the pictures and/or visual example to the webpage, and 9) collecting feedback and making changes that are needed to the website. Despite the tremendous amount of work, it was certainly a very enjoyable task.

The most challenging part about the project was to write the literature review. Like the website, it too was very demanding and time-consuming. By writing the review of literature, I learned now emphasis these two important themes which are: clear communication and ability to teach students using their primary language especially when explaining abstract concepts. In addition, the use of technology provides teachers and students the means of enhancing communication and exchanging ideas during teaching and learning. Furthermore, adequate training in how to teach a specific subject like mathematics is another effective tool. With these tools, students can succeed well in classes and beyond.
References


Appendices

A. Vocabulary

Absolute value (p. 20) – the distance that a number is from zero on a number line
Algebraic expression (p. 4) – is a mathematical phrase that can include numbers, variables, and operation symbols
Coordinate plane (p. 24) – a plane formed by two number lines that intersect at right angles
Coordinates (p. 24) – the numbers that make an ordered pair and identify the location of the point
Dependent variable (p. 28) – a variable that provides the output values of a function (usually is the y-variable)
Domain (p. 29) – the possible values for the input, or the independent variable, of the function
Equation (p. 5) – a mathematical sentence that uses equal sign
Evaluate (p. 10) – (an algebraic expression by substituting a given number for each variable)
Exponent (p. 9) – a number that shows repeated multiplication
Function (p. 27) – a relation that assigns exactly one value in the range to each value of the domain
Inequality (p. 19) – is a mathematical sentence that compares the value of two expressions using an inequality symbol, such as < or >
Integers (p. 17) – Whole numbers and their opposites (2, -1, 0, 1, 2, 30)
Independent variable (p. 28) – a variable that provides the input values of a function (often is the x-value)

Irrational numbers (p. 18) – a number that cannot be written as a ratio of two integers (in the form of $a/b$ (fraction), where $a$ and $b$ are integers). Irrational numbers in decimal form are nonterminating and nonrepeating ($\sqrt{10}$, $\pi$, $.1010$)

Mean (p. 40) – to find the mean of a set of numbers, find the sum of the numbers and divide the sum by the number of items.

Measure of central tendency (p. 40) – mean, median, and mode. They are used to organize and summarize a set of data.

Median (p. 40) – the middle value in an ordered set of numbers

Midpoint (p. 25) – the point $M$ that divides a segment $AB$ into two equal segments $AM$ and $MB$

Mode (p. 40) – the date item that occurs the greatest number of times in a data set. A data set may have no mode, one mode, or more than one. (largest repeating number in a set)

Natural numbers (p. 17) – the counting numbers (1, 2, 3, …)

Negative correlation (p. 34) – the relationship between two sets of data, in which one set of data decreases as the other set of data increases

No correlation (p. 34) – there does not appear to be a relationship between two sets of data

Open sentence (p. 5) – an equation that contains on or more variables

Opposites (p. 20) – a number that is the same distance from zero on the number line as a given number, but lies in the opposite direction
Order of operations (p. 10) – 1) Perform any operation(s) inside grouping symbols, 2) Simplify powers, 3) Multiply and divide in order from left to right, 4) Add and subtract in order from left to right (Please Excuse My Dear Aunt Sally)

Ordered pair (p. 24) – two numbers that identify the location of a point

Origin (p. 24) – the point which the axes of coordinate plane intersect (where the axis (x and y) intersect)

Outlier (p. 40) – a data value that is much high or lower than the other data values in the set

Positive correlation (p. 34) – the relationship between two sets of data in which both sets of data increase together

Power (p. 9) – the base and the exponent of an expression of the form \(a^n\)

Probability (p. 93) – how likely it is that an event will occur (written formally as \(P\) (event))

Quadrants (p. 24) – the four parts into which the coordinate plane is divided by its axes (the four sections on the graph) (start from the top right as Quadrant I and move counterclockwise to Quadrant II, III, and IV).

Range (p. 42) – the difference between the greatest and the least data values for a set of data

Range (p. 29) – the possible values of the output, or dependent variable, of a function

Rational numbers (p. 17) – a real number that can be written as a ratio of two integers. Rational numbers in decimal form are terminating or repeating. It is any number that you can write in the form of \(a/b\) (fraction), where \(a\) and \(b\) are integers and \(b \neq 0\).

Real numbers (p. 18) – a number that is either rational or irrational
Scatter plot (p. 33) – a graph that relates data of two different sets. The two sets of data are displayed as ordered pairs.

Simplify (p. 9) – replace an expression with its simplest name or form (a numerical expression, you replace it with its simplest name).

Stem-and-leaf plot (p. 42) – a display of data made by using digits of the values.

Term (p. 81) – a number, variable, or the product or quotient of a number and one or more variables.

Variable (p. 4) – a symbol, usually a letter, that represents one or more numbers.

Whole numbers (p. 17) – the nonnegative integers (0, 1, 2, 3).

x-axis (p. 24) – the horizontal axis on the coordinate plane (graph).

x-coordinate (p. 24) – the location on the x-axis of a point in the coordinate plane.

y-axis (p. 24) – the vertical axis on the coordinate plane (graph).

y-coordinate (p. 24) – the location on the y-axis of a point in the coordinate plane.
B. Evaluation

Evaluation for the website: Math Signs
Please circle the number you feel appropriate. Thank you for your time and feedback.

1) The design of the website was:

<table>
<thead>
<tr>
<th></th>
<th>1: Confusing, I was completely lost</th>
<th>2: Was okay Not very user friendly</th>
<th>3: Satisfying Some changes needed</th>
<th>4: Pretty good Little changes needed</th>
<th>5: Clear Very user friendly</th>
</tr>
</thead>
</table>

2) The vocabulary words (terminology) were:

<table>
<thead>
<tr>
<th></th>
<th>1: There were vocabulary words?</th>
<th>2: Hidden, took me a while to find them</th>
<th>3: Took me several clicks</th>
<th>4: Took one click but I found them</th>
<th>5: Easy to find</th>
</tr>
</thead>
</table>

3) The definitions were:

<table>
<thead>
<tr>
<th></th>
<th>1: Too technical I didn’t understand anything</th>
<th>2: I understood a few words</th>
<th>3: I understood half of the words</th>
<th>4: I understood most of the words</th>
<th>5: Very clear I understood every meaning</th>
</tr>
</thead>
</table>

4) The illustrations and examples were:

<table>
<thead>
<tr>
<th></th>
<th>1: What was that drawing?</th>
<th>2: Took me a while to understand the picture</th>
<th>3: Could have been drawn better</th>
<th>4: Most of the pictures were clear</th>
<th>5: Very clear</th>
</tr>
</thead>
</table>

5) The speed of opening a video clip was:

<table>
<thead>
<tr>
<th></th>
<th>1: Too slow Wasn’t sure if it was working</th>
<th>2: I had to wait a while</th>
<th>3: Could be faster</th>
<th>4: Took a few seconds</th>
<th>5: Popped right up</th>
</tr>
</thead>
</table>

6) The signer was:

<table>
<thead>
<tr>
<th></th>
<th>1: Confusing ASL is definitely not my language</th>
<th>2: I was able to do a few signs</th>
<th>3: I could do half the signs</th>
<th>4: I was able to do most of the signs</th>
<th>5: Very easy to follow</th>
</tr>
</thead>
</table>

29
7) The pace or the speed of the sign was:

1 Too fast
2 Too slow
3 Was okay
4 Mostly good
5 Exactly the right speed

8) Overall the website was:

1 Not helpful at all
2 Somewhat helpful
3 Pretty helpful
4 Mostly helpful
5 Very helpful I plan to use it

9) Overall the website:

1 Didn't meet my expectations
2 Somewhat met my expectations
3 Was what I expected
4 Exceeded my expectations
5 Was very good

10) Concerns or comments on the website:
C. Results of the Evaluation

Evaluation for the website: Math Signs
Please circle the number you feel appropriate. Thank you for your time and feedback.

1) The design of the website was:

<table>
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<tr>
<th></th>
<th>1 [0]</th>
<th>2 [0]</th>
<th>3 [1]</th>
<th>4 [3]</th>
<th>5 [0]</th>
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<tbody>
<tr>
<td></td>
<td>Confusing</td>
<td>Was okay</td>
<td>Satisfying</td>
<td>Pretty good</td>
<td>Clear</td>
</tr>
<tr>
<td></td>
<td>I was completely lost</td>
<td>Not very user friendly</td>
<td>Some changes needed</td>
<td>Little changes needed</td>
<td>Very user friendly</td>
</tr>
</tbody>
</table>

2) The vocabulary words (terminology) were:

<table>
<thead>
<tr>
<th></th>
<th>1 [0]</th>
<th>2 [0]</th>
<th>3 [0]</th>
<th>4 [0]</th>
<th>5 [4]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>There were</td>
<td>Hidden, took me a while</td>
<td>Took me several clicks</td>
<td>Took one click but I found them</td>
<td>Easy to find</td>
</tr>
<tr>
<td></td>
<td>vocabulary words?</td>
<td>to find them</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3) The definitions were:

<table>
<thead>
<tr>
<th></th>
<th>1 [0]</th>
<th>2 [0]</th>
<th>3 [0]</th>
<th>4 [2]</th>
<th>5 [2]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Too technical</td>
<td>I understood</td>
<td>I understood</td>
<td>I understood</td>
<td>Very clear</td>
</tr>
<tr>
<td></td>
<td>I didn't understand</td>
<td>a few words</td>
<td>half of the words</td>
<td>most of the words</td>
<td>I understood</td>
</tr>
<tr>
<td></td>
<td>anything</td>
<td></td>
<td></td>
<td></td>
<td>every meaning</td>
</tr>
</tbody>
</table>

4) The illustrations and examples were:

<table>
<thead>
<tr>
<th></th>
<th>1 [0]</th>
<th>2 [0]</th>
<th>3 [0]</th>
<th>4 [4]</th>
<th>5 [0]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>What was</td>
<td>Took me a while</td>
<td>Could have been</td>
<td>Most of the pictures</td>
<td>Very clear</td>
</tr>
<tr>
<td></td>
<td>that drawing?</td>
<td>to understand the picture</td>
<td>drawn better</td>
<td>were clear</td>
<td></td>
</tr>
</tbody>
</table>

5) The speed of opening a video clip was:

<table>
<thead>
<tr>
<th></th>
<th>1 [0]</th>
<th>2 [0]</th>
<th>3 [0]</th>
<th>4 [1]</th>
<th>5 [3]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Too slow</td>
<td>I had to wait a while</td>
<td>Could be faster</td>
<td>Took a few seconds</td>
<td>Popped right up</td>
</tr>
<tr>
<td></td>
<td>Wasn't sure if it was working</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6) The signer was:

<table>
<thead>
<tr>
<th></th>
<th>1 [0]</th>
<th>2 [0]</th>
<th>3 [0]</th>
<th>4 [1]</th>
<th>5 [3]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Confusing</td>
<td>I was able to</td>
<td>I could do</td>
<td>I was able to do</td>
<td>Very easy</td>
</tr>
<tr>
<td></td>
<td>ASL is definitely not my language</td>
<td>do a few signs</td>
<td>half the signs</td>
<td>most of the signs</td>
<td>to follow</td>
</tr>
</tbody>
</table>

7) The pace or the speed of the sign was:

<table>
<thead>
<tr>
<th></th>
<th>1 [0]</th>
<th>2 [0]</th>
<th>3 [0]</th>
<th>4 [1]</th>
<th>5 [3]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Too fast</td>
<td>Too slow</td>
<td>Was okay</td>
<td>Mostly good</td>
<td>Exactly the right speed</td>
</tr>
</tbody>
</table>
8) Overall the website was:

<table>
<thead>
<tr>
<th></th>
<th>1 [0]</th>
<th>2 [0]</th>
<th>3 [0]</th>
<th>4 [1]</th>
<th>5 [3]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not helpful at all</td>
<td>Somewhat helpful</td>
<td>Pretty helpful</td>
<td>Mostly helpful</td>
<td>Very helpful</td>
</tr>
<tr>
<td></td>
<td>I plan to use it</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9) Overall the website:

<table>
<thead>
<tr>
<th></th>
<th>1 [0]</th>
<th>2 [0]</th>
<th>3 [2]</th>
<th>4 [0]</th>
<th>5 [2]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Didn't meet my expectations</td>
<td>Somewhat met my expectations</td>
<td>Was what I expected</td>
<td>Exceeded my expectations</td>
<td>Was very good</td>
</tr>
</tbody>
</table>

10) Concerns or comments on the website:

* [#] – number of people that selected this point value as their response