



INTERNATIONAL JOURNAL ON INFORMATICS VISUALIZATION

journal homepage : www.joiv.org/index.php/joiv



Developing Online Learning Applications for People with Hearing Impairment

Hidra Amnur^{a,*}, Yandri Syanurdi^a, Rika Idmayanti^a, Aldo Erianda^a

^aDepartment of Information Technology, Politeknik Negeri Padang, Padang, Indonesia

Corresponding author: *hidra@pnp.ac.id

Abstract— To make a communication with a hearing-impaired person, who is someone who has a problem with hearing ability, a special form of communication using sign language is required in order to make the purpose of the conversation convey properly. It is clearly that providing a proper and appropriate education for hearing impaired person is very important. Android technology is the best and useful solution for hearing-impaired person in learning as today's technological developments. The purpose of this research was to make an Android-based application for hearing impaired person. Scrum method was used to find and utilize existing libraries as well as the needs for application development. This application provides various kinds of subject from videos and documents uploaded by the teachers. It can be downloaded of it, if it is needed. It means that the users can study anytime and anywhere without concerning of limited time and internet access. Other features of the application are quiz, make schedule, event, chat, memory game, and other features to maximize the online learning process for hearing-impaired person.

Keywords— Hearing impairment; android library; application; scrum; use case; class diagram.

Manuscript received 15 Oct. 2020; revised 29 Jan. 2021; accepted 2 Feb. 2021. Date of publication 17 Feb. 2021. International Journal on Informatics Visualization is licensed under a Creative Commons Attribution-Share Alike 4.0 International License.



I. INTRODUCTION

Hearing problems has been a serious problem since the last previous years in many countries. Based on the 2019 report, World Health Organization estimated that 466 million people in the world have hearing problems, and 34 million of them are children. According to the Ministry of Social Affairs data downloaded on October 8, 2019, the percentage of hearing-impaired people was 7.03% among disabled people in Indonesia [1]. Based on the 2011 Social Protection Program (PPLS) Data Collection, there were 130,572 disabled children, including hearing impairment (3,861 children); hearing and speech impairment (7,632 children). Those cases are distributed throughout Indonesia [2].

Hearing impairment in relation to education is a serious problem. First, the numbers of people are many; their location is not evenly distributed, and likely, to collect them in one place is difficult. It has been a normal issue that not all public schools can accept them to get an education. It is because they require special treatment and teachers with remarkable skills as well. Communicating with hearing-impaired people requires a unique form of communication

using sign language to deliver the purpose of the conversation properly [3].

In Indonesia, based on article 31 (1) of UUD 1945 on concerning the National Education System states that "every citizen has the right to education". Furthermore, persons with disabilities are protected by the Law No 8 Year 2016 issued by the Directorate General of Disease Prevention and Control, Ministry of Health stating about on how to interact with people with hearing disabilities [4].

By considering the development of IT technology, especially smartphones, it is extremely easy for everyone to be able to learn, especially in the current COVID-19 condition. However, there are not many applications that can be used for hearing-impaired people. The previous applications for the hearing-impaired people are only to help them to recognize sign language. It could not help children to learn various kinds of subjects such as in public schools. Without an online tutoring application for children with hearing impairments, it will make children with hearing impairment are increasingly lagging behind other normal children. Relying on the school, it is not sufficient for hearing-impaired children to compete with other normal children in education, even in the world of work later for the future.

This research was to design and make an application by paying attention to hearing-impaired children's needs in learning activities, including the teacher does not teach hearing-impaired children by turning their backs on them. The video of this application learning material is recorded by paying attention to positions that have opportunities for hearing-impaired children to read teacher lips easily. The teacher speaks at an ordinary volume, but it is with clear lip movements. It is expected that toward the application, children with hearing impairment can also feel the benefits of online learning like any other normal child.

II. LITERATURE REVIEW

Directorate General of Disease Prevention and Control, Ministry of Health has already issued how to interact with people with hearing-impaired people such as ask before helping, do not make assumptions, and give respect. It is even elaborated into:

- Talking with faces looking at each other. Maintain eye contact and without putting anything in your mouth when talking to them
- Keep sight of them. try to keep their eyes at the same level as theirs (sit if he is sitting, standing if he is standing)
- Move lips clearly and speak lightly. If it is not understood, they can write it in simple sentences.
- Use facial expressions and body language; if they do not know what it means, try to repeat the words.
- Use sign language for a full conversation.
- It can be practiced by waving, turning off the lights, tapping hands on the table or tapping the shoulder to attract attention.

Effendi [5] proposed applying the science learning program towards the respiratory system of the SDLB part B for hearing-impaired people. The application is made into program code using Adobe Flash CS 6 Professional Edition software. Using the software, each application page is built with a multimedia concept combining audio, visual, animation, and it is equipped with sign language. Learning material for the human and animal respiratory systems can be explained in detail by the stages of each process that

occurs in the system. The result shows a multimedia-based respiratory application program for humans and animals [5]

Another research conducted by Sentosa [6] entitled Designing the Indonesian Sign Language System Learning Application (SIBI) for the Deaf-Speech. The research finds an application displaying a language learning through pictures, video signs, and games. The overall evaluation results and the SUS value of 70.71 show that the application design is good enough to provide ease of learning sign language for children with hearing and speech impairment [6].

Research from Wirna [7] resulted in designing an Android-based sentence corrector application for the deaf. This application is to assist and develop sign language. One of the features is using games that they like, and the game itself is still an educational game installed on android [7].

Huda [8] presented his findings at the National Seminar on Technology and Business, IIB Darmajaya Bandar Lampung. It shows a desktop-based sign language learning application for people with hearing disabilities. This application serves to learn to recognize numbers and letters. So that people with disabilities can easily understand letters and numbers. The users are not bored and not lazy in learning.[8]

From all the studies discussed, it can be seen that people with disabilities can use computer and smartphone technology in learning. A suitable application is developed by Android and IOS operating systems for people with a loss of hearing. The presented material can be in the form of text, images, multimedia, and video. Techniques of material delivery can be in direct delivery of learning materials, quizzes, and educational games. The language used is sign language. Method of learning delivery must be in line with the Directorate General of Disease Prevention and Control, Ministry of Health policy.

III. RESEARCH METHODOLOGY

Method of this research was scrum, as shown in Figure 1. The framework in learning problems for the hearing impaired has been clearly shown in Figure 1 below.

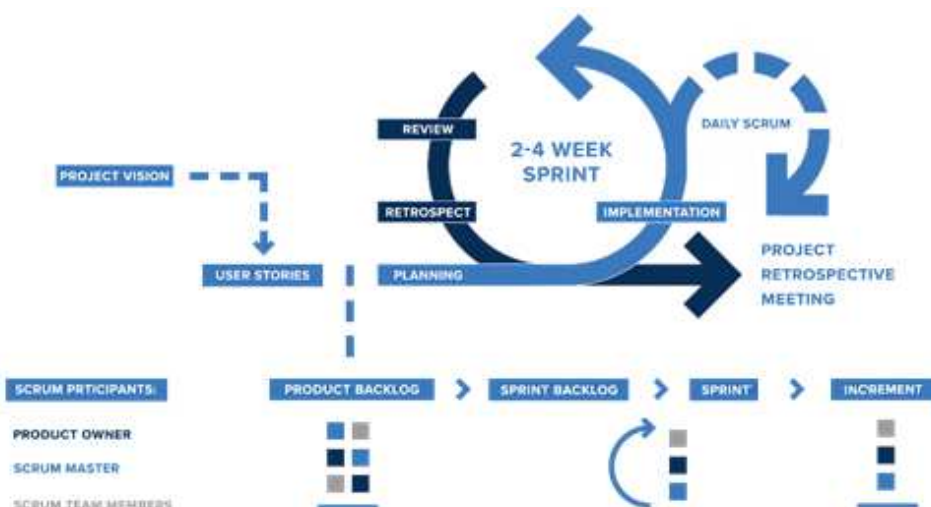


Fig. 1 Processes of Scrum

Figure 1 above can be described as follows:

1) *Scrum Participants:*

- Product Owner: an administrator, a teacher, hearing impaired students.
- Scrum Master: Head of PKM
- Scrum Team Member: PKM's Member
- User Story.

To use the Scrum method, the Product Owner must decide the user story. User stories are used to create a backlog. User story has the site of username and features where the system needs and the purpose of the planned features. User stories are generated in a common user language. This is enabled to use easily by business and technical people. One of the most essential things in this user story is the analysis between

technical and businesspeople to achieve software development expectations.

- Admin (Web)
Login, Manage Users, Posts, Classroom, Subjects, Videos, Schedule, News, Events, Documents, Chat, Edit personal data
- Teacher (Web)
Login, manage videos related to the subjects taught, documents in line with the subjects taught, schedules, events, posts, create quizzes, chat, edit personal data.
- Hearing-Impaired student (Android and Web)
Register, Login, View learning videos, Learning Documents, Schedule, Dictionary, Make Quizzes, Read the Al Quran, View News, Manage Events, Play Games, Chat, Edit personal data, Contact admin (figure 2).

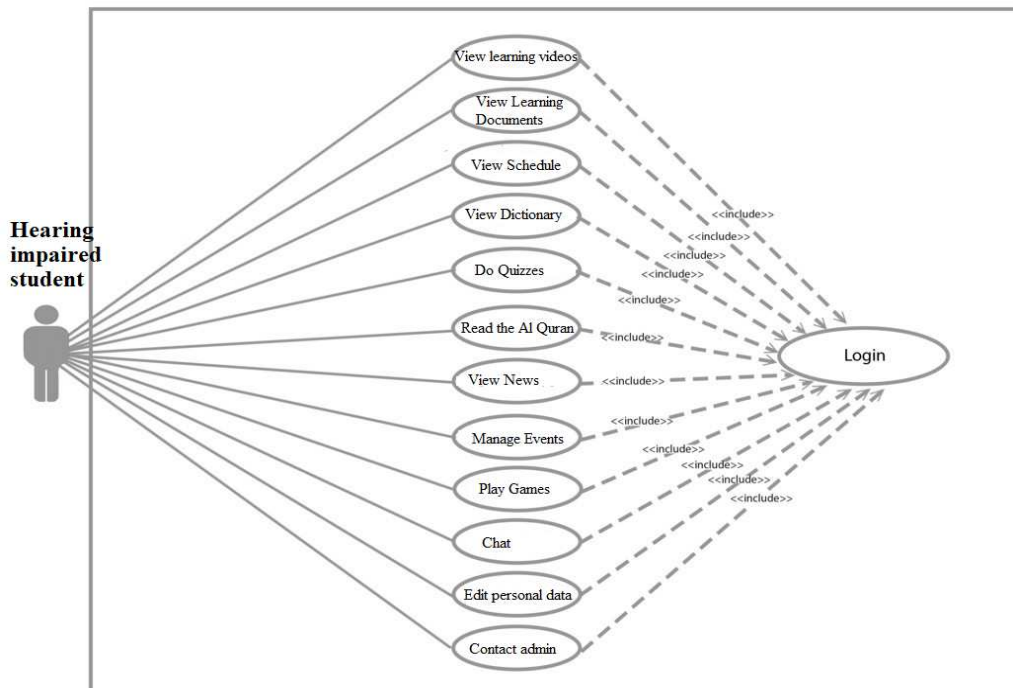


Fig. 2 Use A Case Diagram of Online Learning Applications for People with Hearing Disability

2) *Product Backlog:* The product backlog creation stage is the division or grouping of processes based on the previous step's analysis. It contains a master list of all important functions in a learning application product for hearing disabilities. Based on the steps explained in user stories, the product backlog is divided into three categories such as system users, admin, teachers, and hearing-impaired students. Each backlog feature has priority, for example, high, medium, and low. It is determined based on the urgent level of the needs of the user. Priority determines which features must be firstly worked. In addition to the priority, there is another thing to consider, i.e., distribution of time to work on the Backlog feature of the Sprint. The sprint's priority and length are determined by the agreement between the development team representatives, the Scrum Master, and the product owner. In this case, the timing is adjusted based on the time of PKM DIKTI.

TABLE I
BACKLOG PRODUCTS

No	Features	Estimation	Priority
1	Register, Login	8	High Priority
	Main Dashboard	6	High Priority
2	Hearing impaired Student level users (Android and Web)	60	High Priority
	Menu 1: Study, Schedule, Dictionary Quiz, Al-Quran, News, Document, Game	25	High Priority
	Menu 2: Website, Event, Admin, Creator	20	Medium Priority
	Menu 3: Home, Study, Upload, Chat, Profile	15	Low Priority
3	Teacher level users (Website)	35	High Priority
4	Admin level users (Website)	35	High Priority

3) *Sprint Backlog:* The sprint backlog of this application meets the needs of the predetermined product backlog process. The sprint backlog in the development of this

application fulfills the needs of the predetermined product backlog process. The development of android-based

applications of the research is only from the perspective of the users of the disabled students.

TABLE II
BACKLOG PRODUCTS

No	Use Case	Information
1	Login	Firstly, users must log in before entering the deaf android application for online learning
2	Do Quizzes	Users can access the quiz feature. If a user succeeds in completing the quiz, the system will display the score based on the test result. Then, the score will be stored into the system in the database.
3	View learning videos	Users can view video lessons that the teacher or admin has uploaded on the android application.
4	Read the Al Quran	Users can access the Al-Qur'an features by selecting a letter and verse fragment to be translated into sign language.
5	View Dictionary	Users can access the dictionary by selecting the words to be translated into sign language.
6	View Learning Documents	Users can see all lesson documents that the Teacher and Admin have uploaded on the Android application.
7	View News	Users can watch news by accessing the news feature and selecting the news to watch from the existing news list.
8	Play Games	Users can access the memory game feature. If they can complete the game, the system will display their score. Then, it will be saved by the system into the database.
9	View Schedule	Users can manage the schedule data by viewing, adding, editing, and deleting data based on the data schedule that have been set.
10	Manage Events	Users can manage event data by viewing, adding, editing, and deleting data based on the set event data.
11	chat	Users can communicate with other application users by using the chat feature.
12	Edit personal data	Users can edit their passwords and e-mails and all of their personal data
13	Contact admin	Users can contact the admin when needed, such as when a bug is found or if there is an error while using the application.

This is a Class diagram figure with a static model describing the structure and description of classes and the relationships between online learning applications for people with hearing disabilities.

4) *Sprint*: This stage is a continuation of the previous stage to determine the sprint backlog. When the sprint backlog has been agreed upon in the sprint planning, then developing of the sprint backlog is started. This process is carried out to achieve the goals of each sprint backlog. The

output of this process is the release of the online learning application for people with hearing disabilities. On the sprint execution, the system development stage, called feature testing, is carried out. This is important to test system functions. In this research, the test was black-box testing because they did not see and test the source code program for online learning applications for people with hearing disabilities.

TABLE III
ONLINE LEARNING APPLICATION BLACKBOX TEST FOR PEOPLE WITH HEARING DISABILITIES

No	User Interface	Test scenario	Expected output	Validation
1	Login	Access Android and then log in with username and password	The login page appears and the login process is successful	Usable
2	Do Quizzes	Choose the quiz menu on the home menu. Complete all quiz questions on the quiz page	The quiz page display and the quiz score appear	Usable
3	View learning videos	Choose one of the subject matters listed on the subject list pages	The video lesson page appears according to the selection of subject matter and the video can be played properly	Usable
4	Read the Al Quran	Select a letter from the list of surahs in the Al-Qur'an menu. Select one of the verses from the Quran on the excerpt page of the Al-Quran to translate into sign language	A page display of the cut verses in the Al-Qur'an appears based on the Surah selected by the user. A video page with the translation of a verse from the Al-Qur'an verse appears based on the verse from the Al-Qur'an that the user has selected	Usable
5	View Dictionary	Select the dictionary menu on the home. Select a word to translate into sign language from the list of words available on the sign language dictionary page.	The sign language dictionary page display appears. A word translation video page appears according to the word that the user has selected	Usable
6	View Learning Documents	Select the document menu on the home. Select one of the documents contained on the document page.	The document page appears. A display of the document data view page appears. The user can read it according to the document that has been selected.	Usable
7	View News	Select the news menu on the home. Select one of the news headlines contained on the news page.	The news page display appears. A news video page appears where the content of the news matches the news that the user has selected	Usable
8	Play Games	Select the game menu on the home menu. Complete missions from the game on the	The game page appears. The game score page appears	Usable

9	View Schedule	game page Click the view data button on the schedule page	A schedule list page appears consisting of a list of schedules from the application user An event page appears containing all the information on the current event.	Usable
10	Manage Events	Select the event menu on the home. Select one of the events on the event menu	The event detail page appears containing complete information about the events that the user has selected	Usable
11	chat	Select the chat menu on the navigation tab. Select one of the contact lists to call on the chat contact list page.	The chat contact list page appears. The chat page appears, and the message has been successfully sent to the intended contact	Usable
12	Edit personal data	Select the profile menu on the navigation tab. Click the edit profile button on the profile page, after that, make changes to the profile data.	The profile page appears. The profile update page appears, and the modified profile data is saved successfully.	Usable
13	Contact admin	select the admin number to contact from the admin list on the admin contact page	Dial number page appears	Usable

5) *Increment*: Increments are the result of the Product Backlog that has been completed during the Sprint. At the end of the sprint, the Increment must be completely completed where it means that it must be in a usable state.

IV. RESULTS AND DISCUSSION

The development of workflow of online learning application for hearing disabled people is conceptually the same as building other application platforms, where several steps are carried out, such as Project Setup, write (Code and Assets), Build and Run, iterate (Debug, create profiles, and test) and publish it.

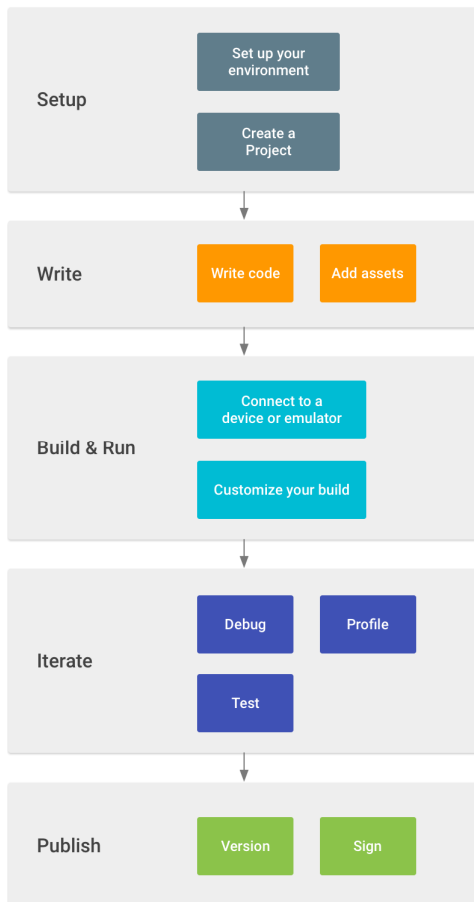


Fig. 3 Workflow Development of Online Learning Applications for People with Hearing Disabilities[9]

Several android libraries are used to develop a useful and effective online learning application for people with hearing disabilities. Android libraries are structurally the same as Android application modules. These libraries can include everything needed to build an app, including source code, resource files, and the Android manifest. Among these libraries are:

- deprecated-react-native-listview (0.0.6) library to create a list view in react
- nativereact-native-bcrypt (2.4.0) library to translate encrypted password
- react-native-datepicker (1.7.2) library to display the datepicker
- react-native-image-picker (2.3.1) library for uploading image files
- react-native-pdf (6.2.0) library for opening pdf files in react-native
- react-native-vector-icons (6.6.0) library for adding icons to the app
- react-native-video (5.0.2) library for displaying videos in the app
- react-navigation-stack (2.1.1) library to as a link between one page/class to another page
- react-navigation-tabs (2.7.0) library for creating navigation tabs
- react-navigation-drawer (2.3.4) library to create a navigation pane
- rn-fetch-blob (0.12.0) library to download the desired files from the react-native application
- native-base (2.13.8) library to make beautiful the appearance of the application, for example, to create a card view

The page that appears after the displayed screen page is the user manager page. On these page, two options are displayed to the user in the form of a login button and a register button. To use online learning applications for people with hearing disabilities, it is necessary to register as deaf students first. There is an e-mail and password form on the login page that the user will fill in to see the Android application menu. Login is successful when registration is successful. The display of the user manager and login pages can be seen in Figure 5.

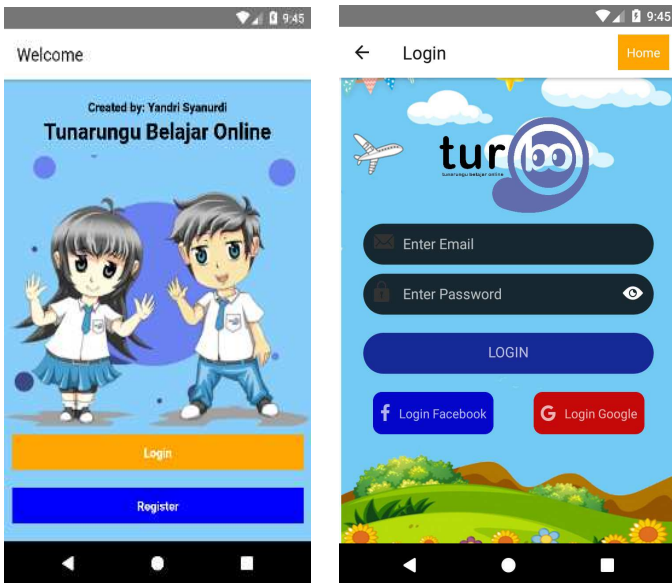


Fig. 4 Workflow Development of Online Learning Applications for People with Hearing Disabilities

The home page is the first page that appears when the user has successfully logged in. On the home page, several menus are displayed, and on the quiz page, several pictorial questions are displayed presenting gesture movements that represent various letters of the alphabet. The user's task is to guess what letters are displayed in each question. If the user completes all quiz questions on the quiz page, the quiz score page will display the score the user resulted from completing the quiz.

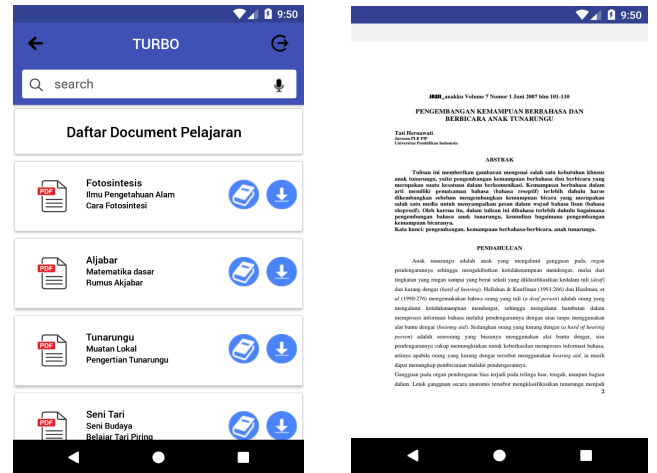


Fig. 6 Learning Documents of Online Learning Applications for People with Hearing Disabilities

The user can select the video lesson page of the subject matter. In the video, the teacher explains the subject matter using sign language. The video can be played well because of the react-native-video (5.0.2) library. The users can download video lessons.

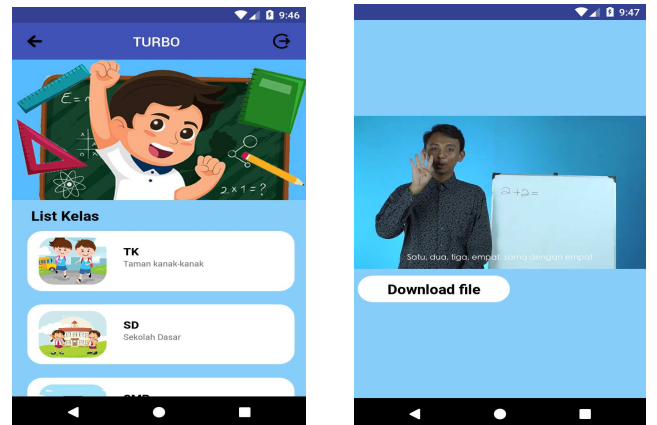


Fig. 7 Learning Video of Online Learning Applications for People with Hearing Disabilities

On the chat page, users can communicate with other users by sending messages to each other.

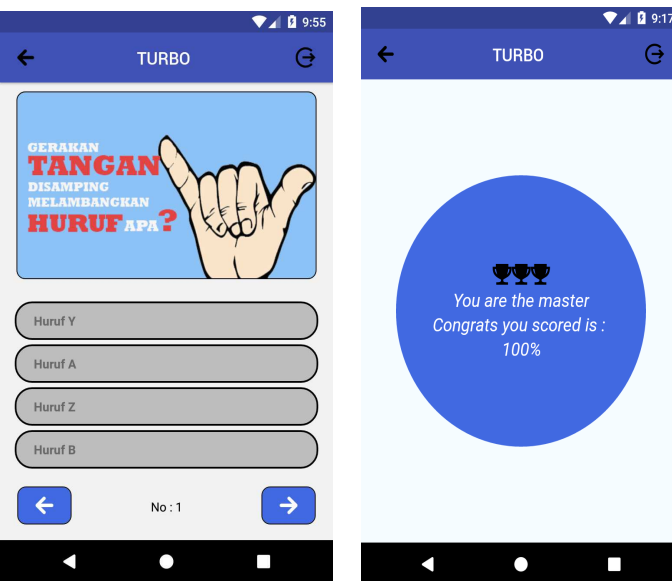


Fig. 5 Quiz Page of Online Learning Applications for People with Hearing Disabilities

The document page can display a list of study documents that the user can read. React-native-pdf (6.2.0) library is useful if the user wants to open a document from the list of available documents.

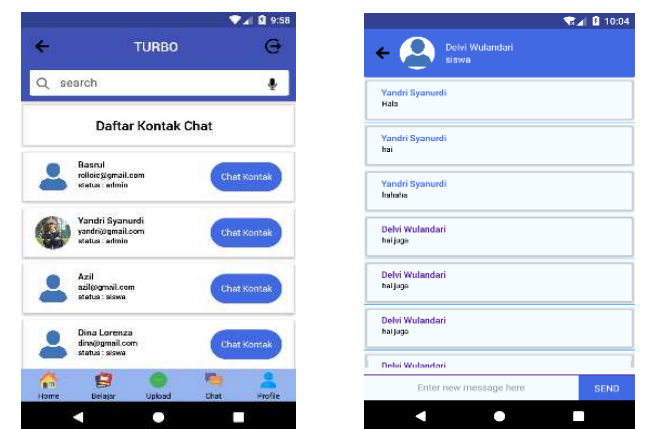


Fig. 8 Chat of Online Learning Applications for People with Hearing Disabilities

V. CONCLUSION

The project given can be completed by the product owner (admin, teacher, hearing-impaired students) by implementing the Scrum framework. Although the features are a lot to be made first and varied with different complexity levels, the problem can be resolved. The Scrum method can reduce the risk of project failure with the limited time provided. Practically, the Scrum system directs teams to solve the highest risk things and time to fix problems or fail early. The highest risk is on menu 1, then menu two, and the lowest is menu 3. It will be given a longer time for a high priority, and it is worked in advance. If the project is stopped, the team can continue the next project and provide good feedback on products and processes even though this research project was carried out in Covid-19 conditions to follow health protocols. This project was also carried out online by the team with the Trello application and video conference.

ACKNOWLEDGMENT

We are grateful to the Directorate General of Higher Education, Ministry of Education and Culture for the Student Creativity Program (PKM) and thank the Politeknik Negeri Padang for this research.

REFERENCES

- [1] D. P. dan P. P. T. Menular, "infodatin tunarungu 2019." Pusat Data dan Informasi Kementerian Kesehatan RI, Jakarta Selatan, 2019.
- [2] Haenuidin, *Pendidikan Anak Berkebutuhan Khusus Tuna Rungu : Peserta Didik Berkebutuhan Khusus dengan Hambatan Pendengaran*. Jakarta: PT Luxima Metro Media, 2013.
- [3] M. P. Dr. Dudi Gunawan, *Modul Guru Pembelajar SLB Tunarungu*. Bandung: PPPPTK TK dan PLB Bandung, 2016.
- [4] P. R. Indonesia, *UU No 8 Tahun 2016 tentang Penyandang disabilitas*. Republik Indonesia, 2016.
- [5] D. Effendi and B. Hardiyana, "Implementasi Rancangan Aplikasi Program Pembelajaran Ipa Materi Sistem Pernapasan Untuk Sdlb Bagian B Tunarungu Berbasis Multimedia," *J. SIMETRIS*, vol. 8, no. 1, pp. 99–112, 2017.
- [6] A. D. Qoyyimah and E. P. Adi, "Aplikasi Permainan Berbasis Android dalam Meningkatkan Kemampuan Kosakata Anak Tunarungu," *J. Ortopedagogia*, vol. 3, no. November, pp. 2–5, 2017.
- [7] Y. Wirna, E. C. Silitonga, M. Fika, and R. Putri, "Rancang Bangun Aplikasi Korektor Kalimat Berbasis Android untuk Anak Tunarungu," *J. Inov. Vokasional dan Teknol.*, vol. 18, no. 2, pp. 41–48, 2018.
- [8] N. Huda, N. Adha, and O. Saputri, "Aplikasi Pembelajaran Bahasa Isyarat bagi Penyandang Disabilitas Tunarungu Berbasis Desktop," *Semin. Nas. Teknol. dan Bisnis*, pp. 19–26, 2018.
- [9] Google, "Dasar-dasar alur kerja developer." [Online]. Available: <https://developer.android.com/studio/workflow?hl=id>.