Developing An Android-Based Prototype for Learning Pronunciation for Deaf and Hard-Hearing Students

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Abstract. This study aims to develop a prototype android-based application for deaf and hard-hearing students. The researchers implemented the pre-production, production, and post-production stages led to the creation of the prototype. In the pre-production stage, the researcher creates the application workflow prototype, creates the instructional materials, evaluates the workflow, and tests the prototype. During the production stage, the researcher produces an application design that includes the primary menu, submenus, and headings. Canva, PowerPoint, and iSpring Solutions are used by researchers to develop and build an application workflow. For Android to open the application, the researcher uses the APK Building tool to transform HTML5 into a file with the.apk extension. The researchers test the prototype and discuss the application with the teacher to collect ideas for later turning this prototype into a finished product.

Keywords: Android-Based Application, Deaf Students, Hard of Hearing, Pronunciation Learning, Special Need Students

1 Introduction

The main principle of inclusive education is that all students have the same right to get a quality education without discrimination based on their differences or needs. Inclusive education focuses on providing access, learning experiences, and an inclusive environment for all individuals, including students with special needs who differ physically, cognitively, emotionally, or socially. It also ensures that all students, including those with special needs, have equal access to education. This includes physical access to educational facilities, appropriate materials, and meaningful learning. Inclusive education also encourages healthy social interaction between all students. This helps reduce stigma or stereotypes against students with special needs and creates a more empathetic and respectful environment for diversity. One of the goals of inclusive education is to provide opportunities for students with special needs to develop fully. Inclusive education aims to create a learning environment that embraces all students, promotes collaborative learning, and promotes educational equity for all individuals.

J. Handhika et al. (eds.), *Proceedings of the 4th International Conference on Education and Technology (ICETECH 2023)*, Atlantis Highlights in Social Sciences, Education and Humanities 25,
https://doi.org/10.2991/978-94-6463-554-6_44

As well as the other special needs students, creating an inclusive learning environment for people who are deaf or hard of hearing is also crucial. This means ensuring that all materials, activities, and assessments are accessible to deaf and hard-of-hearing students (1). The system should emphasize the importance of teacher training in sign language, curriculum adaptation, and support for deaf learners. Besides, the need to reconsider inclusion and segregation in the education of deaf learners and the importance of equipping teachers with the necessary skills and knowledge to meet the needs of all learners are also important factors in teaching deaf people (2).

Some scholars emphasize the importance of deaf schools in providing a more inclusive education for deaf learners and present examples of innovative models of inclusive education (3). This regulation will overcome some limitations related to teachers' capabilities. The teacher's rules can lead to communication problems and hinder the learning process of these students. Teachers may struggle to explain certain curriculum content due to limitations in knowing or performing the correct signs. This lack of proficiency can also lead to the creation of their signs or the use of outdated sign language dictionaries, causing confusion and negatively affecting the academic learning aspects of deaf students (4). The importance of teachers being familiar with deaf culture and sign language and highlighting the need for early exposure to sign language and school resources for deaf students impacts the learning process outcomes (5).

Parents also play an essential role in teaching people who are deaf or hard of hearing. The parents lack sign language proficiency, leading to difficulties understanding and communicating with their children. The study emphasizes the need for comprehensive support programs to equip parents with the skills to raise their deaf children. Additionally, the challenges these parents face, including limited access to sign language training, lack of formal support services, financial difficulties, and resorting to corporal punishment out of frustration, become the problems (6). People who are deaf or hard of hearing must also be supported with first language acquisition. Evidence suggests that it can be challenging for deaf adults to learn a language later in life if they have not acquired it in childhood. This delayed language learning can lead to cognitive disabilities due to the lack of communication (7).

Other challenges faced by deaf and severely hard-of-hearing students in learning foreign languages, mainly English, emphasize the importance of creating motivating and effective learning environments incorporating sign language and teaching effective learning strategies. One of the main challenges is the need for a motivating and effective learning environment that uses national sign language to enhance teaching efficiency (8).

In learning English, the deaf experience challenges. The challenges include difficulties understanding language concepts, grammar rules, word order, and writing issues. Furthermore, the lack of exposure to spoken English means they often cannot hear grammatically accurate English, further hindering their pronunciation skills (9). Deaf people also experience problems related to communication, vocabulary, writing ability, and non-linguistic factors. Those problems lead teachers to employ various coping strategies, including focusing on specific skills, adapting teaching methods, using visual aids, and simplifying the material. They also rely on sign language and

the student's native language to facilitate understanding (10). Another study identifies six challenges for deaf people in learning English, including misinterpretation of words, lack of attention, difficulty in delivering the meaning of words, lack of articulation and comprehension, and the need for repetition. The teacher's strategies to overcome these challenges include using different vocabulary, using pictures and sign language, and repeating words multiple times (11).

Focusing on English pronunciation learning, it highlights the relationship between hearing and speech development and the impact of hearing impairment on cognitive activity (12). Learners with hearing loss tend to reach lower reading abilities in the majority language during their school years than their hearing peers (13). In speech communication, the principle of forming the speech of children with hearing problems and learning pronunciation is based on the system of shortened phonemes. To overcome the difficulty in learning pronunciation, the teachers' strategies cover cued speech, supportive technology, practical language use, personalized communication, and fostering a positive emotional learning climate.

In Indonesia, aids and media for deaf students learning English are limited. A previous study develops an Android-based application for individuals with hearing impairments to enhance their online learning experience. It offers various features such as video and document uploads, quizzes, scheduling, chat, and memory games (14). This product deals with general subjects and knowledge for deaf people. A study from (15) also deals with developing an Android application, BisAndro, designed to facilitate communication between deaf and hearing individuals using Indonesian Sign Language (BISINDO). This application relates to translating sign language gestures. Another multimedia product is trying to develop vocabulary mastery that focuses on designing interactive multimedia learning vocabulary for students with communication disorders and deafness, specifically during the Covid-19 pandemic (16). Another Indonesian developer also creates Akuarintar, a suitable medium for teaching and learning Arabic for deaf people. It also emphasizes the importance of incorporating technology and innovative approaches in language education for students with disabilities (17). This application is developed for deaf people to learn Arabic. Another assistive technology application called "PESAN KULIAH" support students with hearing impairments in understanding and writing scientific papers. The application includes explanations, sign language videos, and examples of different types of scientific papers (18). Another product, the development of a mobile application for Arabic Sign Language (ArSL), uses image recognition technology to assist deaf individuals in learning and reading the Quran (19).

The SIBI sign language media application can display visuals in the form of videos with sign language following augmented reality technology (20). Besides the application, previous research suggests that AR technology can benefit students with different learning abilities and impairments (21). Besides the mobile application and AR, the development of multimedia-based English learning materials, such as a sign language dictionary application, is necessary to support the learning of DHH children (22). (23) develop the implementation of gamification-based learning media on Android for deaf students in Civics. Seeing those provided applications, media, and applications for deaf learning pronunciation is not found. These gaps lead the research-

ers to create an Android-Based application for the deaf people in learning English, especially pronunciation.

2 Method

The initial study identified the learning traits of deaf children that need specialized learning tools. Children's learning is anticipated to benefit from the use of interactive media. Therefore, when developing this application, researchers focused on accessible and appealing learning media. The curriculum's material scope also becomes the basis in constructing the material. The contents of creating this application are the utilization of videos, graphics, and interactive text.

The pre-production, production, and post-production stages of the product prototype were the three primary stages into which the research team broke the creation of this prototype. The researcher makes the prototype application workflow, develops the instructional materials, test the workflow, and trial the prototype in the pre-production stage. The researcher creates an application design containing the main menu, submenus, and headings during the production stage. Researchers design with Canva and PowerPoint and build an application workflow with iSpring Solutions. The researcher completes the application using the APK Building program, which converts HTML5 into a file with the.apk extension so Android can open it. The researchers trial the prototype and discuss with the teacher related to the application to gather suggestions for creating this prototype product into the final product afterward.

3 Finding

Before creating the prototype, the researchers conducted preliminary research based on product specifications. The researchers used a descriptive qualitative research design by implementing in-depth interviews with the teachers of deaf people in SLB YKK Pacitan. The researchers also did observations. Preliminary research results indicate that there are obstacles to the learning of deaf children. The limited learning resources they can access are one of the problems in the teaching and learning process. In Pacitan, there are not many places that are friendly to children with disabilities. Their access to learning relies on learning resources at school. In addition, the lack of innovative learning media also makes learning monotonous. In learning English, pronunciation is the most challenging thing. This is because they do not get adequate input, as people learn pronunciation from listening, so deaf people get little or no information.

The following steps create this prototype:

3.1 Pre-production.

In the pre-production stage, the researchers take the following steps:

Creating the Workflow

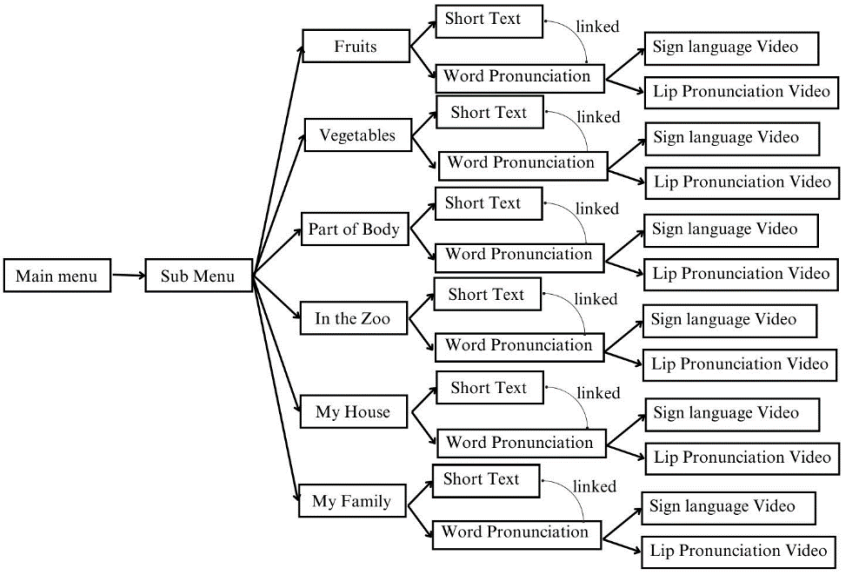

Fig. 1. The Prototype Workflow

The researchers make a simple application workflow to make the application user-friendly for deaf people. The researchers made the simple workflow since this application is created for primary school students with different digital literacy. The application is divided into five layers: the main menu, sub-menu, heading 1 material, heading 2 materials, and heading 3 materials.

Develop Instructional Material

After creating the workflow, the researchers compile the material, including the primary material (vocabulary, sign language video, and lip pronunciation video) and the supporting material (shapes, animation, colors, pictures, and fonts). The teacher is the main source of the video for sign language and lip pronunciation.

Test the Workflow

After compiling the material, the researchers arranged the material into a main menu, sub-menu, and headings. The researchers also linked all the materials to run the application smoothly.

Run the Prototype

Before compiling all the material, the researchers test the prototype into a trial final product to make sure that the prototype can be run in an Android application.

3.2 Production

In the production stage, the researchers mainly arrange all the material below:

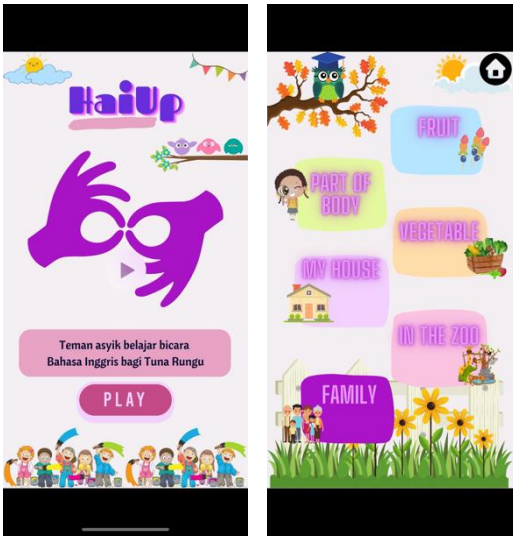

Fig. 2.: The Application Cover Main Menu and Sub Menu

In the application cover, the researchers put the name of the prototype application, the logo, the application description, and the button "Play." The users do not need to fill in the title to make this prototype simple and practical. After pushing the "play" button, the users will be directed to the sub-menu comprising six provided sub-menu. These are "Fruit," "Part of Body," "Vegetable," "My House," "In the Zoo," and "Family." The users can click one of the submenus and will be directed to the cover of subheading 1 (the short text for each sub menu). The researchers put the button "Home" in the sub-menu.

Heading 1 consists of the material "Fruits." The researchers give the short text on the first page. This short text consists of words that will be explained on the next page. The users can click one of the bold words and be directed to the next page. The next page consists of two videos: a sign language video and a lip pronunciation video. The video can be clicked to play. The users can replay the video by pushing the play button in the center of the video. The researchers also put the home button to direct the users to the sub-menu page. The researchers also put the button "next" and "back." The next button leads users to the following material (other fruits). The back button directs the users to the short text page.

Fig. 3. Sign Language and Pronunciation Video (Fruits)

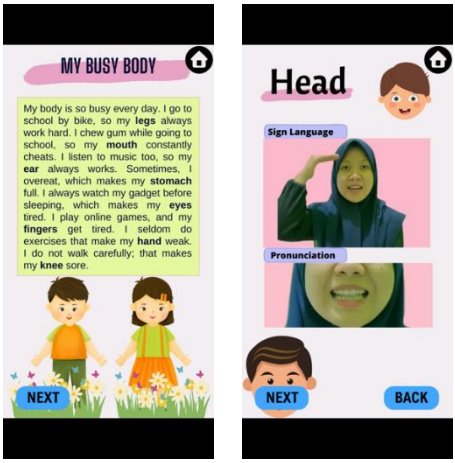

Fig. 4. Sign Language and Pronunciation Video (Part of Body)

Heading 1 also consist of the material "Part of Body." The researchers give the short text on the first page. This short text consists of words that will be explained on the next page. The users can click one of the bold words and be directed to the next page. The next page consists of two videos: a sign language video and a lip pronunciation video. The video can be clicked to play. The users can replay the video by pushing the play button in the center of the video. The researchers also put the home button to direct the users to the sub-menu page. The researchers also put the button "next" and "back." The next button leads the users to the following material (other parts of the body). The back button directs the users to the short text page.

Heading 1 consists of the material "Vegetables." The researchers give the short text on the first page. This short text consists of words that will be explained on the next page. The users can click one of the bold words and be directed to the next

page. The next page consists of two videos: a sign language video and a lip pronunciation video. The video can be clicked to play. The users can replay the video by pushing the play button in the center of the video. The researchers also put the home button to direct the users to the sub-menu page. The researchers also put the button "next" and "back." The next button leads the users to the following material (other vegetables). The back button directs the users to the short text page.

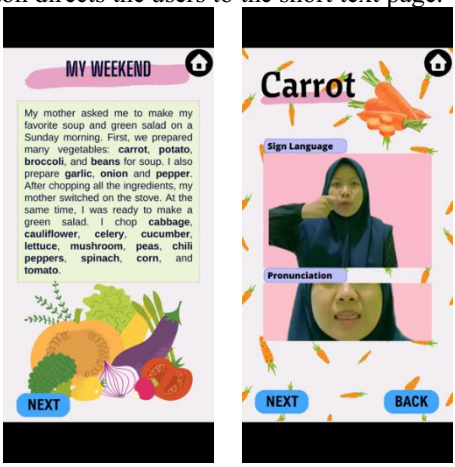

Fig. 5.: Sign Language and Pronunciation Video (Vegetables)

Heading 1 consists of the material "My House." The researchers give the short text on the first page. This short text consists of words that will be explained on the next page. The users can click one of the bold words and be directed to the next page. The next page consists of two videos: a sign language video and a lip pronunciation video. The video can be clicked to play. The users can replay the video by pushing the play button in the center of the video. The researchers also put the home button to direct the users to the sub-menu page. The researchers also put the button "next" and "back." The next button leads users to the following material (other rooms). The back button directs the users to the short text page.

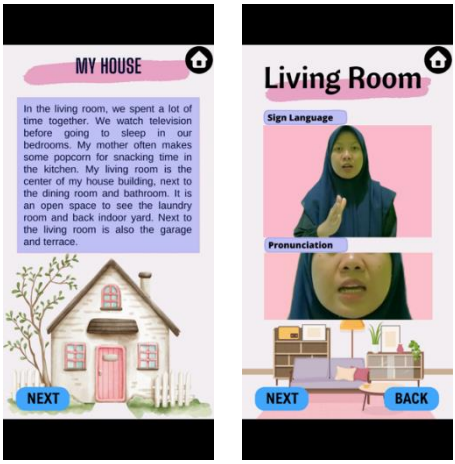

Fig. 6. Sign Language and Pronunciation Video (My House)

Heading 1 consists of the material "In the Zoo." The researchers give the short text on the first page. This short text consists of words that will be explained on the next page. The users can click one of the bold words and be directed to the next page. The next page consists of two videos: a sign language video and a lip pronunciation video. The video can be clicked to play. The users can replay the video by pushing the play button in the center of the video. The researchers also put the home button to direct the users to the sub-menu page. The researchers also put the button "next" and "back." The next button leads users to the following material (other animals). The back button directs the users to the short text page.

Fig. 7. Sign Language and Pronunciation Video (In the Zoo)

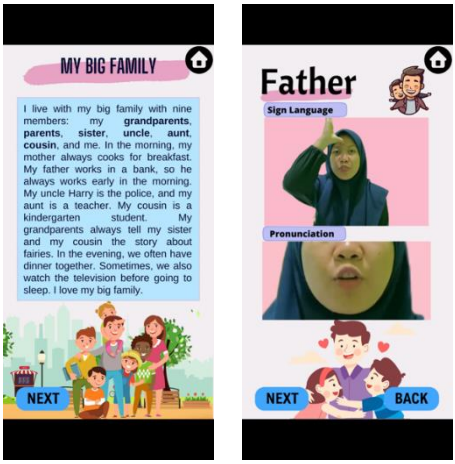

Fig. 8. Sign Language and Pronunciation Video (My Family)

Heading 1 consists of the material "My Family." The researchers give the short text on the first page. This short text consists of words that will be explained on the next page. The users can click one of the bold words and be directed to the next page. The next page consists of two videos: a sign language video and a lip pronunciation video. The video can be clicked to play. The users can replay the video by pushing the play button in the center of the video. The researchers also put the home button to direct the users to the sub-menu page. The researchers also put the button "next" and "back." The next button leads the users to the following material (other family members). The back button directs the users to the short text page.

3.3 Post-production

At this stage, the researcher goes through the following steps:

1. The design from Canva and PowerPoint is saved.
2. After it opens on the PowerPoint menu, the researcher uploads it using iSpring Solutions
3. after the process, the output file is HTML5.
4. After that, the HTML5 file is created by the application using the APK builder.
5. The application is complete and can be installed on Android.

4 Discussion

The use of visual aids helps deaf people in learning. The learning suggests using technology and visual materials to support their learning and emphasizes the need for inclusive education and adapted learning environments (24). The learning media do not only improve language comprehension. The other study also emphasizes the sig-

nificance of integrating technology in special education and suggests that Android-based learning media can positively impact cognitive skills (25).

Visual aids are crucial in teaching deaf and hard-of-hearing students. They can help these students understand and retain information more effectively. This can include pictures, diagrams, videos, and other visual materials. The application uses interesting materials completed with colorful cartons, images, and animations. This visual medium can make abstract understanding of the material to concrete things easier and strengthen memory. It can connect the lesson's content with the natural world and develop science with illustrations that support students' memory (26).

This application also can be downloaded and installed on Android-based devices anywhere. This supports the message of autonomous learning for deaf and hard-hearing students. Independent learning can also be beneficial. This can involve teaching students how to independently use resources and learning strategies (8).

In the material construction, this application points out two videos: a sign language video and a lip video. The video shows facial expressions that emphasize the importance of motion and intensity in deaf children's recognition of human facial expressions and emotions. The study found that deaf children better recognized emotions in dynamic facial expressions than static ones (27).

5 Limitation of The Prototype Application

This product was created simply by using iSpring Solutions. Later, the researchers will develop this prototype into a final application product with other software.

6 Conclusion

The prototype was created by implementing the pre-production and post-production stages. The researcher makes the prototype application workflow, develops the instructional materials, test the workflow, and trial the prototype in the pre-production stage. The researcher creates an application design containing the main menu, submenus, and headings during the production stage. Researchers design with Canva and PowerPoint and build an application workflow with iSpring Solutions. The researcher completes the application using the APK Building program, which converts HTML5 into a file with the.apk extension so Android can open it. The researchers trial the prototype and discuss with the teacher related to the application to gather suggestions for creating this prototype product into the final product afterward.

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