

Master's Project Evaluation Report for ASLingo

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Introduction

American Sign Language (ASL) is growing across the nation and internationally. Although ASL is becoming more popular, it is still not recognized as a foreign language in some states in the U.S. Approximately only 20 states agree to recognize ASL as a foreign language (Penilla & Tayler, n.d.). Due to this, the deaf and ASL community is considered a minority group and are often neglected compared to the common hearing people (Penilla & Tayler, n.d.). The plan was to develop a solution that helps spread awareness on the importance of ASL, provides a place for adults to learn, and create a community for the deaf and ASL users to feel more welcomed and accepted.

After identifying a solution, the collaborative design process of the mobile app, ASLingo began during a course I took called Mobile Learning. Within the early stages of designing ASLingo, my group partners and I explored existing ASL apps and evaluated their features based on our ideas. We identified problems with a few mobile apps such as not having a variety of useful features, a lack of learning content that grows with the user, and a cost of money to either download the app or have access to all the features (Clason, 2019). Additionally, each mobile app had a single focus on a main feature (i.e. dictionary, translator, etc.), but not multiple features in one place. After discussing possible solutions, we decided that it was best to design a mobile app that has multiple features conveniently in one place, one that introduces and teaches adults ASL, and creates a safe space for the ASL community to socialize with others.

The main purpose of ASLingo is to help adults learn about ASL, teach the language, and create a space for the ASL community to socialize, feel welcomed, and accepted. The app features a dictionary of terms for the learner to study, an interactive learning function with full lessons that includes audio and video, and a social function that allows users to connect with

each other. Technically, the learning function of ASLingo is supposed to be utilized in tandem to an ASL course or workshop as an additional resource. However, my group and I decided to apply multiple features in one place. Therefore, we wanted to solve the neglect problem by adding a social feature so that users can connect with each other through local ASL events, instant messaging, and a live social feed to share content.

ADDIE Instructional Design Model

I utilized the ADDIE model for the design and development of both ASLingo and the evaluation process. ADDIE stands for analysis, design, development, implementation, and evaluation (Peterson, 2003). It is known as “a common approach widely used in the development of instructional courses and training programs” (Peterson, 2003, p. 227). Here are how the steps of the ADDIE model was implemented from the design process of ASLingo to the recent evaluation process for the master’s project.

Analysis

During the analysis phase, the most important thing to consider is the target audience (Peterson, 2003). The target audience for ASLingo is adult learners. Specifically, it is for adult learners that are currently or would like to study ASL and individuals within the ASL community (i.e. Deaf, ASL speakers, related interest, etc.). During the design process, the main objective was to design a contemporary style app that included the following features

1. An interactive learning experience that includes a dictionary, full lessons, and assessments so adult learners can study ASL.

2. A social function that allows users to connect with each other by finding local ASL events, instant messaging, and a social feed for users to share content with other users.

I wanted the design of ASLingo to also have simple usability function, an attractive visual design on each page, and a layout that is comprehensible for the user.

The timeline for the design and development process for ASLingo was relatively short due to the small number of remaining weeks in the semester. My group and I had to come up with a strategy to complete our objectives in time for the final presentation. We decided to split the workload of adding the features and the usability functions to the app. Once completed, we amalgamated our parts and ensured that the app included the learning content, social feature, and consistent usability functions.

Design

The design phase is the second step and consists of researching and planning (Peterson, 2003). In the Mobile Learning course, a fully developed app by the end of the semester was not expected. Instead, one purpose of the course was to help the learner gain a better understanding on the early stages of designing and developing a mobile learning app. The design process of ASLingo began with drawing a wireframe on sheets of paper. My group and I re-designed the wireframe in Balsamiq, an online mockup tool used to create applications (Aravindan, 2016).

I had the idea of simplicity in mind during the process of designing the introduction page, login, registration, and main menu. Using the basic principles of design, I took the ideas from our illustrated wireframe and designed simplified and attractive pages. The main menu is considered the center hub of the mobile app that allows the user to access the main features such as the

dictionary, lessons, and community. The dictionary was designed for users to learn the sign language for a specific word. If the learner needs to find a word, they can use the search function to see if the word is listed. The lessons were designed to be an interactive learning experience that includes audio and videos of subject matter experts. The app has interactive learning activities and assessments so that the user can feel engaged and effectively learn ASL. The community feature allows users to connect with each through a social feed, instant messaging, and a local event finder. Additionally, each user has a customizable profile that allows them to introduce themselves and share accomplishments with others.

Development

The development process is the third phase when designers begin constructing a product based on the design (Peterson, 2003). The development of ASLingo was a simple process. After receiving feedback on the wireframe created in Balsamiq, I decided to utilize InVision to create an app prototype. InVision allowed me to add more realistic usability functions like a fully developed app. It included animations and transitions when the user interacts with the pages such as swiping the screen, scrolling, and pressing buttons. This was the final and most recent development of ASLingo that was evaluated and will be revised during the master's project.

Implementation

During the implementation phase, the designer is active by presenting their product to the target audience (Peterson, 2003). Since the mobile app is only a prototype, the implementation of ASLingo is currently limited. I presented the mobile app to approximately nine of my peers and the instructor during the final presentation of the Mobile Learning course. My peers had the opportunity to test out the app's usability functions and express their thoughts and opinions on

the app's design and content. Fortunately, the presentation went smoothly and there were no significant errors that occurred during the testing phase. The feedback that I received overall was mostly positive with only a few minor questions and suggestions for improvement.

Evaluation

The evaluation phase is the final and most important phase of the ADDIE model and can be both formative and summative (Peterson, 2003). The evaluation process of the app and the master's project were both summative. Based on the timeline and structure of the Mobile Learning course, the evaluation took place after the completion of the wireframe and prototype instead of each step during the design process. The evaluation did not provide result in quantitative data. Instead, my peers tested out the usability component of my artifact and provided verbal feedback.

I analyzed my current ASL knowledge to determine the most suitable approach for my master's project. I am not an expert in ASL and, therefore, could not accurately evaluate the instructional component of my mobile app. Therefore, I decided to only evaluate the usability and design component. I started by designing a detailed outline of my evaluation plan that explained the methodologies for collecting qualitative and quantitative data. Participants within my target audience evaluated my artifact using the think-aloud strategy and the System Usability Scale (SUS). I evaluated the received feedback which helped determine the revisions needed for my artifact. Lastly, I decided to keep the evaluation process simple for both myself and the participants to prevent cognitive overload, which will be explained in further detail in my chosen learning theory.

Cognitive Load Theory

The ASLingo mobile app presents simplicity when it comes to usability and design. I had several ideas for features to incorporate into the app. However, my intention was not to cram significant loads of information and features that could potentially become confusing. The app would grow to be too complex and overload both new and experienced users. Therefore, I focused on creating a satisfying design and usability experience while making the app rich in valuable learning and social content.

In correspondence to ASLingo's design, the usability evaluation for the app was also created as a simple process that provides both qualitative and quantitative data for my analysis. For both the design and evaluation process, the Cognitive Load theoretical framework was utilized. The Cognitive Load Theory is defined as, "the learning of complex cognitive tasks, where learners are often overwhelmed by the number of information elements and their interactions that need to be processed simultaneously before meaningful learning can commence" (Sweller et al. 2004, p. 1). The mobile app and usability evaluation were purposely designed to reduce the amount of cognitive overload on the user. Here are my methodologies of applying the Cognitive Load Theory to the artifact design and evaluation process.

Intrinsic Cognitive Load

Intrinsic cognitive load is present when the learner is overloaded by, "the number of information elements and their interactivity" (Sweller et al. 2004, p. 2). The primary focus was to ensure that completing a task within the app was achievable while performing other actions, and to create a user-friendly navigation system for both new and experienced users. Intrinsic cognitive load within the mobile app was diminished by reducing the amount of interaction with buttons, using common visual elements as icons for features, and removing any unnecessary pages so that users can easily reach each page. That way, the user can focus on using the mobile

app and not feel overwhelmed by the other actions they perform simultaneously (Harrison et al. 2013).

The PACMAD model used to shape the design of the usability evaluation applies to cognitive load because it could impact the usability of the mobile app (Harrison et al. 2013). The evaluation focused on seven areas: Effectiveness, efficiency, satisfaction, learnability, memorability, errors, and cognitive load (Harrison et al. 2013). I believe that the amount of intrinsic cognitive load the user encounters contributes to the user's view on the seven areas of PACMAD. Therefore, I applied PACMAD to the usability evaluation by modifying the System Usability Scale (SUS), a likert scale developed by John Brooke (Brooke, 1996) I wanted to see how participants would rate each of the ten questions based on the seven areas. Depending on the results received, it would determine whether the content and interaction within in the mobile app was complex and that the intrinsic cognitive load was too high within the mobile app.

Lastly, I had to consider intrinsic cognitive overload in the overall design of the usability evaluation process. Originally, I developed a more rigorous process for participants to complete the evaluation. The process required participants to create a Think-Aloud video, a questionnaire on a Microsoft Word document, and several other tasks that could cause an overload of new information. After re-evaluating my target audience, user capabilities, and technologies available for me to use, I revised the process so that the participants were not overloaded with processing complicated instructions.

Extraneous Cognitive Load

Extraneous cognitive load is present when information and activities are unnecessary and do not “contribute to the processes of schema construction and automation” (Sweller et al. 2004,

p. 2). My immediate thought was to design a modern-style app with a minimized amount of unnecessary visual elements. I wanted each page to remain simple with a small number of graphic and buttons present on each page. While studying other existing apps, I noticed that text, graphics, and animations were kept to a minimum on each page. I decided to apply the idea to my design and reduce the amounts of extraneous cognitive load. By following the basic principles of design, I applied content that was straight to the point, eliminated any unnecessary pages, and ensured the usability functions were straightforward. This helped prevent the overload of a user's mental space by diminishing anything not relevant app's design and content.

Evaluation Data Results and Analysis

I suggested applying more than one methodology to obtain valuable data such as the think-aloud strategy and the SUS Usability Scale. Each methodology provided different forms of data, the think-aloud videos being qualitative, data that can be observed and recorded (Surendar, n.d) while the questionnaire was quantitative, data that is measured in numerical values (Pickell, 2019). For my analysis, I recorded important visual and audible notices from the think aloud videos and calculated the SUS Usability Scale questionnaire scores using the SUS method. Here is what I found based on the finalized results.

Think Aloud Videos

Out of the five individuals that participated in the usability evaluation, I received a total of two completed think aloud videos The think-aloud strategy is defined as asking, “test participants to use the system while continuously thinking out loud — that is, simply verbalizing their thoughts as they move through the user interface” (Nielsen, 2012). This method was used to evaluate the participants comprehension of the tasks while also considering their tone of voice

and facial expressions while testing the mobile app. For example, if a user expressed confusion in their tone of voice or facial expression while on a certain page, it is clear to me that the page makes the task confusing due to an issue with the page.

The first participant was categorized as a new user since they did not know anything about ASL. They were not aware of the six tasks I provided for them to complete while evaluating the mobile app. The constant revision of my communication methods could potentially be the cause of the participant not being aware of the list of tasks. However, the participant provided detailed feedback while narrating their actions within the app. On the registration page, they expressed confusion due to not knowing about the scrolling function which causes an issue with the app's effectiveness and efficiency. The participant expressed confusion a second time while viewing the social media page. In the video, they explained that their expectations were different than the outcome of the page. The term "social media" gave them the idea of connecting to existing social media platforms such as Facebook, Twitter, Instagram, and others.

While the participant did point out a few minor issues, they also mentioned several areas of excellence within the mobile app that outweighs the suggested improvements. For example, the tone in their voice reached a higher pitch of amazement when they reached the profile page, providing positive comments of the features. This contributes to the overall user satisfaction of the usability component. The user also expressed the same amount of excitement while going through the dictionary and the learning function. Even though the instructional design component is not my primary focus now, I noted the enthusiasm for possible future developments of the mobile app.

Based on my own observation, the participant knew the locations of buttons and quickly navigated around the app. As stated previously, the participant mentioned that they have no experience in ASL but holds an interest that has grown because of the application. I did not receive feedback on the app's memorability, learnability, and cognitive load since the user did not perform the tasks. Overall, they showed mostly positive reactions to the app's functions and features.

The second participant was categorized as an experienced user with a bit of prior knowledge in ASL. The participant was aware of the six tasks given in the instructions and completed the evaluation by performing each task. The participant did not provide much feedback during the process until the completion of the final task, providing positive feedback on the user experience. They did not have any issues with the app's navigation, did not show any sign of cognitive overload or confusion from error and was able to easily navigate through the app efficiently. The observation of the participant showed strength in areas in the usability such as effectiveness since they completed all tasks, efficiency since it was a quick process, cognitive load, errors since the user did not find any, and user satisfaction. I did not receive clear data on the participant's opinion of the learnability and memorability, but my hypothesis is that the participant quickly learned the app's usability and memorizing it during the following use is possible.

SUS Usability Scale Questionnaire

A total of five participants completed the SUS questionnaire by answering the default total of 10 questions based on the app's usability. The questions were modified to reflect the PACMAD usability model (Saleh et al., 2015).

The finalized score of the SUS questionnaire is not calculated as the normal sum. In order to calculate the final score, the following steps are required:

1. “For each of the odd numbered questions, subtract 1 from the score.
2. For each of the even numbered questions, subtract their value from 5.
3. Take these new values which you have found and add up the total score. Then multiply this by 2.5” (Thomas, n.d).

I analyzed the receive data by calculating the given score by each participant. Based on that information, here is what I found.

SUS Usability Scale Questionnaire Results (Participants)					
SUS Raw Score	34	40	17	21	30
Final Score Out of 100	85	100	42.5	52.5	75
Average Final Score	71				

Table 1.1 - Calculated results based on participants

The first table was calculated based on the scores of the participants (See Appendix A for the full table). The displayed numerical data seems more straightforward than the think-aloud video data. According to Thomas (n.d), finalized scores should be measured using the following way:

1. 80.3 or higher is a grade A.
2. 68 is a C grade and states the mobile app is average and has a few issues.
3. A score of 51 or under is considered an F. The mobile app has major issues that needs immediate attention.

Most of the numbers turned out to be more on the greater side after doing the SUS calculations with an average of 71. However, one participant's score was a significantly low 42.5 according to the measured passing scores. Reviewing all the given scores, my hypothesis is that the participant had difficulty understanding the navigation of the app and identified a significant error in the app's usability. The low score is considered a failing score and indicates that there needs to be a major change to the app's usability.

Next below the passing score is 52.5. Reviewing the data for each question, the participant provided a score of 3 for user satisfaction and error. My theory is that a significant error decreased their overall satisfaction with the mobile app. Based on the open-ended feedback received, my belief is that the issue has to do with the learn function. One piece of feedback states that all the answers provide feedback as incorrect to the user. This can be considered a major error since the app does not have all the button features included.

Analyzing the overall scores for each question, five questions caught my attention with low scores, the lowest being a statement about the app having little to no errors. Overall, majors within the app were identified by almost all participants. Reflecting to the early stages of designing ASLingo, all the functions were not added in the prototype to keep things simple for demonstration. The remaining four questions has to do with the app's effectiveness, efficiency, and overall user satisfaction. The low scores indicate that the mobile app's revision needs to focus on these lacking areas to create a better user experience.

Artifact Recommendations

Both the qualitative and quantitative data provided enough feedback. In addition to the numerical data received from the questionnaire, I also gave participants the opportunity to provide additional feedback on the app as an open-ended question. These comments provided

more detailed information on the app's areas of excellence and what needs to be improved.

Overall, I was able to recommend a few changes to the mobile app's usability and design:

1. One piece of feedback I received from a participant's think aloud video is changing the term "social media" on the button that navigates the user to a social feature because it can be easily misinterpreted by users. The misunderstanding of the term could contribute to the amount of cognitive load that is present because it confuses the learner based on their expectations. My plan is to change the term "social media" to something more specific that better reflects the actual function.
2. Another suggestion I received from a think aloud video is to shorten the sign-up page to eliminate the scrolling function and make the page more simplified. One of the usability evaluation tasks asked the user to create an account. While viewing a participant's think aloud video, I noticed that it was difficult for them to locate the submission button that navigates them to the next page. This could potentially be the cause of the low score within the error category on the SUS questionnaire.
3. There are visual representations that are commonly known around the globe, specifically icons. In one of the think aloud videos, a participant was confused by some of the icon choices in the mobile app and what they mean. I would like to change some of the button icons to make their function more comprehensible (ex. The chat button being a chat bubble icon).
4. From a design perspective, I would like to improve the overall design of the pages to make them look more like a finished product. Therefore, my hope is to re-design the prototype with improved visual elements throughout each page.

5. Based on the quantitative feedback received, the category with the lowest score was the error portion. I predict that the lack of interaction features on the buttons exhibits error to mostly new users. For the revised version of my artifact, I would like to incorporate interactive functions to all buttons and reduce the amount of present errors.

As I mentioned before, these recommendations are derived from the feedback received throughout the think-aloud videos, the finalized scores on the questionnaire, and the additional feedback received in the open-ended question at the end of the questionnaire. The remaining timeline will determine how I will start making these revisions to my artifact.

Overall Reflection on Experience

The usability evaluation process for ASLingo was both exciting and terrifying. Since I have no prior experience in education, the evaluation process was new to me. Due to the unpredicted pandemic and the master's project taking place during the summer semester, receiving responses was more difficult than I expected. My first main takeaway from this experience is that planning and organization with time and strategy is essential to successfully design, develop, and evaluate. There are many things I wish I could have done to improve the evaluation experience. In the end, some things were in my control, while other issues were not.

My second main takeaway is that I need to incorporate a needs assessment before both the design phase and the evaluation phase to identify what type of mobile app users would like to see. This will help me create an even better application and evaluation plan for others to test a product that is closer to being finished. I believe that conducting a needs assessment will eliminate the frustration I had, especially during the evaluation planning phase.

Overall, the feedback I received about my mobile app was mostly positive, which encourages me to continue developing the app further to a finished product. In order to do so, I first need to improve in designing and strategizing.

Appendix A – SUS Usability Scale Questionnaire Results

What is your gender?

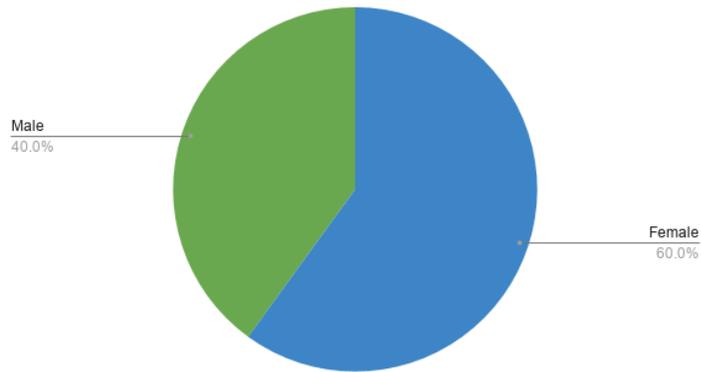


Figure 1 shows the results of participant responses to the demographic question “What is your gender?”

What is your age?

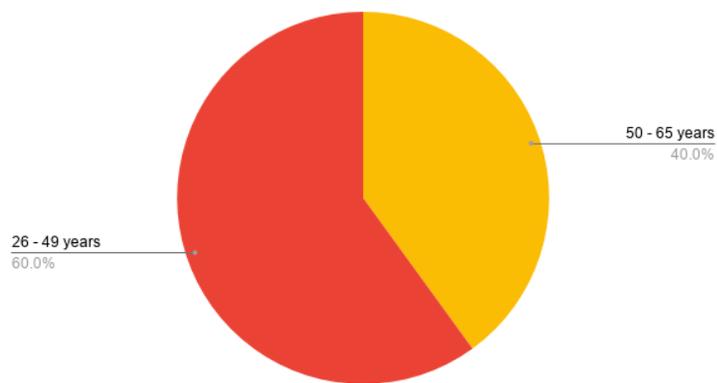


Figure 2 shows the result of participant responses to the demographic question “What is your age?”

Are you currently deaf or have severe hearing loss conditions?
5 responses

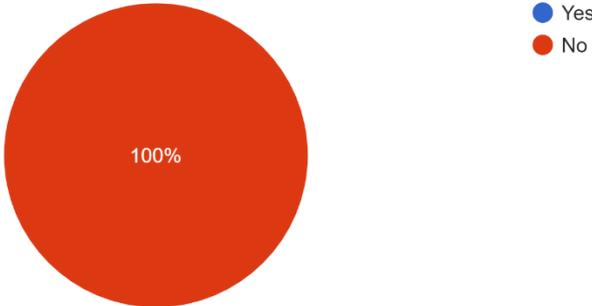


Figure 3 shows the result of participant responses to the demographic question “Are you currently deaf or have severe hearing loss conditions?”

SUS Usability Scale Questionnaire Results (Participant Score)					
Questions	P1	P2	P3	P4	P5
I was able to complete all the tasks successfully in the mobile application.	5	5	4	4	4
I thought the mobile application was easy to use.	5	5	4	4	4
I was able to complete each task quickly without problems.	5	5	4	4	4
I think that I would like to use this mobile application frequently.	5	5	4	3	5
I feel like I have learned how to use the mobile application effectively by completing the tasks.	5	5	4	5	5
I am confident that I will remember how to use this mobile application if used in the future.	5	5	4	5	5
During the evaluation, little to no errors while completing all the tasks.	4	5	3	3	2
The application navigation was easy to understand and memorize.	5	5	4	4	5

The page layout of the application was simple to understand.	4	5	5	5	5
The information on each page was easy to process and was not mentally overwhelming.	5	5	5	4	5
SUS Raw Score	34	40	17	21	30
Final Score Out of 100	85	100	42.5	52.5	75
Average Final Score	71				

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