

Enhancing Reproductive Health Literacy via Audio App for Visually Impaired Female Adolescents in Indonesia: Design and Usability Evaluation

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ABSTRACT

Background: Visually impaired female adolescents face significant barriers in accessing sexual and reproductive health (SRH) information due to inaccessible educational materials and societal stigma. Audio-based mobile applications provide an innovative, inclusive approach to addressing these challenges, enabling the dissemination of reproductive health information tailored to their needs. **Objective:** This study aimed to design and evaluate the usability of an audio-based mobile application to enhance reproductive health literacy among visually impaired female adolescents in Indonesia. **Methods:** A mixed-methods study was conducted, comprising the development of an audio-based mobile app using a user-centred design framework and a usability evaluation involving 15 visually impaired female adolescents aged 15–19 years. Quantitative data were collected using the System Usability Scale (SUS) and Post-Study System Usability Questionnaire (PSSUQ), while qualitative data were gathered through semi-structured interviews. Data were analysed using descriptive statistics and thematic analysis. **Results:** The app achieved a mean SUS score of 85.3 (SD = 6.4), indicating excellent usability. The PSSUQ revealed high user satisfaction, with a mean score of 1.9 (SD = 0.4). Qualitative analysis identified three themes: Accessibility and Navigation, Content Relevance and Clarity, and Suggestions for Improvement. Participants appreciated the app's voice-guided navigation and culturally appropriate content, although recommendations were made to enhance interactivity and customisation features. **Conclusion:** The audio-based mobile app demonstrated high usability and satisfaction, effectively addressing the SRH education needs of visually impaired female adolescents. Future development should incorporate user feedback to improve navigation and introduce personalised features, ensuring broader accessibility and engagement.

Keywords: Audio-Based App; Mobile Health Education; Reproductive Health Literacy; Usability Evaluation; Visually Impaired Adolescents

INTRODUCTION

Adolescents with visual impairments often face substantial barriers in accessing sexual and reproductive health information due to the limitations of conventional educational materials. Badu, Agyei-Baffour and Opoku (2018) revealed that visually impaired women in Ghana encounter significant challenges in obtaining sexual and reproductive health services, including inaccessible information and societal stigma. Similarly, Ubisi (2020) emphasised the critical need for comprehensive sexuality education specifically designed for learners with visual impairments, highlighting the essential role of disability professionals in implementing such programmes. In Indonesia, Pakasi and Kartikawati (2013) identified cultural barriers and taboos surrounding sexuality education for adolescents, stressing the importance of culturally sensitive and inclusive approaches in reproductive health education.

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Comprehensive sexuality education has been widely recognised for its positive impact on adolescent sexual behaviour and health outcomes. Kirby, Laris and Rolleri (2007) analysed 83 studies and found that two-thirds of the programmes reviewed significantly influenced at least one sexual behaviour among individuals under 25 globally. In Indonesia, Kusumaningtyas, Wahyuni and Hapsari (2022) explored parental experiences in supporting menstrual hygiene education for adolescents with mental disabilities, shedding light on broader issues faced by adolescents with disabilities in accessing reproductive health resources. Rushton, Kossyvakaki and Terleksi (2022) demonstrated the effectiveness of music-based interventions in engaging individuals with profound learning disabilities, highlighting the potential of auditory modalities in education. Additionally, Kusumaningrum and Wulandari (2022) underscored the importance of equipping parents with adequate resources to deliver reproductive health education. These studies collectively underscore the urgent need to address the reproductive health education of visually impaired adolescents, particularly in Indonesia.

Audio-based applications present a promising solution, offering customised, accessible approaches tailored to the unique needs of visually impaired individuals. Such tools have the potential to enhance reproductive health literacy and empower visually impaired adolescents with essential knowledge. For instance, Nasser *et al.* (2024) developed AI- and IoT-enabled mobile applications to improve mobility for the visually impaired. Sianipar and Siregar (2023) demonstrated the effectiveness of audiovisual media in improving anaemia knowledge among adolescent girls, highlighting the value of audio components in educational tools. Similarly, Chaudary and Ahmad (2023) investigated the usability of remote navigation assistance for visually impaired individuals, emphasizing the importance of user-centred design in technology development. Moured and El-Sayed (2024) introduced haptic Scalable Vector Graphics (SVG) diagrams to assist blind individuals in understanding graphical information.

Developing audio-based educational interventions tailored to the needs of visually impaired adolescents could bridge the accessibility gap in reproductive health education (Bagirisano *et al.*, 2025). Nurses, as frontline health educators and advocates, play a pivotal role in identifying the health needs of underserved populations and facilitating the delivery of inclusive, culturally sensitive education (Ahmed *et al.*, 2021). Their involvement in the design, implementation, and evaluation of digital health tools ensures that content is not only clinically accurate but also contextually appropriate and responsive to the lived experiences of adolescents with disabilities (World Health Organisation, 2024). This study aims to design and assess an audio-based application to enhance reproductive health literacy for visually impaired female adolescents in Indonesia. By addressing the distinct challenges faced by this population, this research seeks to contribute to the development of inclusive educational tools that support nurses in delivering effective, equitable health education, ultimately promoting informed decision-making, reproductive autonomy, and improved health outcomes among adolescents with visual impairments.

METHODOLOGY

Study Design

This study employed a mixed-methods design comprising two phases: (1) the development of an audio-based mobile application aimed at enhancing reproductive health literacy for visually impaired female adolescents and (2) the usability evaluation of the app using quantitative and qualitative approaches. The development phase followed a user-centred design framework, incorporating needs assessment, iterative prototyping, and expert validation. The usability testing phase assessed the app's usability, functionality, and user satisfaction.

Sample

Participants were visually impaired female adolescents aged 15–19 years, enrolled in schools or community centres for individuals with visual impairments in Indonesia. Inclusion criteria included the ability to use mobile devices with assistive technologies (e.g., screen readers such as VoiceOver (iOS), TalkBack (Android), and NVDA or JAWS (for Windows)) and informed consent from participants or their guardians. Adolescents with severe hearing impairments or cognitive disabilities affecting comprehension were excluded. The sample size for usability testing was determined using the formula for usability studies, which recommends 5–10 participants per user group to identify 80% of usability issues (Nielsen, 2000).

Based on this guideline, 15 participants were recruited to ensure diverse feedback while maintaining feasibility. A purposive sampling technique was used to select participants, ensuring representation from various schools and community centres catering to visually impaired adolescents in urban and rural areas. Informed consent was obtained from all participants and their guardians before participation. Confidentiality and anonymity were ensured throughout the study. Participants were informed of their right to withdraw at any time without repercussions.

Instruments

A content validation checklist was used to assess the app's content relevance, clarity, and cultural appropriateness. The checklist was developed based on reproductive health literacy frameworks and validated by three reproductive health experts and two assistive technology specialists. The System Usability Scale (SUS), developed by Brooke (1996), was employed to evaluate the app's usability. It consists of 10 items rated on a 5-point Likert scale, ranging from "Strongly Disagree" (1) to "Strongly Agree" (5). Scores are converted to a range of 0–100, with higher scores indicating better usability. The SUS has demonstrated reliability with a Cronbach's alpha of 0.85 in the original study. The PSSUQ, developed by Lewis et al. (1995), was used to assess user satisfaction with the app. It comprises 16 items scored on a 7-point Likert scale, with lower scores indicating higher satisfaction. The original instrument reports a reliability coefficient of 0.91.

Procedure

A needs assessment was conducted through focus group discussions with visually impaired adolescents and interviews with educators and healthcare professionals to identify key reproductive health topics and preferred delivery formats. Content was developed in collaboration with reproductive health experts. The app was developed using Android Studio with Kotlin, incorporating audio navigation compatible with screen readers. Prototypes were iteratively tested with a small group of users to refine functionality and accessibility. Content and technical validation were conducted by five experts in reproductive health and assistive technologies. A Content Validity Index (CVI) and modified kappa statistic were calculated to ensure validity. Usability testing was conducted in a supervised setting. Participants completed predefined tasks, such as navigating the app, accessing modules, and listening to audio content. Data were collected through SUS and PSSUQ, as well as semi-structured interviews, to gather qualitative feedback. Feedback from usability testing was analysed, and necessary modifications were implemented to improve the app's usability and functionality.

Data Analysis

Quantitative data from the SUS and PSSUQ were analysed using descriptive statistics to determine usability scores and user satisfaction. Qualitative data from interviews were transcribed and analysed thematically to identify common usability issues and suggestions for improvement. Triangulation of quantitative and qualitative findings was performed to provide a comprehensive evaluation of the app's usability.

Ethical Consideration

The study was approved by the Institutional Review Board (IRB) of STIKes Sukabumi, Indonesia with reference number 077/ETIK/III/2024 on 4th March, 2024.

RESULTS

Development of the Mobile Application

The development phase followed a user-centred design framework, which included a needs assessment, iterative prototyping, and expert validation. The needs assessment identified key reproductive health topics, including menstrual health, family planning, and prevention of sexually transmitted infections. Preferred delivery formats emphasised audio navigation and compatibility with assistive technologies. The app was designed with voice-guided navigation, simple interfaces, and compatibility with screen readers. The content of the audio mobile application was shown in Table 1 and Figure 1.

Table 1: Feature on Audio Mobile Application

| Topics | Modified from Qualitative Study | Related Feature |
|-------------------|--|---|
| Physical Health | Physical health and puberty | Animated videos with audio voice featuring personal stories |
| Mental Health | emotional and romantic needs | Quiz question, Textbox for reflection, Mood tracker |
| Nutrition | Nutrition | Edu game |
| Physical Activity | | Animated videos with audio voice featuring personal stories |
| Sexual Health | perspective on having sexual partners and engaging in sexual activity before marriage. | Links to trusted external educational sites, resources, and support |
| Pregnancy | perspective on having sexual partners and engaging in sexual activity before marriage. | Animated videos with audio voice featuring personal stories |
| Sexual Violence | Sexual violence | Scheduling follow-up conversations with friends directly into calendar, Conversation preparation checklist and template |
| | community resources for sexual and reproductive health | Scheduling follow-up conversations with friends |
| | informational resources of reproductive health | Links to trusted external educational sites, resources, and support |

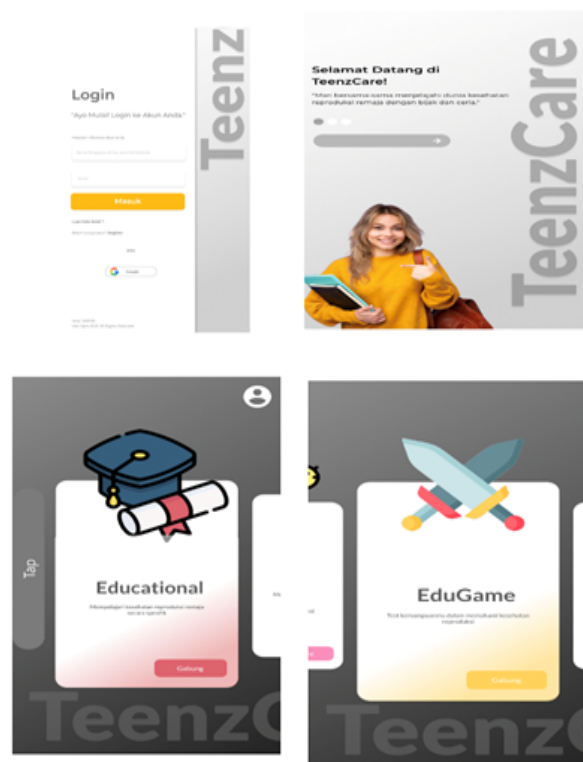


Figure 1: Example of Prototype of Audio-Base Mobile Application

Expert validation of the app's content and technical aspects yielded a Content Validity Index (CVI) of 0.92 and a modified kappa statistic of 0.88, indicating excellent content validity and inter-rater agreement. An iterative testing process was conducted with a small group of users to ensure the accessibility and usability of the mobile application. This process involved multiple rounds of testing and refinement, in which participants interacted with the app under observation and provided feedback on its functionality, navigation, clarity of content, and compatibility with assistive technologies such as screen readers. After each round, developers made targeted improvements based on user feedback, and the revised version was re-tested to confirm enhancements. This user-centred approach not only helped identify and resolve usability issues early in

development but also ensured that the final application was accessible and intuitive for adolescents with varying levels of digital literacy.

Usability Testing

A total of 15 visually impaired female adolescents participated in the usability evaluation phase. The demographic characteristics of the participants are summarised in Table 1. The participants were aged 15–19 years, with a mean age of 17.4 years (SD = 1.2). The majority (60%) were enrolled in urban-based schools, while the remaining participants (40%) attended rural community centres for individuals with visual impairments. All participants had prior experience using mobile devices with assistive technologies, and none reported severe hearing impairments or cognitive disabilities.

Table 1: Demographic Characteristics

| Variable | n | % |
|---|----|-------|
| Age Group (years) | | |
| 15–16 | 6 | 40.0 |
| 17–19 | 9 | 60.0 |
| Location | | |
| Urban | 9 | 60.0 |
| Rural | 6 | 40.0 |
| Experience with Assistive Technology | 15 | 100.0 |

The System Usability Scale (SUS) results indicated that the mobile application had a mean usability score of 85.3 (SD = 6.4), reflecting excellent usability. A mean score above 68 is generally considered acceptable, indicating the app was well-received in terms of ease of use and navigation (Table 2).

Table 2: Usability Score

| SUS Usability Scores | Mean (SD) |
|----------------------|------------|
| Overall usability | 85.3 (6.4) |

The Post-Study System Usability Questionnaire (PSSUQ) revealed high user satisfaction, with an average score of 1.9 (SD = 0.4), indicating participants found the app easy to use and satisfactory in meeting their needs (Table 3).

Table 3: Satisfaction Score

| PSSUQ Scores | Mean (SD) |
|----------------------|-----------|
| Overall satisfaction | 1.9 (0.4) |

Thematic analysis of the semi-structured interviews yielded three main themes: Accessibility and Navigation, Content Relevance and Clarity, and Suggestions for Improvement. Representative quotes illustrate participants' experiences and feedback.

Accessibility and Navigation

Participants appreciated the voice-guided navigation and audio content tailored for visually impaired users.

"The app is easy to navigate because it guides you step by step. I don't feel lost when using it."

"The audio quality is clear, and it works well with my screen reader."

"I can access all the features without needing help from others, which gives me confidence."

Content Relevance and Clarity

The reproductive health content was described as informative and culturally appropriate.

"I learnt a lot about menstrual health and family planning, which were not discussed in school."

"The language used in the app is easy to understand, even for someone with limited education."

"It's comforting to have information that feels respectful to our culture and beliefs."

Suggestions for Improvement

Suggestions included adding more interactive features and enhancing customisation options for audio playback.

"It would be great if there were quizzes or interactive sessions after each module."

"I'd like to adjust the speed of the audio because sometimes it feels too fast."

"Including more examples or real-life stories would make the content even more engaging."

Triangulation of Quantitative and Qualitative Data

Triangulation of quantitative and qualitative data highlighted overall positive usability and satisfaction with the app. Quantitative scores from the SUS and PSSUQ aligned with qualitative feedback, demonstrating that the app effectively met the needs of visually impaired female adolescents.

DISCUSSION

The results of this study underscore the effectiveness of the mobile application in addressing the unique needs of visually impaired adolescents, as evidenced by high usability and satisfaction scores from the quantitative analysis. These findings are consistent with previous research emphasizing the importance of user-centred design in developing accessible technologies for individuals with visual impairments (Soltani et al., 2025). The app's ability to meet user needs reflects its success in incorporating features that enhance accessibility and deliver content specifically tailored to the target audience.

Qualitative data provided deeper insights into user experiences, complementing the quantitative results. Participants highlighted the app's accessibility features, such as screen reader compatibility and voice navigation, which align with best practices in inclusive technology development (Chaudary & Ahmad, 2023). Furthermore, the app's content was deemed highly relevant and useful, contributing to its overall high satisfaction ratings. These findings emphasise the critical role of accessibility and content relevance in fostering user engagement and satisfaction (Dixit, 2024).

However, the qualitative analysis also revealed areas for improvement, such as difficulties in navigating complex tasks and the need for more personalised features. This feedback offers actionable insights for iterative development, allowing for enhancements in user experience and the resolution of gaps (Zhong et al., 2025). Similar findings in prior studies have underscored the importance of integrating user feedback into development processes to improve functionality and effectiveness (Li et al., 2023). The integration of quantitative and qualitative data strengthens the study's conclusions, providing robust evidence of the app's positive reception and utility for visually impaired adolescents. This mixed-methods approach highlights the value of combining numerical trends with detailed user perspectives, offering a holistic understanding of intervention outcomes (Creswell & Creswell, 2017).

This study holds several practical implications. First, it demonstrates the potential of mobile applications to support visually impaired adolescents by offering accessible and relevant resources. Second, it underscores the importance of user-centred design in achieving high satisfaction and usability, which are crucial for sustained engagement (WebAIM, 2024). Finally, the findings offer a framework for future app development, emphasizing the need to incorporate user feedback and address identified limitations.

Limitation

Despite its strengths, the study has certain limitations. The sample size, while sufficient for initial testing, may not fully capture the diversity of experiences among visually impaired adolescents. Future research should include larger and more varied samples to improve generalisability. Although purposive sampling ensured representation across urban and rural settings and included various institutions for visually impaired adolescents, the non-random nature of the sampling technique may introduce selection bias. Additionally, the perspectives gathered may not fully capture the diversity of usability experiences among broader populations of visually impaired adolescents, especially those outside institutional settings or with varying levels of digital literacy. Additionally, longitudinal studies are needed to evaluate the app's long-term effects on

outcomes such as quality of life and self-efficacy. Future development efforts should prioritise resolving the identified challenges, such as improving navigation for complex tasks and introducing more personalised features. Addressing these areas could enhance the app's effectiveness and user satisfaction further.

CONCLUSION

This study demonstrates the high usability and satisfaction associated with a mobile application designed for visually impaired adolescents, supported by both quantitative and qualitative evidence. The app's positive reception highlights its potential as a valuable resource for addressing the needs of this population. Future research could explore the long-term effectiveness of the mobile application in enhancing the quality of life and independence of visually impaired adolescents. Additionally, expanding the application's features to include integration with assistive technologies, such as braille devices or voice-controlled systems, could provide further accessibility and user engagement. Cross-cultural studies could evaluate the app's adaptability and effectiveness in diverse settings, ensuring its relevance to a broader audience. Research focusing on gamification elements and their impact on user motivation and skill acquisition may also offer valuable insights for improving the app. Finally, assessing the application's scalability and potential integration into educational or healthcare systems could pave the way for widespread implementation and impact.

Conflict of Interest

The authors have no competing interest.

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