

## Development of Indonesian Sign Language System (SIBI) Dictionary Application for Students with Special Needs

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### ABSTRACT

The process of communication for deaf persons needs to be facilitated by a particular language. Friends who are deaf want language that is appropriate for everyday requirements in order to communicate and comprehend communications. The objectives of developing assistive technology for the Indonesian Sign Language System (SIBI) dictionary application are to optimize services, create friendly assistive technology, improve the language skills of students with hearing impairments by utilizing technology, and create an inclusive campus that is friendly for students with special needs. The model used in research and development (R&D) is Borg & Gall. The development stage of the SIBI dictionary application goes through 10 stages, from collecting vocabulary information to the resulting product in the form of an application embedded on a smartphone. Product testing was carried out in two stages to identify constraints in the application and use of the available features. The population was 17 students with special needs at various semester levels, including eight students with hearing impairments (deaf), students with visual impairment (blind/low vision) as many as eight students, then there is one student with obstacles to the function of mobility. The results of this study are that the SIBI Dictionary Application is a dictionary in the form of sign language videos equipped with sound and text as well as word meanings. The video also has a tutorial. This tool can help hearing-impaired pupils study after utilising a digital dictionary. Increasing hearing-impaired kids' vocabularies (value indicator assessment). Deaf community "GERKATIN" and special education students. Thus, the SIBI Dictionary Application with sign language movies with sound, text, and word definitions can better aid kids with special needs and can be downloaded from smartphone app services. All UNM students receive volunteer instruction from special needs classmates.

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## 1. INTRODUCTION

One of the fundamental necessities of humans is education. Education equips students with the knowledge, abilities, and attitude they need to succeed in the present global economy. There are four aspects of education initiated by Ki Hajar Dewantara, namely spiritual, intellectual, kinesthetic, and aesthetic. These four dimensions certainly complement each other and are related to the embodiment of noble values in each individual. Those need improvements (Aswat, Tayibu, et al., 2022; Aswat, Fitriani, et al., 2022). The national education system that was established in Indonesia, changes and developments in educational evaluation occur (Nurhikmah et al., 2021; Sujarwo; Sukmawati; Yahrif, 2019 Nurhikmah, et al., 2022; Akhiruddin, et al., 2022) in aspects of life (Nurhikmah H et al., 2021), All citizens have an equal right to good access to high-quality education (Sujarwo et al., 2019), including access for those who are disabled (Wijayanti et al., 2019). For years, the implementation of education for person who has hearing impaired is still faced with various challenges.

The provision of high-quality educational services for individuals with impairments is frequently a topic of contention (Zhang et al., 2012). The level of engagement exhibited by students with special needs towards recognising the importance of learning and adopting effective learning strategies is rather low. This pertains to the extent of comprehension and the calibre of the educational environment's assistance for individuals with exceptional abilities. The situation is further worse by statistical data pertaining to the prevalence of disabilities and the extent of their involvement in formal educational settings. Due to their need for specialised healthcare, educational accommodations, and targeted interventions aimed at mitigating limits and fostering independence associated with their respective disorders, it is imperative to acknowledge and differentiate students with disabilities from their peers within the same age cohort. According to Veriza et al. (2021), the implementation of this initiative is expected to facilitate the development of autonomous communal living. The concept of disability inclusion encompasses the ability to lead an autonomous lifestyle, actively participate in societal affairs, and have an equivalent degree of personal agency as individuals without disabilities. Instead of residing in solitude, individuals with impairments possess agency in determining their living arrangements, thereby enjoying a comparable array of choices as those without impairments.

Organizing Education for students with special needs at the Department of Special Education (PLB) of UNM has accepted students with various obstacles or special needs. Students with hearing impairments who experience difficulties in language development will continue to be left behind in the learning process as well as in the process of preparing assignments and writing the final report (thesis). One of the accepted students with special needs is students with hearing impairments. Special education students of UNM Makassar registered in March 2021 with a total of 17 students with special needs at various semester levels, including 8 students with hearing impairments (deaf), while students with visual impairment (blind/low vision) as many as 8 students, then there is 1 student with obstacles to the function of mobility.

Students with hearing impairments (deaf) use sign language daily to communicate but still need assistance in every learning process (Rahagiyanto et al., 2017). Because the most significant aspect of human life is communication (Sujarwo et al., 2022). Verbal language is generally used to communicate, although deaf persons have limitations. They converse via sign language. Many individuals do not get the meaning of this hand motion, which is used as an example in sign language (Sulfayanti, Dewiani, Lawi, 2016). The categorization of hearing impairment is classified according to intensity and amplitude. On a decibel (dB) scale, where the quietest audible sound has a value of 0 dB and the loudest 140 dB, the intensity of a sound is perceived as loudness. A typical conversation takes place at a volume of 40 to 50 dB (Farrell, 2009, cited in Chairun Nisak, Iskandar Abdul Samad, 2019)). This happens because students with hearing impairments are unfamiliar with scientific words or new vocabulary conveyed during the lecture process. One of the reasons students find it difficult to learn languages is that there are no easy-to-learn and inexpensive learning resources, so they need a language dictionary that can be used anytime.

Students with hearing impairments who experience difficulties in language development will continue to be left behind in the learning process as well as in the process of preparing assignments and

writing the final report. In line with the problems above, the writing ability of students with hearing impairments will affect their written language skills (grammar) using Indonesian spelling. In line with this, the expressive abilities of deaf students in writing are greatly influenced by how much information related to written language is received by deaf students. There is no media and methods that suit the needs of deaf students in learning language (Lintangsari, 2014). Sign language is deliberately made to enable the deaf and speech-impaired community to convey messages and communicate with the other people. However, learning, practicing, and applying sign language in daily life is still not common in society (Andriana, et al., 2021).

Thus, one of the important components in learning is using adaptive equipment to meet the needs of the child. This important component can influence whether a child or young person with a disability will engage in physical activities, sports, and play in various local environments (Bergem, 2019). The equipment in question is anything that is the result of technology that is used to help the interests of children with special needs. The development of assistive technology for students with hearing impairments is carried out by collecting data in the form of vocabulary that is often used in learning in tertiary institutions. The use of this vocabulary will have an impact on vocabulary richness and skills in using these words in learning, so that the preparation of assistive technology meets the needs of students with special needs/deaf. Technology Assistance as a Language Acquisition Service With hearing impairments Special education is essentially learning designed for children with special needs due to the conditions of the obstacles experienced. In practice, Special Education always considers 4 main components, namely: physical environment, teaching procedures, teaching content/materials and use of adaptive equipment.

Some previous studies stated that SIBI sign language in technological advances can support learning process. The design of Augmented Reality to introduce the letters SIBI will help in the learning process. The black box test results showed all the features and functions of the application can run well (Aditama et al., 2021). In line with the other study indicated that SIBI alphabet user interface modeling met the needs of deaf children consisting of the presentation of sign language-related material using hand gestures in a card search game and guessing images based on the child's need to learn while playing the game (Ridzky & Effendy, 2019). Another study supports this study claimed that the design of an object-based learning application for the deaf in Sibi for the deaf aims to provide teaching for deaf children so they can recognize and understand the letters of the alphabet and their sign forms that have been set by the government in an educational environment (Khotijah & Driyani, 2022).

Sign language enables individuals to communicate by utilising hand or finger motions to form coherent words or sentences. In Indonesia, two distinct sign language systems, namely the Indonesian Sign Language System (SIBI), have been implemented to facilitate communication with those who are deaf or have speech impairments (Aditama et al., 2021). The objective is to create a translation system that focuses on written Indonesian and SIBI. The objective of this device, as stated by Rakun et al. (2013), is to address a prevalent communication barrier by facilitating conversation between individuals with hearing impairments and others without such impairments who are unable to understand sign language (referred to as SIBI).

Students with hearing impairments (deaf) use sign language daily to communicate but still need assistance and aids in learning activities. This happens because students with hearing impairments still have difficulty understanding scientific words or new vocabulary presented in the lecture process. For many students with deafness, it is important and helpful in teaching them, how to manage their own behavior and classroom accommodation. One of the most common accommodations in the classroom involves determining where the deaf students will seat (Hamidah, Nur, 2021).

It is thought that creating a video-gesture-based dictionary will aid students with hearing loss in developing their linguistic abilities. The SIBI Dictionary is often known as the Sign Language Dictionary. To use a specific language must be made easier for deaf people to use in order to communicate. People who are deaf desire to communicate and understand communications in a language that is acceptable for daily needs.

The aim of this study is the development of a video-gesture-based dictionary is considered a solution that can help students with hearing impairments in improving their language skills. The Sign Language Dictionary is referred to as the SIBI Dictionary. The dictionary of a Sign Language video is equipped with sound and text as well as word meanings. In addition, the video is equipped with a how-to or tutorial hinting at it. This is considered to be able to facilitate students learning sign language.

## 2. METHODS

### 2.1 Research Design

The approach used is known as Research and Development (R&D). Research and development is a research method which aims for deliberately, systematically, directed, to seek, find, formulate, improve, develop, produce, test the effectiveness of products, models, methods/strategies/means, certain superior procedural services, new, effective, efficient, productive, and meaningful (Gall, & Borg, 2007; Sugiyono, 2018).

Assistive Technology Development used research and development (R&D) method. The model applied in the development of the SIBI Dictionary Application media is developed by (Gall, & Borg, 2007) with 10 stages: 1) Preliminary studies (research and information collecting), 2) planning, 3) initial product development, 4) initial fielded testing, 5) initial product revision, 6) main product test, 7) main product revision 8) operation field test, 9) final product revision, 10) dissemination and implementation. The development stage of the SIBI dictionary application goes through 10 stages starting from collecting vocabulary information to the resulting product in the form of an application embedded on a smartphone. Product testing was carried out in two stages to identify constraints in the application and to use of the available features.

The research carried out was a population assessment where the research sample was drawn from all populations of Deaf students who were still active as students. With a limited test on a group of deaf students within the scope of Special Education, Faculty of Education UNM Makassar. The success test is carried out using an indicator value - assessment.

As for the stages of media development research, the translator is described as follows:

- 1) Gathering information  
Aims to determine the needs of Indonesian translator application to SIBI. Matters to be considered in determining the need for an Indonesian language translator application to SIBI include, among other things, the suitability of requirements between willingness and current technological needs. The steps taken in the information gathering stage are:
  - a) Literature study is carried out by collecting theories related to the development of translator applications. This stage is carried out to get an overview of the application to be developed.
  - b) Field studies at this stage the researcher analyzes by making observations to see the condition of the existing special schools and conducting interviews with the aim of finding out deficiencies in communication between the deaf and the deaf to the general public, so that the deficiencies are found, namely the need to develop an Indonesian language translator application to SIBI.
- 2) Planning  
At this stage the researcher conducts an assessment of what will happen later required or that must exist in the application. Based on the needs analysis that has been planned with the results of gathering information, both in terms of needs in the sign language used, management and services the menus in the development of this media.
- 3) Development of the initial form of the product  
At this stage is the initial design stage of the product to be made. Making product specifications according to needs.

### 2.2 Data source

The data to be collected in this study consists of two data, namely quantitative data and qualitative

data:

- a) Quantitative data as primary data is data regarding the product quality of the translator application as a communication medium based on assessments by material experts, media experts, SLB lecturers and students.
- b) Qualitative data is data regarding the process of developing a translator application as a communication medium in the form of criticism and suggestions from material experts, media experts, SLB lecturers, and students.

### **2.3 Data Collection Instruments**

The data collection instrument used to collect data in this study is a questionnaire. Questionnaires are data collection techniques through forms that contain questions submitted in writing to students and teachers to get answers or responses and information needed by researchers (Norman K. Denzin, 2018). The function of this questionnaire is to determine the feasibility and attractiveness of the media developed by the researchers.

### **2.4 Data analysis technique**

Data analysis is carried out after the data has been collected from the research results. This was done during data collection and after data collection (Leavy, 2017).

This data analysis technique is done by grouping information from qualitative data in the form of input, responses, criticism and suggestions for improvement contained in the questionnaire (Creswell, J. W., & Creswell, 2017), and the results of interviews with media experts, individual trials, and teacher responses. The results of this data analysis are then used to revise communication media products.

#### **Descriptive Statistical Analysis**

This analysis technique is used to process the data obtained through a questionnaire in the form of descriptive percentages. Data in the form of suggestions, criticisms and input are summarized and then used as a basis for revising the product to obtain the final product.

### **2.5 Assistive Technology Development Method (Assistive technology)**

1. Identification of Vocabulary (Identifying): Collect vocabulary data used in the learning process, Vocabulary mapping based on scientific studies, and Alphabetical arrangement of vocabulary
2. Gesture Design (designing): Assist students with hearing impairments in developing sign language skills through Determination of gestures with the deaf community, Composition of word gestures, and Setting up the signer (Interpreter)
3. Making a Digital Sign Language Dictionary (Design) through Making Sign Language videos, Making video tutorials for Sign Language Movement, Gesture-compliant audio or voice input, and Voice-friendly text input
4. Development of a digital sign language dictionary application through Designing applications on smartphones, Entering data into the application, Validation, Conducting application trials and Revision

Dissemination of digital sign language dictionary application: Done to study programs that are similar and have students with the same hearing impairment.

## **3. FINDINGS AND DISCUSSION**

Assistive technology in this development is the "SIBI Sign Language Dictionary for Students with hearing impairments in Higher Education", which is an application that functions to make it easier for students to use and understand easy scientific terms/words and the SIBI Dictionary Application is practical to use and makes it easier independent in identifying scientific terms and able to understand the use of the vocabulary sought/studied.

This SIBI Dictionary Application Model Specification is intended for students with hearing impairments that can be installed on a smartphone (Android) device. Development Objectives Based on the needs analysis, the goals to be achieved in developing assistive technology for students with

hearing impairments are: a) To make it easier for students with hearing impairments to find and learn new vocabulary. b) To assist students with hearing impairments in developing SIBI sign language skills. c) To make a sign language dictionary application that is easily accessible d) To make it easier for students with hearing impairments to understand that they have similarities in accessing learning

The advantage of the SIBI application developed in this dictionary application is that the vocabulary is identified according to the needs of the lecture. In addition to the vocabulary included in the dictionary, there is a scientific vocabulary that makes it easier for students to use it in lectures and in discussions. This SIBI dictionary application is made with the feature of using the correct vocabulary, which is complemented by using selected vocabulary by following PUEBI.

The process of developing assistive technology for the SIBI dictionary application for students with hearing impairments is:

### **3.1 Preliminary study (needs analysis) Identification of Vocabulary**

The creation of video-based sign language input materials involves a series of actions, which include: The present study aims to identify and analyse the SIBI Dictionary application, focusing on its features, functionality, and user interface. This endeavour entails the identification and acknowledgment of vocabulary frequently encountered in lectures, encompassing both newly acquired vocabulary from lectures and pre-existing scientific terminology. The process of mapping involves the creation of visual representations or graphical depictions of spatial data or This task is conducted in order to create a mapping or establish distinctions between levels of vocabulary difficulty. The organisation of vocabulary in alphabetical order. The purpose of this task is to organise the recognised vocabulary by sorting and mapping them in a graded manner, followed by arranging them in alphabetical order. The vocabulary input process involves the entry of input resources, such as signal films, narration (audio), and suggestive text.

### **3.2 Gesture Design Planning**

Helping students with hearing impairments in the development of sign language skills. a. Determination of gestures with the deaf community b. Composition of word gestures c. Setting up the signer (Interpreter). Development of the initial product design in the form of making a digital sign language dictionary (Design). Preparation of sign language application prototype: a. Making a sign language video b. Making video tutorials for Sign Language Movement c. Audio or sound input according to gestures d. Voice-friendly text input

A limited trial was carried out on a group of deaf students within the scope of the Special Education Study Program with indicators of signal suitability, video clarity, and readability. Initial product revision Development of digital sign language dictionary applications are designing applications on smartphones and entering data into the application.

### **3.3 Conducting application trials via smartphone media**

The design is revised based on the trial results' recommendations; preparation of the User Interface/display of the dictionary application interface Sign language (SIBI), selection of application functions/features, and application usage guide. Sign language application testing, evaluation of application use and improvement of the SIBI dictionary application prototype. The final product revision is in the form of application installation and ease of using features in the application, adding application content, recommendations to Playstore and IoS.

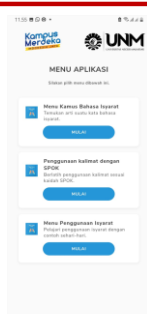
The dissemination of the digital sign language dictionary application is carried out to similar study programs and students with the same hearing impairment, the GERKATIN community and students. To illustrate the design method for the development of this assistive technology, a storyboard is presented as follows:

No. Board : 01  
 Name: Sign Language Dictionary  
 Page Name: Main Page



1. background
2. Independent campus logo and UNM logo
3. Gesture image
4. App name
5. Developer team information

No. Board : 03  
 Name: Sign Language Dictionary  
 Page Name: Menu page



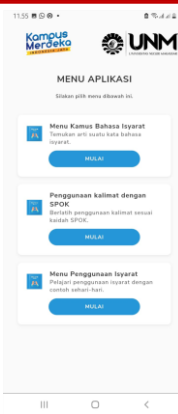
1. Title Menu/feature
2. Cue Videos
3. Sounds of Cue
4. Word meaning/explanation
5. Back button
6. Exit button

No. Board : 02  
 Name: Sign Language Dictionary  
 Page Name: Welcome page



1. happy dating explanation about the Application and the development team
2. welcome and team gesture video
3. back and next buttons
- 4.

No. Board : 04  
 Name: Sign Language Dictionary  
 Page Name: Menu page 1



No. Board : 05  
 Name: Sign Language Dictionary  
 Page Name: Menu page 2



1. Title Menu/feature
2. Vocabulary pictures/illustrations
3. Stuffing Box with SPOK
4. Keyboard and Suggested Words
5. Back button
6. Exit button

No. Board : 06  
 Name: Sign Language Dictionary  
 Page Name: Menu page 3



1. Title Menu/feature
2. Scientific Vocabulary Entry Box
3. Examples of the use of scientific vocabulary
4. Videos on the use of scientific vocabulary
5. Back button
6. Exit button

Figure 1. Storyboard of the design method for the development of this assistive technology

Based on results, it can be discussed that deafness can be interpreted as a state of hearing loss which results in a person not being able to perceive various stimuli, especially through the sense of hearing. People with hearing loss generally have difficulty accessing language sounds, because their

hearing aids are lacking/incapable of accessing speech sounds that occur in their environment. Thus, people who have hearing loss, their oral language skills will experience obstacles, because the main modality for imitating the sound patterns of language that grows and develops in their environment is not owned.

There should be other language alternatives that can be used as tools for carrying out communication interactions by people who are unable to access language sounds through their sense of hearing, such as sign media, finger alphabets, or other symbols that can be accessed through the senses of sight and touch, such as those used in the American Sign Language or the International Sign Language. As a result, those who are deaf or hard of hearing must acquire the skills and resources necessary to participate in social relationships. Hearing-impaired youngsters, like their hearing-impaired peers, require many forms of media to express themselves.

The SIBI translator application developed can be categorized as valid based on the results of validation by content/material experts. The indicator validation questionnaire shows that the suitability of the material with basic competencies and the relevance of the material for communication purposes are in the good category. The development of the application refers to the accuracy of the SIBI movement and the communication goals to be achieved and is developed in the form of a video of the SIBI movement so that it is more interesting and the delivery is simple so that it makes it easier to understand the material.

The SIBI application created in this dictionary application has the benefit of identifying vocabulary in accordance with the demands of lectures in one of the courses. The scientific vocabulary makes it simpler for students to use it in lectures and in discussions in addition to the terminology found in the dictionary. This SIBI dictionary software is built with the ability to use the right words, which is reinforced by employing specific words chosen in accordance with PUEBI.

The development of assistive technology for students with hearing impairments is carried out by collecting data in the form of vocabulary that is often used in learning in tertiary institutions. The use of this vocabulary will have an impact on vocabulary richness and skills in using these words in learning, so that the preparation of assistive technology fits the needs of students with special needs/deaf. The technology developed must emphasize visualization, motion and images (Nurpiena et al., 2021), so that they do not overlap because in the use of sign language the legibility of movements is an important point (Q. Xiao, M. Qin, P. Guo, 2019). Ease of learning can be pursued by giving tutorials of gestures and equipped with text containing word information (Zhang, D., Katsiyannis, A., Ju, S., & Roberts, 2012).

In an effort to develop language and communication for students with hearing impairments, the technology developed must be equipped with voice and lip movements. Sounds and lip movements are intended for those who still have residual hearing or use hearing aids (ABM). Use Gestures must use signs that are easily understood and performed by people with hearing impairments. The most obvious consequence of having hearing loss from an early age is the sluggish rate at which a person learns a language and, as a result, develops communication skills. In order to get past this obstacle, hearing-impaired people need media and educational materials that also include visual features that are more perceptible than lip movements. This justifies the requirement for the development of sign language (Rakun et al., 2013).

Therefore, in determining the gestures that will be included in the assistive technology, there must be the involvement of the community or related parties. The application is able to enhance the understanding of the time three seconds faster than before using the app. On the usability and user acceptance testing, the application has largely met the expectations of the user (Setiawan & Pradana, 2017). Some results of studies stated that after testing for gestures of the alphabet A to Z based on SIBI (Indonesian Sign Language) with static and dynamic movements the performance analysis with leave-one-out-validation method produced an accuracy of 82.31% (Rahagiyanto et al., 2017). By using the Scrum framework, the product owner (admin, teacher, and pupils who are hard of hearing) can finish the specified project. The issue can be solved even if there are many features that need to be created

first and a variety of them with different degrees of complexity (Amnur et al., 2021). The system has been successful in converting spoken sentences into visual sentences represented by SIBI graphics. While for the evaluation of the user interface, the menu of options, the results of the translation, the user guide, the informative, and the recording sensitivity. The average value provided by respondents is 86%, which is a very good number (Ramadani et al., 2021). Improve SIBI's gesture recognition ability by trying other hand shape features that have better capabilities than the handshape feature in this study (Erdefi Rakun, 2022). The development of an Indonesian signed language approach for inclusive classrooms is to proceed successfully (Sheehy, 2014).

This study applied the feasibility test was carried out by involving deaf students, namely the Deaf community "GERKATIN" and Special Education students. The results of this study are that the SIBI Dictionary Application is a dictionary in the form of sign language videos equipped with sound and text as well as word meanings. The innovation in technology has enabled the creation of digital dictionary (Raihan et al., 2019). The content of this dictionary is developed by integrating multimedia components such as pictures, graphics, and animation (McKee, R. L., & McKee, 2012).

Moreover, searching for a word online takes a shorter time than using a printed dictionary (Jensen, S. S., & Øvad, 2016). In addition, the video is equipped with a how-to or tutorial hinting at it. The use of this application shows the improvement of the learning outcomes of students with hearing impairments after using a digital dictionary application. Then, it increases the vocabulary words understood by students with hearing impairments (value indicator - assessment). Deaf community "GERKATIN" and students with special education.

Furthermore, the success indicators of Assistive Technology Use can be seen through an increase in learning outcomes for students with hearing impairments after using the digital dictionary application, an increase in the amount of vocabulary understood by students with hearing impairments (value indicator - assessment), and applications can be obtained from smartphone application service providers in Play store as assistive technology.

#### 4. CONCLUSION

The provision of education services for individuals with disabilities often engenders significant debate and disagreement. Insufficient emphasis has been placed on recognising the imperative nature of acquiring knowledge and comprehending the learning patterns that arise from the unique circumstances of kids with special needs. Furthermore, it has been shown that the utilisation of digital dictionary applications has resulted in enhanced academic achievements among students with hearing impairments. There has been a notable rise in the extent of word comprehension among pupils who have hearing impairments, as indicated by assessments. The proposed follow-up plan for this activity involves disseminating the use of a sign language dictionary application beyond the Education department. This initiative aims to promote equal opportunities and create an inclusive campus environment for visually impaired students of universities. Additionally, the plan includes further developing features for the sign language dictionary application, which is being created by the proposing team. Furthermore, the plan entails establishing a disability service centre at Makassar State University to enhance the provision of optimal assistance to students with special needs. Lastly, the plan involves making the application available through smartphone application service providers in the Play Store as an assistive technology tool. As a suggestion for promoting the use of the sign language dictionary application beyond the confines of the Education department, it is proposed that this initiative be extended to encompass all students with visual impairments. This approach aims to ensure equitable access and opportunities for these students across various educational institutions.

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