

SignApp: An Assistive Tool for Learners with Hearing Impairment

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ABSTRACT

This research developed a mobile learning tool for hearing-impaired learners named SignApp, which introduced innovation in teaching and learning. Specifically, this study 1) gathered relevant information in terms of the curriculum of the learners with hearing impairment, teaching methods and approaches, and teaching and learning materials; 2) designed and developed the SignApp application based on the curriculum; and 3) conducted users' acceptability testing. Results show that SignApp served as a supplementary teaching tool for SPED teachers to help them easily explain and discuss their lessons. The application covered sign language lessons in Basic English and Mathematics. Aside from the learners in the SPED Center, out-of-school-youths with hearing impairment can also utilize the application to further help them learn to overcome and adapt to their daily obstacles. Furthermore, because of its mobility, learning can be anytime and anywhere.

Introduction

Special Education (SPED) refers to the education of persons who are gifted or talented, and those who have physical, mental, social, or sensory impairment and cultural differences so as to require modification of the curricula, programs and special services, and physical facilities to develop them to their maximum capacity (Genove, 2013). These persons include those with cognitive deficits, visual impairment, hearing impairment, with behavior problems, orthopedically handicapped, with special health problems, learning disabled, speech impaired or multiple handicapped.

Hence, SPED is a field where mobile technologies can be used powerfully to cater the needs of learners. Mobile learning, realized with mobile technologies, is an emerging technology that has transformed learning from being confined within the four walls of the school to a borderless landscape.

According to the research conducted by Microsoft Educator Network (n.d), learners with special needs are also benefited from this mobile revolution. Assistive technology is built into computers, tablets, and other mobile devices, which can help teachers accommodate all students in one setting that include students with different learning styles, learning speeds, and learning capabilities.

Cuhadar, et al. (2009) stated that in addition to providing a flexible education, the use of technology in educational settings will give hearing impaired learners freedom, and increase the level of interaction between themselves and their motivation, thus the self-confidence of hearing impaired individuals will improve. Apparently, achieving effective communication skills through speaking or using signs is not sufficient for hearing impaired children. In order for the hearing impaired children to completely develop their academic and intellectual skills, it is also necessary to develop reading and writing dimensions of oral communication effectively. Thus, there is a need for new approaches and methods which will be effective on hearing impaired children' cognitive, social, emotional and academic success levels which develop differently from their peers. Accordingly, mobile learning environments which allows for teaching and learning opportunities free from time and place is a very effective choice for education of hearing impaired children.

Purposes of the Research

Thus, this research was conducted primarily to develop a mobile learning tool for hearing-impaired learners that introduce innovation in teaching and learning.

Specifically, the following research questions were considered:

1. What are the teaching methods and approaches, and teaching and learning materials used for hearing-impaired learners?
2. What is the appropriate design of the mobile application suited for the learners with hearing impairment?
3. Is the developed mobile application acceptable to target users?

Hence, this study aimed to 1) gather relevant information in terms of the curriculum of the learners with hearing impairment, teaching methods and approaches, and teaching and learning materials; 2) design and develop the SignApp application based from the curriculum; and 3) conduct users' acceptability testing.

Methodology

Research Design

This research employs the design and development research framework.

Figure 1 illustrates this framework: input-process-output model. The input of the study include 1) curriculum guide for learners with hearing impairment; 2) teaching methods and approaches; and 3) teaching and learning materials. Considering the inputs, the SignApp application was designed and developed. Also, users' acceptance testing in terms of its functionality, usability, and performance was conducted.

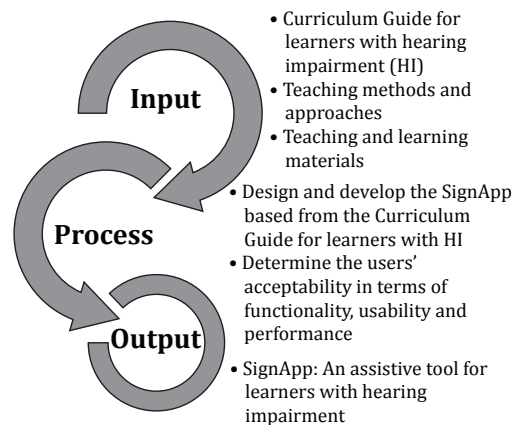


Figure 1. Research Paradigm.

Participants

All the respondents in this research are three SPED teachers and seven hearing impaired learners from the pilot school. Prior to the conduct of this study, the

researchers asked consent from the parents of the learners with hearing impairment for the conduct of the study.

Research Instruments

To gather relevant information about the curriculum of the learners with hearing impairment, teaching methods and approaches, and teaching and learning materials, and unstructured interview were used. The researchers obtained the said information from DepEd personnel and teachers from the pilot school. The researchers together with the SPED teachers reviewed the existing curriculum guide for hearing-impaired learners to identify the lessons and the format of the lessons used in the application.

Furthermore, the researchers adopted the VTT's Mobile-D agile software development methodology (*Agile Software Technologies Research Programme*, n.d.) for the design and development of the SignApp. The workflow is distributed into six phases. These are explore, initialize productionize, stabilize, system fix, and evolve shown in the Figure 2.

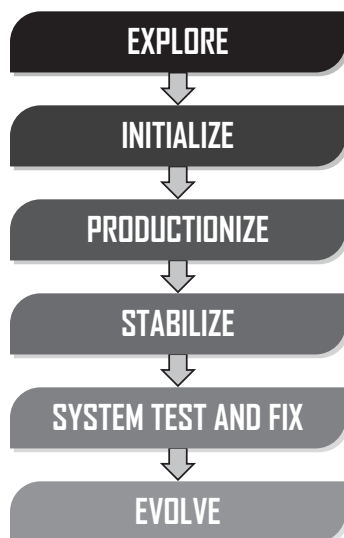


Figure 2. Mobile-D agile software development methodology.

To determine the users' acceptability in terms of functionality, usability, and performance, Users' Acceptance Testing (UAT) was conducted using the FURPS (Functionality, Usability, Reliability, Performance and Supportability) model for classifying software quality. Three SPED teachers and seven learners with hearing impairment served as respondents. The learners were assisted by their teachers during the conduct of UAT. The respondents were given time to use the application and were asked to evaluate the application using the UAT rubric. The scale to measure the users' acceptability in Table 1 was used to interpret the data.

Table 1.

Scale to measure the users' acceptability

Weighted Mean Range	Interpretation
4.20 - 5.00	Strongly Agree
3.40 - 4.19	Agree
2.60 - 3.39	Moderately Agree
1.80 - 2.59	Disagree
1.00 - 1.79	Strongly Disagree

Three SPED teachers served as experts in evaluating the application in terms of the correctness of the contents.

Results and Discussion

Based on the interviews conducted, there is a special curriculum guide for learners with hearing impairment that is based on the new K to 12 program of Department of Education (DepEd). The curriculum guide consist of the curriculum and instructional approaches designed for hearing-impaired students in the academic areas of Math, English, Science, Filipino and Araling Panlipunan. Hearing-impaired learners will learn the oral language through expressive language, phonological awareness, book and print knowledge, alphabet knowledge, word recognition, structural analysis,

fluency, spelling, hand writing through eye-hand coordination, grammar, vocabulary, listening comprehension skills, reading comprehension skills, oral-manual reading skills and attitude towards language, literature and literacy. The development of language, reading, and writing are integrated in each of the content areas. Students will learn basic sign languages and it will integrate faster way of learning with this curriculum guide for hearing-impaired learners.

Also, the SPED teachers identified oral language, alphabet knowledge, spelling, and number and number sense as component of the SignApp.

The context flow diagram of the teaching and learning setup is shown in Figure 3. It presents the current method or how the teaching and learning process flows. It explains how teachers introduce and deliver the content of the lesson and how the hearing-impaired learners interpret it, interact with it, and perform activities as well. The diagram illustrates the usage of flashcards, books, charts and papers that serves as teaching tools. The teacher checks activities manually to know the improvement of each learner.

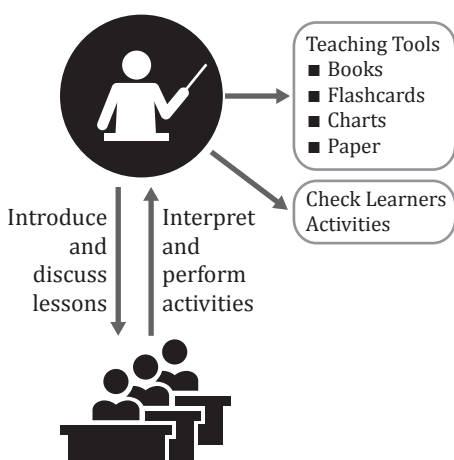


Figure 3. Context Flow Diagram.

The following are difficulties encountered by hearing-impaired learners and their teachers in the current process of teaching and learning. Teachers of hearing-impaired learners take more time in teaching and have struggle in encouraging the learners; teachers of hearing-impaired learners also have difficulty in communicating and interacting with them in performing their activities in class; hearing-impaired learners have difficulty in learning sign language; schools are not inclined in using mobile applications used in teaching which lessen the interest of hearing-impaired learners; education for learners with hearing impairment is only confined to the four walls of the classroom using hand, board and chalk teaching approach.

The Development architectural design of the application is shown in Figure 4, which shows the technologies and tools used in the development of the system. The system was created in a Windows 8 platform. Eclipse (Luna), Adobe Photoshop (CC 2014) and Android SDK (Software Development Kit). These were the tools used in building the system.

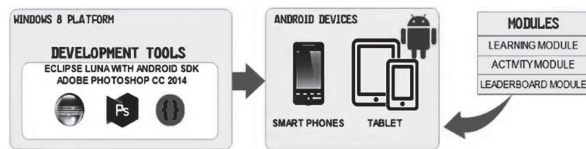


Figure 4. Development Architectural Design of the Application.

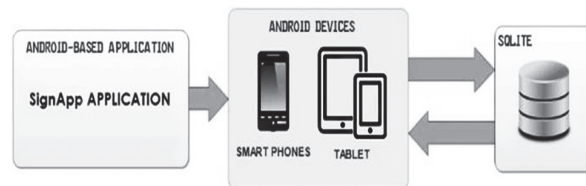


Figure 5. Deployment Architecture.

The system was implemented in an android device running on platform version 4.0 (Ice Cream Sandwich) or higher.

Figure 5 illustrates the deployment architectural design of the application. SQLite was used as the database. The SignApp application runs in android-based devices with version 4.0 or higher.

The main processes included in the application are the management of learning, activities, and leader board. Figure 6 presents the main menu of the application with buttons: begin, leader board and exit.

The application includes three main modules:

Learning Module: This module allows the user to read, view, and understand the lessons. The system provides images and demo of sign languages that contain the lesson. The user can choose lessons from different topics.



Figure 6. Main Menu of SignApp.

The following topics with corresponding performance standards were considered for this module:

- Oral Language — the learner shares personal ideas, thoughts, actions and feelings using common and appropriate words;
- Alphabet Knowledge — the learner distinguishes similarities and differences of English alphabet;

- Spelling — the learner spells simple words from literary and ICT-based materials and from other subject areas such as Math and Science. Also, spells three-letter and two-syllable words.
- Numbers and Number Sense — the learner explores the concepts of numbers and compares these in various contexts.



Figure 7. Learning Module.

Activity Module: This module allows the user to answer all questions that will pop out. After reading and understanding the lesson, the user can take the exercises by tapping the Quiz button and before taking exercises, the user can choose on what topic he/she wants. The system provides a question and answer game. Button choices are arranged randomly so that the user cannot memorize the sequence of the answer.



Figure 8. Activity Module.

Leader board Module: This module enables the user to view the rewards/scores. After answering the quiz, the system shows

the correct and wrong answers. The answers are saved and checked against the database before showing to the user. An input box for the name of the users is prompted before taking the quiz for inclusion of the user's name in the score board. There is also a reset button in the system to reset all the saved scores.

In systems development, an acceptance test is performed to determine whether the system fulfills user requirements (Satzinger, Jackson, & Burd, 2000).

Based on the user acceptance test conducted to the SPED teachers, the application obtained an overall mean of 4.70 (see Table 2), which means that the respondents strongly agree on functionality, usability, and performance of the SignApp. According to the teachers, they were overwhelmed in experiencing this kind of teaching approach. They are also extremely glad that the application is a big help to them and to the learners and they will not be left out by the new trends of technology. With the help of the application, learning becomes more effective as it encourages the learners to be more active and participate better in class.

Table 3 shows the user acceptance test result conducted to learners. The computed overall mean is 4.72. This result signifies that the respondents strongly agree on the application's functionality, usability, and performance. It was observed that the attention of the learners focused on the application and they got very excited upon trying the application.

Table 2.

User Acceptance Test (Teachers)

Categories	Mean	Description
1. Functionality	4.70	Strongly Agree
2. Usability	4.80	Strongly Agree
3. Performance	4.60	Strongly Agree
Overall Mean	4.70	Strongly Agree

Table 3.

User Acceptance Test (Learners)

Categories	Mean	Description
1. Functionality	4.56	Strongly Agree
2. Usability	5.00	Strongly Agree
3. Performance	4.60	Strongly Agree
Overall Mean	4.72	Strongly Agree

Conclusion and Recommendations

In the existing teaching and learning process of the pilot school, it was noted that teachers have not introduced technology yet in teaching. However, learners are using mobile devices basically for entertainment and recreation.

The developed application –SignApp was evaluated using users' acceptance test rubric by the SPED teachers and learners with hearing impairment. It is interesting to note that both teachers and learners rated the application strongly agree in terms of its functionality, usability, and performance.

The SignApp was developed to introduce innovation and provide an interactive tool in teaching and learning based on the curriculum of the hearing-impaired learners. With the help of SignApp, special education can be transformed. It is essential to bring it into the classroom to empower learning with the use of technology which will engage them to improve education.

Also, schools offering SPED programs can utilize the application to further help these individuals to learn. Furthermore, this study could be a remedy to the problems of the Department of Education (DepEd) in line with the out-of-school-youth with hearing impairment because most of these students are lacking of self-assurance to deal with other people.

This also provides a fun, exciting, and interactive learning experience for learners. Teachers are also benefited. This helps them

encourage their pupils to actively participate in class. This is beneficial in providing importance on the education of SPED children especially the hearing-impaired learners.

Since this study focused on the design and development of the SignApp, it is recommended that the effectiveness of the application developed to the learning skills of hearing-impaired learners be assessed.



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