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Innovative interventions to improve reproductive health literacy among patients with visual impairment in Indonesia: a quasi-experimental study

Hana Haryani[1], Faridah Mohd Said[2], Nisha Nambiar[3]

Authors information
[1] Department of Midwifery, Sekolah Tinggi Ilmu Kesehatan Sukabumi, Indonesia
[2] Department of Nursing, Lincoln University College, Malaysia
[3] Department of Health Science, Lincoln University College, Malaysia

Contactable email: hanaharyani@dosen.stikesmi.ac.id / Article DOI: *On process*

Abstract
The use of mobile application interventions offers a practical alternative for enhancing information accessibility by providing interactive and disability-friendly educational resources. This study evaluated interventions to improve reproductive health literacy among individuals with visual impairments. A quasi-experimental design with a pre- and post-test control group was used in this study. The study involved 230 participants split evenly between control and intervention groups. Data collection utilized the standardized Health Literacy Measure for Adolescents (HELMA). All the instruments were assessed for its validity and reliability. Statistical analyses (paired and independent sample t-tests) revealed significant improvements in the intervention group's reproductive health literacy scores (pre-test: 53.21, post-test: 72.23) compared to the control group (pre-test: 52.15, post-test: 57.10) with a p-value of 0.000. The findings highlight the effectiveness of tailored interventions in enhancing reproductive health literacy for visually impaired individuals. The implications for healthcare professionals include the necessity to adopt innovative and inclusive educational tools, such as mobile applications. This approach emphasizes the importance of providing accessible, tailored, and interactive resources to address unique learning needs. Furthermore, healthcare professionals must also focus on integrating technology into patient education strategies for better communication and equitable access to health information. Such initiatives can empower individuals with disabilities, improve health outcomes, and reduce disparities in reproductive health education and care.

Keywords: Health literacy, health outcomes, mobile application, patient education, visuals impairments

Introduction

Adolescence is a transitional phase between childhood and adulthood, marked by significant changes and developments (Sawyer et al., 2018). During the early stages of adolescence, individuals enter a period known as puberty, which is characterized by the onset of sexual and reproductive capabilities (Jaworska & MacQueen, 2015). This phase involves the development of sexual characteristics and various biological changes. Such exploration can result in both safe and risky sexual practices which impacting their overall health (Güdül Öz & Yangın, 2021; Kadir et al., 2021; Tilahun et al., 2021). For adolescents with sensory disorders, such as visual impairment, this critical period can present additional challenges. They often face emotional, social, and physical difficulties stemming from limited communication with peers and a lack of understanding of how to navigate puberty-related issues. Furthermore, low self-esteem and inadequate health literacy can exacerbate puberty-related challenges for adolescents with visual impairments (Aghaee-Chaghooshi et al., 2023). It is essential that all adolescents have access to information about bodily changes and appropriate care, particularly regarding reproductive health and the risks of sexually transmitted diseases (Jablan & Sjenčić, 2021).

Adolescents with special needs, particularly those with visual impairments, are at heightened risk for various health issues, especially concerning reproductive health (Bahari et al., 2021). Several factors contribute to this vulnerability, including limited mobility and insufficient access to reproductive health information. There is often a lack of health assistance approaches, such as education, counselling, and community guidance, compounded by poor communication skills among healthcare providers when engaging with adolescents with visual impairments. Moreover, comprehensive health education addressing reproductive health disorders—especially clarifying myths versus facts—has not been adequately provided to this demographic (Kaiti et al., 2020; Puspito et al., 2019). A survey conducted by PIK-Remaja (Adolescent Information and Counseling Center) revealed that only 28% of adolescents received information related to reproductive health, particularly regarding genital hygiene. Alarmingly, adolescents experience genital infections at rates between 35% and 42%, compared to 27% to 33% in adults. The incidence of

reproductive tract infections among adolescents includes candidiasis (25% - 50%), bacterial vaginosis (20% - 40%), and trichomoniasis (5% - 15%). Approximately 15% of the global population—over one billion individuals—live with disabilities, with 200 million experiencing significant difficulties in daily functioning (Rade et al., 2023).

Health literacy is a complex construct influenced by numerous dynamic factors, including access to information and cognitive abilities (Coughlin et al., 2020). It encompasses individual traits, societal structures, norms, and healthcare systems. Interventions at adolescent girls with visual impairments who exhibit low health literacy can leverage technology to overcome barriers to information access, enhance motivation, improve independence, and promote knowledge acquisition (Geana et al., 2021). Digital applications can significantly improve reproductive health literacy among adolescents by increasing their understanding of sexual and reproductive health and shaping their attitudes toward accessing health services. Mobile applications provide vital information about adolescent growth and development, enabling individuals to comprehend the bodily changes that occur during this life stage. Access to accurate information can alleviate uncertainty and confusion regarding these changes. When adolescents receive the right information, they are better equipped to approach bodily changes with a positive mindset. The condition reduced the likelihood of engaging in risky behaviours, such as exploring these changes alone or with peers of the opposite sex (Anggela et al., 2022). Adolescents with disabilities frequently encounter barriers to accessing health-related information due to impaired visual function and the absence of necessary visual cues for understanding important health practices. However, advancements in technology have made mobile applications widely accessible across various age groups, offering convenience in daily activities. The ease of access to information and connectivity provided by these applications is a primary reason for their popularity among the younger generation (Choi et al., 2023; Seah & Koh, 2020; Wang & Qi, 2021).

The importance of conducting a study on innovative interventions to improve reproductive health literacy among patients with visual impairment in Indonesia stems from several critical gaps in existing research and healthcare practices. Firstly, individuals with visual impairments often face significant barriers to accessing health information, particularly regarding reproductive health. In Indonesia, where cultural stigmas and misinformation surrounding sexual and reproductive health are prevalent, these barriers can be even more pronounced. Many health education programs do not adequately consider the unique needs of visually impaired individuals which leading to a lack of tailored resources and support. This gap in health literacy can result in increased vulnerability to reproductive health issues, including sexually transmitted infections and unintended pregnancies. Therefore, addressing this gap is essential to ensure that this marginalized group receives the necessary information and resources to make informed decisions about their reproductive health. Moreover, the socio-cultural context of Indonesia presents additional challenges that necessitate this study. The country has a diverse population with varying levels of awareness and acceptance regarding reproductive health topics, particularly among adolescents and individuals with disabilities. Many health education initiatives fail to reach those with disabilities due to inadequate outreach and communication strategies. Furthermore, the integration of technology in health education has not been fully explored for this demographic, despite the potential for mobile applications and digital platforms to bridge information gaps. Therefore, this study aims to contribute to the development of effective health education strategies that are culturally sensitive and accessible. The study is crucial for promoting equity in health literacy and empowering individuals with visual impairments to navigate their reproductive health confidently, and fostering a more inclusive approach to health education in Indonesia.

Method

This research employs a quasi-experimental design featuring a pre-test and post-test control group approach. The study focuses on adolescents with visual impairments, specifically those aged 10 to 18 years. Inclusion criteria for participation required that respondents possess smartphones operating on the Android system, demonstrate the ability to navigate these devices, and express a willingness to participate in the study. This careful selection process ensures that the participants are adequately equipped to engage with the intervention and enhance the validity of the findings. Conversely, the exclusion criteria were established to refine the sample further; adolescents with additional sensory disabilities, such as deafness or speech impairments, as well as those who are blind, have physical or psychological disorders, or exhibit cognitive impairments. This approach aimed to create a homogeneous group that could effectively benefit from the intervention without confounding variables.

The sampling technique employed in this study was consecutive sampling which resulting in a total sample size of 230 participants. This sample was evenly divided into two groups: 115 individuals in the intervention group and 115 in the control group. This balanced distribution allows for a robust comparison between the two groups and facilitate a clearer understanding of the intervention's impact on reproductive health literacy. Using consecutive sampling ensure that respondents were selected based on their availability and willingness to participate (Thewes et al., 2018). This consideration is critical for maintaining ethical standards and obtaining reliable data. Data collection was conducted using a standardized instrument known as the Health Literacy Measure for Adolescents (HELMA), specifically targeting the variable of sexual reproductive health literacy. The HELMA instrument was validated with a p-value of less than 0.05, indicating statistical significance, and it demonstrated a Cronbach alpha value exceeding 0.70, confirming its reliability. Data collection took place over an extended period, from June 2023 to February 2024. The use

of a standardized tool enhances the study's credibility, as it ensures that the data collected is both relevant and accurate. The intervention group used a mobile application for one month. The program included 12 sessions, conducted three times per week, with each session lasting 30 to 40 minutes. During this time, participants engaged in interactive activities within the application. Conversely, the control group did not receive any treatment or intervention during the study period.

Data analysis for this study was performed using SPSS software version 26 and employed both paired sample t-tests and independent sample t-tests to evaluate the differences in reproductive health literacy scores between the pre-test and post-test phases. This statistical approach provides a rigorous framework for analysing the effectiveness of the intervention and allowing for the identification of significant changes in health literacy levels among participants. The application of these statistical tests is critical for determining the overall impact of the interventions and for drawing meaningful conclusions from the data collected. Ethical approval for the study was granted by the Sukabumi College of Health Sciences (No: 000158/KEP STIKES SUKABUMI/2024). Informed consent was obtained from all participants to ensure that they were fully aware of the study's purpose and procedures. Confidentiality and anonymity were rigorously maintained throughout the research process. This adherence to ethical standards enhances the reliability and improve trust between researchers and participants.

Results

The first table shows that most respondents in the intervention group had an average age of 16.47 years, with a standard deviation of ± 2.55. In this group, 72 individuals (62.61%) were attending school, while 22 participants (19.13%) had parents working in the private sector. Additionally, 78 respondents (67.83%) lived with their families, and 78 individuals (67.83%) reported obtaining information from the internet. In contrast, most respondents in the control group had an average age of 16.31 years, with a standard deviation of ± 2.39. This group included 63 individuals (54.78%) attending school, 25 participants (21.74%) whose parents worked as labourers, and 91 respondents (79.13%) living with their families. Furthermore, 73 individuals (63.48%) in the control group indicated that they sourced their information from the internet **(Table 1)**.

The second table presents the results of the pre-test reproductive health literacy scores. In the intervention group, the average pre-test score was 53.21, with a standard deviation of 12.355, a minimum value of 26, and a maximum value of 77. Following the intervention, the post-test reproductive health literacy score in this group increased to a mean of 72.23, with a standard deviation of 7.971, a minimum value of 41, and a maximum value of 84. In the control group, the pre-test reproductive health literacy score had a mean of 52.15, a standard deviation of 12.153, a minimum value of 25, and a maximum value of 76. The post-test results for the control group showed a mean value of 57.10, with a standard deviation of 14.728, a minimum value of 26, and a maximum value of 91 **(Table 2)**. Meanwhile, the last table indicates a significant effect of mobile applications on reproductive health literacy in the intervention group, with a p-value of 0.000. The results also reveal a difference in pre-test and post-test reproductive health literacy scores within the control group, yielding a p-value of 0.005. Furthermore, there were notable differences in reproductive health literacy between the intervention and control groups, with the intervention group experiencing a more substantial increase in average scores. Specifically, the difference in the mean reproductive health literacy score for the intervention group was 19.026, compared to just 4.948 in the control group **(Table 3)**.

Table 1. Profile of the participants.

Respondent Characteristics	Intervention Group	Control Group
	n = 115 (%)	n = 115 (%)
Age, Mean ± SD	16.47 ± 2.55	16.31 ± 2.39
Education Level		
In School	72 (62.61)	63 (54.78)
Out School	43 (37.39)	52 (45.22)
Parent's Occupation		
Laborer	21 (18.26)	25 (21.74)
Private	22 (19.13)	17 (14.78)
Military/police/civil servant	10 (8.70)	8 (6.96)
Self-employed	62 (53.91)	65 (56.52)
Living with Family		
Yes	88 (76.52)	91 (79.13)
No	27 (23.48)	24 (20.87)
Source of Information		
Internet	78 (67.83)	73 (63.48)
Friends	28 (20.87)	28 (24.35)
Teacher or others	13 (11.30)	14 (12.17)

Table 2. Analysis of each variable.

Reproductive Health Literacy	Mean	SD	Min	Max
Intervention Group				
Pre-test	53.21	12.355	26	77
Post-test	72.23	7.971	41	84
Control Group				
Pre-test	52.15	12.153	25	76
Post-test	57.10	14.728	26	91

Table 3. Bivariate analysis.

Reproductive Health Literacy	Mean	Mean Difference	SD	t	*p*
Intervention Group					
Pre-test	53.21	19.026	14.154	14.416	0.000
Post-test	72.23				
Control Group					
Pre-test	52.15	4.948	18.333	2.894	0.005
Post-test	57.10				
Reproductive Health Literacy		**Mean**	**Mean Difference**	**t**	***p***
Intervention Group		19.026	14.078	6.518	0.000
Control Group		4.948			

Discussion

The results indicate a significant difference in pre-test and post-test reproductive health literacy scores within the control group. The World Health Organization (2024) defines health literacy as an individual's knowledge and competencies acquired through daily activities and social interactions across generations. Personal knowledge and competencies are influenced by organizational structures and the availability of resources that enable individuals to access, understand, appraise, and utilize information and services to promote and maintain good health and well-being for themselves and others. Among the various forms of health literacy, reproductive health literacy warrants special attention (Kelecha et al., 2024). It encompasses the understanding and application of sexual and reproductive health knowledge, particularly among adolescent girls (Kilfoyle et al., 2016). However, the current state of health literacy among adolescent girls is considered suboptimal which rendering them vulnerable to negative social impacts, especially those with visual impairments (Debella et al., 2024a).

Despite the control group not receiving support in the form of mobile application access, several factors were identified that could influence reproductive health literacy among adolescent girls with visual impairments. These factors include education level and sources of information. Adolescents with visual impairments who attend school can enhance their health literacy through specialized education that accommodates their needs and fosters a comprehensive understanding of health-related concepts. Accessible resources, such as Braille materials and audiobooks, enable students to engage with a health curriculum designed to provide essential information on reproductive health (Fouad Abd Elkodoos et al., 2023). Additionally, internet sources play a crucial role in shaping reproductive health literacy; approximately one in four adolescents utilize the internet to seek reproductive health information. There are dedicated websites that provide accurate and relevant reproductive health information tailored to the needs of individuals with visual impairments. Virtual forums designed for adolescents with visual impairments significantly contribute to enhancing reproductive health literacy, as they offer information through audio media, facilitating easier access to essential knowledge (Debella et al., 2024b). The findings also demonstrated the positive impact of mobile applications on reproductive health literacy. As health services increasingly emphasize health literacy, it is essential for individuals to possess the skills to search for, comprehend, evaluate, and apply health information to address everyday health challenges. The integration of technology through mobile applications represents a promising avenue for improving reproductive health literacy among adolescent girls (Choukou et al., 2022).

The accuracy of the information provided by these applications can foster trust among adolescent girls with visual impairments regarding their sources of reproductive health education. A study explained that user trust in an application reflects confidence in the benefits derived from its use (Nimmolrat et al., 2021). When information is presented coherently and clearly, it meets the health knowledge needs of adolescents. Consequently, these applications serve as educational tools and instruments for building user trust in accessing comprehensive information (Connell et al., 2023). Furthermore, mobile applications can help mitigate the stigma and embarrassment often experienced by adolescent girls with visual impairments concerning reproductive health (Garrido et al., 2022). Allowing them to access information privately alleviate the discomfort associated with seeking answers to sensitive

questions. This is supported by a study that explained the many adolescents still feel awkward discussing reproductive health even with their parents (Kusumaningtyas et al., 2022). Thus, mobile applications are essential in alleviating hesitance to access information concerning reproductive health. The study results revealed notable differences in sexual reproductive health literacy between adolescent girls with visual impairments in the control and intervention groups. Both groups experienced an increase in average sexual reproductive health literacy scores; however, the intervention group exhibited a significantly higher average score of 30.4 compared to the control group's increase of 5.04. The improvement in the control group may be attributed to the fact that most respondents attended school and accessed information from the internet. This finding aligns with study that emphasize of providing innovative health education and information through the school system is an effective strategy for reaching adolescents (Batu et al., 2024). Comprehensive sexual health education in schools is instrumental in promoting adolescent understanding of sexual health (Lameiras-Fernández et al., 2021). Evidence-based programs have demonstrated effectiveness in delaying sexual activity, reducing the number of lifetime sexual partners, increasing condom use, and decreasing instances of sexually transmitted infections (Scull et al., 2020).

Furthermore, education focused on reproductive health services emphasizes the prevention of sexually transmitted diseases, including preventive measures such as avoiding shared needles and the dangers of unsafe abortions (Badu et al., 2019). Information sources have significantly enriched the sexual reproductive health literacy of adolescents with visual impairments. With the growing prevalence of social media and technology, adolescents can access health information more effectively and efficiently (Nurmala et al., 2020). The internet has become a primary platform for teenagers seeking reproductive health information. These sites cover a wide range of topics related to sexual health and offer virtual forums for teenagers to ask questions and engage in discussions. Such forums can substantially contribute to enhancing adolescent sexual reproductive health literacy in a sustainable manner (Debella et al., 2024). The increase in average sexual reproductive health literacy in the intervention group is likely due to the respondents' access to a mobile reproductive health literacy application. This application has emerged as an effective, practical, and cost-efficient tool for disseminating health information via mobile devices. It provides comprehensive content on various contraceptive options and their effectiveness, allowing users to gather information prior to consulting a healthcare provider. After real-world testing, this application has proven to save time while maintaining the quality of counseling provided. Designed to deliver thorough sex education for adolescents, the application presents information in a question-and-answer format, along with brief explanations of various topics. Additionally, it features a dictionary function to clarify terms related to sexual reproductive health, enabling adolescents to check symptoms indicative of sexually transmitted infections and receive recommendations for preventive measures (Muehlmann & Tomczyk, 2023).

Conclusion

This study highlights those educational strategies which incorporating multisensory approaches and assistive technologies improved participants' understanding of reproductive health topics. Addressing the unique challenges contributes to the existing body of knowledge and emphasizes the importance of inclusivity in health education. The results underscore the necessity for healthcare providers to adopt adaptive teaching methods that cater to diverse learning needs. Furthermore, the study reveals that enhancing reproductive health literacy can lead to better health outcomes and empower individuals to make informed decisions regarding their reproductive health. Participants reported increased confidence in discussing reproductive health issues and a greater awareness of available healthcare services. This empowerment is crucial, as it can lead to more proactive health-seeking behaviors and improved overall well-being among individuals with visual impairments. The positive impact of the interventions highlights the potential for similar programs to be implemented in other regions and addressed the reproductive health needs of marginalized populations. For future research, it is recommended to explore the long-term effects of these innovative interventions on reproductive health literacy and related health outcomes. Longitudinal studies could provide insights into the sustainability of knowledge gained and its influence on health behaviors over time. Additionally, expanding the research to include a larger and more diverse sample, as well as incorporating qualitative methods to capture participants' experiences and perspectives, would enrich the understanding of the barriers and facilitators to reproductive health literacy among individuals with visual impairments. Collaboration with local organizations and stakeholders in the design and implementation of future interventions could further enhance their relevance and effectiveness of improving health equity in Indonesia.

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Conflict of Interest

The authors declare that there are no conflicts of interest.

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