Designing user interface using user-centered design method on reproductive health learning for visual impairment teenagers

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Abstract. One of the non-profit organizations that have concerns in reproductive health education for high school teenagers provides materials about reproductive health on its website. However, it is not accessible for visual impairment teenagers, for example, the picture cannot be read by screen reader software, and the absence of reproductive health learning that specifically for the visual impairment teenagers causes the lack of comprehensive learning and lack of independent learning for visual impairment teenagers. Android-based application of reproductive health learning will be developed to reduce effort such as opening a browser and typing the e-learning address. The application designed to implement multimodal interaction, that can become natural interaction involving several human senses in using applications that offer flexibility, efficiency and the use of a usable environment. The application allows the user to interact through several inputs such as touch, or gesture and get an output as a sound. In this study, the User-Centered Design method had used, so the design can be focused on the user. The user interface model had tested with USE questionnaire parameters that reach an average usability percentage 87.4%, it shows that usability obtained in the excellent category.

1. Introduction
Visual impairment people can be interpreted as a condition of visual impairment that can interfere with the learning process and learning achievement optimally [1]. Therefore, in the world of education required learning methods that must be adapted to the needs of visual impairment people. There is a non-profit organization that has a concern in reproductive health education for high school students in Bandung. They provide learning materials on reproductive health to educate high school students on their website.

Visual impairment teenagers are accustomed to operates mobile-based applications to support their activities. This also proven by the observations at SLB Negeri A in Bandung, students are used to operating smartphones, especially Android-based smartphones. The absence of reproductive health learning media on the website that specifically for the visually impaired causes a lack of comprehensive learning and a lack of independent learning for visual impairment teenagers. The solution for that problem was built an Android-based application that contains learning materials about reproductive health that can be accessed well by visual impairment teenagers and to reduce effort such as opening a
browser and typing the web address. This research is focused on designing the user interface of reproductive health learning media by implementing multimodal interaction. Through multimodal interaction, the user who has difficulties with a modality such as visual impairment teenagers are profited greatly by the alternative multimodal [2]. Such as the sound and touch modalities that support visual interface to decrease the burden of using the sense of sight in the learning process that adjusted to the needs of the visual impairment teenagers, which is proposed in the user interface designed in this research.

From the research conducted by Jean-Pierre Peters [3], UCD can be implemented for visual impairment teenagers, because the system that will be built will focus on the task and user persona, so the design is following needs by collecting data from the prospective user. The user interface model that has been built from the implementation of the UCD method will be evaluated using the USE questionnaire to assess usability factors related to user satisfaction. Based on research conducted by Tamanit Chanjaraspong [4], USE questionnaire can be used for persons with disabilities, especially the visually impaired, because the assessment component used is under what is needed by them.

2. User-centered design method
User-Centered Design (UCD) is an alternative approach to construct the interaction and a good interface design according to user needs. From research conducted by Jean-Pierre Peters [3].UCD can be applied to blind users because the system built will focus on tasks and persona so that the design is truly following needs by collecting data from prospective users and include the user in the research process [2] so that the search for data is more qualitative. The main characteristic of the UCD approach is the iterative process [5] UCD will be implemented in this study to provide a user interface of reproduction health application. UCD process is in figure 1:

![UCD Process](image)

**Figure 1.** UCD Process [6].

2.1. Specify context of use
Identifying the context of application usage, the context of application usage is used to find out who the user target, the reason for using the application, what users need, through what and where the application will be used by users. The context of using this application contains student characteristics, tasks, and environment data then used to make a persona. Some interviews and observations were conducted with 12 high school students at SLB N A Bandung. When the population in your sample area is less than 30 population, you can take all population as your sample [7].

The user persona is defined from qualitative and quantitative user research [8], by conducting interviews and observations. Aspects contained in persona include demographics, environment, behavior, level of expertise and necessity which can support to build the user interface design. A persona
can become a representative user. User personas are useful in the process of building user interfaces, such as making decisions about how the UI will be made, communication with users involved in the design. The user persona is shown in table 1.

### Table 1. Visual impairment student's persona.

| Demographic | Persona |
|-------------|---------|
| Age: 17-22 years old | - Student of SLB N A Bandung |
| Skill Level | - Have operated smartphones since they were teenagers |
| | - Able to operate a smartphone with the help of a screen reader application |
| | - Understand Indonesia language |
| Behavior | - Accustomed to using a smartphone |
| | - Accustomed to using helper software to interact with technological devices |
| | - Familiar with voice-based interactions |
| Environment | - Using Android-based smartphone |
| | - Doing learning activity in school and dorm/house |
| Needs | - Get reproductive learning media that accessible with them |
| | - Get flexible learning media that can be accessed anywhere and anytime |
| | - Get sound output to support their lack of visual interaction |
| | - Images can be read, not just text |

2.2. **Specify requirements**

This step aims to determine the user needs to be needed in building applications that match what users need. Application needs at this stage are obtained from the user and have links with the context of the application to be built. The requirement can be obtained from the user needs. The summary of requirement after doing the observations and interviews as follow:

- Using voice feedback to help their lack of visual interaction in doing the activity
- Images can be read by voice feedback, not just text
- Get flexible learning media that can be accessed anywhere and anytime

2.3. **Produce design solutions**

The user interface created using data that has been collected in the previous steps. The user interface is built according to user needs that have been defined in the previous stage. Figure 2 is the sample of user interface which has been built based on user needs in reproductive learning media.

![Image of user interface](Figure 2. User interface of learning material.)
The purpose of using large buttons is to facilitate navigation because some of the visual impairment users use their fingers to fingering the whole smartphone screen to know the content. Using voice to read the image and text are some of the requirements appropriate to the visual impairment student. This application using audio to read the materials and the longest learning audio is four minutes, with a duration of four minutes, students can still understand learning through audio. Because students can understand learning through audio for a maximum of 20 minutes [9]. The UI of learning materials contain a button to play and pause the audio, access to the next and previous material, and back to the list of materials. The purpose of placing the button above the text view is because the talkback will read content starting from the beginning whether the top of the screen, if the text view is placed above the button, it will confuse visual impairment users, because the talkback will immediately read the contents of the text view without reading the available buttons first.

2.4. Design evaluation
Design evaluation is undertaken using the USE Questionnaire method. USE is Usefulness, Satisfaction, and Ease of Use. According to Arnold M Lund [10], usefulness and ease of use are correlated with each other which can drive user satisfaction factors and user frequency. In the usability test used a questionnaire that is measured using a Likert scale to measure user perception. The Likert scale used in this study for usability evaluation had five weighting categories with a value scale of 1 to 5.

| Criteria               | Value Weights |
|------------------------|---------------|
| Strongly Agree (SA)    | 5             |
| Agree (A)              | 4             |
| Neutral (N)            | 3             |
| Disagree (D)           | 2             |
| Strongly Disagree (SD) | 1             |

Table 2. Likert Scale [11].

Equation 1 is used to get the percentage of usability value based on the category level. The category level is determined from the calculation of the range (interval) obtained from the results of the largest percentage minus the smallest percentage divided by K which is the number of categories [12].

\[
\text{Interval} = \frac{\text{Range}}{K} \quad (1)
\]

The results of calculations using equation 1, used are used as assessment indicators that categorize usability scores.

3. Results and discussion
Based on Jakob Nielson Norman's research [13] it needs at least five users to do a test, this usability testing adopting the number of five users to test. Each user was provided with a smartphone that has pre-installed talkback and an application that will be tested. After they complete a series of task that has been determined, they are asked to fill out the questionnaire. The result of the evaluation can be seen in figure 3.
From the average of all parameters, it has a value of 77.3% and gets a good category based on the interval in table 2. From the analysis and observation concluded, a user has difficulty when using the application there is content that is suppressed when they using scroll view text, causing talkback to be active when the material reader voice is activated, this makes the voice active simultaneously between the voice of the material reader and the talkback sound. Based on the results of observation in the first evaluation, improvements will be made to overcome the shortcomings of the prototype, redesign the prototype by removing the text view on the page displaying the contents of the material. The result of the redesign can be shown in figure 4.

After redesigning, the second phase of testing will be carried out. The results of the second stage of testing can be seen in figure 5.
From the average calculation of all parameters, it has a value of 87.4% and gets an excellent category based on the interval test table. In the usefulness parameter has increased, it can be said that the UI that was built already meets the needs of visual impairment users, such as the use of large buttons, and sound for reading material. For the ease of use, the UI that was built can be used easily and friendly for the visual impairment. In the ease of learning the UI built can already be learned easily by visual impairment users. And for the satisfaction parameter rise significantly which means the UI that was built has been decided for visual impairment users, this is also supported by the results of the redesign.

4. Conclusion
Model user interface by implementing User-Centered Design for reproductive health learning for visual impairment teenagers can be concluded:

- The results of modeling the user interface of the application of reproductive health learning media for the visually impaired get very good category with an average of 87.4% it means the application is convenient, effortless to use, painless to learn and pleasing for the visual impairment user.
- By using the voice feature, can help the visual impairment to understand the content, especially image content. Using a large touch area can help visual impairment users navigate the user interface, in the use of language, more attention must be taken, because if use a foreign term, talkbacks will have difficulty reading the term, and will cause misunderstanding for the user.

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