



From Mobile Screens to Awareness: Initiating Learning in Online Reproduction Classes as an Innovation in Health Promotion for Adolescents

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Abstract

Adolescent reproductive health is a crucial issue directly related to the quality of life and future of the younger generation. Adolescent knowledge is a vital foundation for addressing reproductive health issues. Therefore, health promotion media that adapt to the needs and lifestyles of today's adolescents are necessary. This study aims to assess the effectiveness of digital reproduction classes as a learning medium for increasing adolescents' knowledge about reproductive health. It is hoped that this increased knowledge will stimulate awareness of the importance of reproductive health. This research is a single-group experimental study using a pre-post-test design for the trial of the reproductive health classes. The trial was conducted in three stages: a small-scale trial (n=7), a limited-scale trial (n=60), and a large-scale trial (n=380). Data were analyzed using a paired-sample t-test to compare knowledge scores before and after the intervention, and the N-Gain formula was used to assess class effectiveness. The small-scale trial increased the knowledge of 85.7% of participants, with an average increase of 14.3 points. The limited-scale trial showed an average increase of 15 points, while the large-scale trial showed an average increase of 15.54 points, with a p-value of 0.000 (95% CI: 16.67–14.42). The N-Gain score in the small-scale trial was 0.56, compared to 0.47 in the large-scale trial. The results demonstrate the effectiveness of the class in improving adolescents' knowledge. These findings reinforce the potential of online learning as an innovation in health promotion.

Keywords: Adolescents, Online Reproduction Classes, Health Promotion.

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1. INTRODUCTION

Adolescent reproductive health is a crucial issue directly related to the quality of life and future of the younger generation (Wahyuningsih, et al., 2024). In Indonesia, reproductive health issues are becoming increasingly evident. This situation is reflected in the number of early marriages, which has reached 25.53 million girls under the age of 18, placing Indonesia fourth in the world for child marriage (Mufrida, 2024). The rise in early marriages has led to a significant increase in teenage pregnancy rates. The 2020 Long Form Population Census reported a fertility rate of 0.297 live births per 1,000 girls aged 10-14, with the number of adolescent girls in this age group totaling 10.73 million (BPS, 2023). Furthermore, the risk of sexually transmitted infections among adolescents is also rising, with 4,589 cases recorded in 2024 (Rahmadania, 2025).

Another issue that affects adolescent reproductive health is nutritional status, especially among adolescent girls. UNICEF reports that adolescents aged 10 to 19 years in Indonesia currently face a triple nutritional burden, with the coexistence of malnutrition, overnutrition, and micronutrient deficiencies. A quarter of adolescents aged 13-18 years experience stunting or short stature, 9% of adolescents are underweight or have a low body mass index, while 16% of other adolescents are overweight or obese (Unicef, 2021). Another problem is that about a quarter of adolescent girls experience anemia. The 2023 Indonesian Health Survey Report stated that the prevalence of adolescents suffering from anemia reached 15,5% (Kementerian Kesehatan Republik Indonesia, 2023).

Anemia in adolescents is a global problem. It is often caused by iron deficiency (Kolarš & Mijatovi, 2025). While other factors play a significant role, menstruation is a fundamental factor contributing to anemia. Adolescents who do not meet their nutritional needs, especially for iron, are at greater risk of developing anemia (Wiafe et al., 2023). If this condition is not managed effectively, it can have long-term detrimental effects, such as reduced future productivity, an increased risk of complications during pregnancy, and a diminished quality of life for the next generation (Kolarš & Mijatovi, 2025).

Malnutrition in adolescents aged 15 to 19 years affects school performance, reduces work productivity, increases the risk of infectious diseases, and exacerbates disease severity (Thorpe & Cruze, 1956; Soni et al., 2021; Santrock, 2022). If it occurs in adolescent girls, this can lead to delayed menstruation and increase the likelihood of giving birth to a low-birth-weight baby if pregnancy occurs (Farah et al., 2019). This situation highlights the urgent need for effective, relevant, and accessible health promotion strategies for adolescents. Poor nutrition in adolescents not only leads to health problems but also diminishes the quality of future generations. Educating adolescents about the importance of reproductive health in the context of preconception preparation is crucial for addressing this issue (Unicef, 2021).

Adolescence is a crucial phase for the formation of knowledge and attitudes toward reproductive health (Santrock, 2022). Reproductive health education, especially for adolescents, is often considered taboo in society, leading many to seek information independently via the internet without adequate filtering (Nurjanah, 2024; Balumbi, et al, 2025). As a result, they are vulnerable to exposure to false or misleading information, which can influence their thinking and behavior regarding reproductive health (Wahyuningsih, et al., 2024). The increasing use of digital technology has opened up new opportunities to deliver education through interactive platforms that are more engaging and easily accessible (WHO, 2019). A survey conducted by the Indonesian Internet Service Providers Association (APJII) noted that 78.19% of the population, or 215.6 million people, had access to the digital world by early 2023 (Hidayah, 2023). Young people use social media as a primary means of interaction and information gathering, with 64.3% of young users selecting social media as their main platform (Sahertian, 2024).

Traditional face-to-face education is often considered ineffective due to limited interaction and psychological barriers. A study by [Smith et al., \(2024\)](#) confirms that digital media can increase learner engagement and expand access to education, especially among adolescents. Previous research shows that digital-based interventions significantly improve adolescents' knowledge, attitudes, and behaviors in maintaining reproductive health and can reduce incidents of physical and sexual violence ([Rumdari, et al., 2025](#)). Furthermore, the integration of information and communication technology (ICT) in education has been proven to have a broad positive impact, not only on academic performance but also on the transformation of the education system as a whole, with various supporting factors that must be considered in order for change to be effective and efficient ([Timotheou et al, 2023](#)).

mHealth applications have been widely used as educational tools to improve children's health and well-being, health monitoring, lifestyle, and health promotion ([Ruchala & James, 1997](#)). The use of monitoring applications to track health has been recommended by the World Health Organization (WHO, 2018). The COVID-19 pandemic has highlighted the importance of using mHealth applications to monitor public health, including among adolescents ([Helmyati et al., 2022](#)). The use of mHealth applications has several benefits, including facilitating access to health services, providing counseling to the target audience, reducing the workload of health workers, offering educational media for the community, increasing public understanding and awareness of health, supporting health monitoring programs, and saving resources and workforce ([Ruchala & James, 1997](#)).

The urgency of utilizing digital learning in health promotion is closely related to adapting to changes in the health system that incorporate technology, particularly in addressing the challenges of health misinformation in the digital space. According to the digital health platform Halodoc, public health education was one of the biggest challenges in 2017. A study revealed that 92% of health hoaxes originated from social media ([Pratama, 2018](#); [IHTA, 2019](#)). Health transformation requires an educational approach that is evidence-based, sustainable, and adaptive. Digital learning enables the delivery of standardised, structured, and easily updatable health promotion materials in line with scientific developments ([Hasibuan et al., 2024](#)). Therefore, the integration of digital learning with health promotion strategies is one of the indicators of a health system's readiness to implement digital transformation in the health sector.

In this context, digital reproductive education classes are a potential tool to bridge the gap between adolescents' educational needs and their digital lifestyles ([Zou et al., 2023](#)). In addition to providing basic knowledge about reproductive organs and health, these classes also teach essential life skills such as decision-making, self-control, and healthy communication. Through interactive and flexible digital learning methods, digital reproductive classes are expected to foster healthy awareness and behaviors from an early age, as well as help create a generation of young people with high reproductive literacy and a sense of responsibility for their health ([Balumbi et al, 2025](#)). Based on this, developing digital reproductive classes as a learning medium is a relevant and necessary strategic step in promoting adolescent health in today's digital era. Therefore, this research on the development of these classes aims to assess their effectiveness as a learning medium in increasing participants' knowledge about reproductive health. This step is taken to support health transformation in the promotive sector and contribute to achieving the Sustainable Development Goals (SDGs).

2. RESEARCH METHOD

This research focuses on the development of learning media in the form of a digital reproduction class that applies the four-D model. An experimental research design with a one-group pretest-posttest research design was chosen to assess the effectiveness of the media. The population in this study consisted of 6,792 female adolescents in Metro City aged 15 to 19 years. The number of samples participating in this study was divided into three different groups

at different stages. In the small-scale trial group, there were 7 participants, and in the limited-scale trial group, there were 60 participants. This determination was based on the minimum requirements for an experimental study. After completing the second stage of the trial, a large-scale trial was conducted with a sample of 380 female adolescent respondents. This number was calculated based on the population estimation formula for a limited population. Based on the three stages of the trial, the total number of samples used in this study was 447 female adolescents (Sekaran, 2003; Sugiono, 2019; Creswell & Creswell, 2017).

The requirements for prospective participants were age, according to population criteria, willingness to complete the learning process, and possession of a smartphone to access the reproduction class. Sample recruitment was conducted using simple random sampling. If a potential participant received a roll of paper marked "P," it indicated they were eligible to participate in the trial, while a blank roll of paper indicated they were not yet eligible. The number of sheets marked "P" and blank sheets of paper were provided according to the needs of each trial stage, in equal proportion. The learning process began after participants signed informed consent and registered for the reproduction class via smartphone. The results of the knowledge questions served as pretest data. The learning process was divided into three stages, each with a minimum duration of one week, equivalent to seven days, for study and assignments. At the end of each stage, participants completed a test, which could be accessed on the eighth day. The data from each stage served as posttest data.

The learning materials in the reproduction class were developed based on expert assessments from the Metro City Health Office and the needs of adolescents. The learning materials in Phase I covered reproductive health and health management, Phase II focused on anemia and balanced nutrition, and Phase III addressed a healthy lifestyle for adolescents, which included adolescent health programs, such as vaccinations. The research instrument, a knowledge test, was developed based on the material studied. The research materials and instruments were developed one year before the limited and large-scale trials to pass the validity and reliability testing stages. The questionnaire was tested for validity and reliability, with a V-index of 0.83, a p-value of 0.019, and a reliability score of 0.81. Data were analyzed using a paired t-test to compare knowledge scores before and after the intervention. Furthermore, the effectiveness of learning outcomes was assessed using the N-gain test. (Syahril et al., 2019). The flow of the learning process in the reproduction class is presented in Figure 1. All trial activities in this study have obtained ethical approval from the Ethics Committee of the Poltekkes Kemenkes Tanjungkarang, with the number 304/KEPK-TJK/V/2023, dated May 4, 2023.

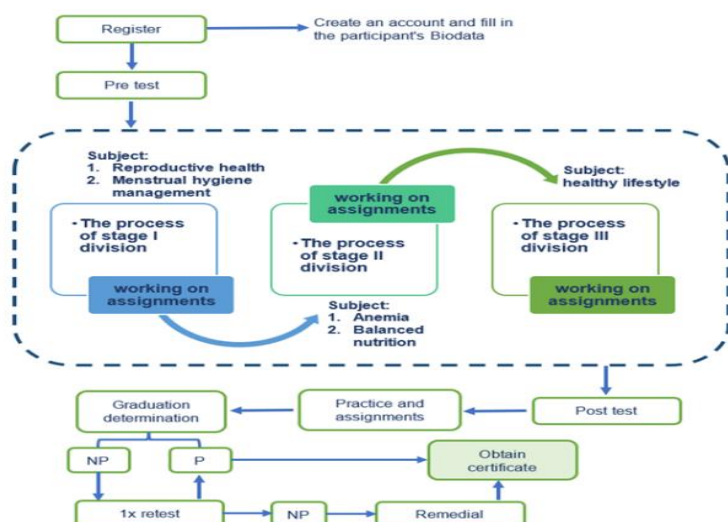


Figure 1. Learning Process Flow in the Digital Reproduction Class.

3. RESULTS AND DISCUSSION

The adolescent participants in the reproductive class were young women living in Metro City. Further details are presented in Table 1.

Table 1. Distribution of respondents based on age and educational status

Characteristic	Frequency	(%)
Age		
15 year	80	17.9
16 year	101	22.7
17 year	88	19.7
18 year	93	20.8
19 year	85	19.0
Total	447	100
Level of Education		
Junior high school student	80	17.8
High school student	236	52.9
University student	131	29.3
Total	447	100

Table 1 shows that most of the respondents were 16-year-old teenagers, accounting for 22.6% of the total respondents, and were high school students. Furthermore, all participants attended reproductive class learning at each stage of the trial. The themes of the reproductive class material were tailored to the needs of adolescents and partially aligned with research findings on health among school children (Choi et al., 2020). Next, the results of each stage of the experiment are presented as follows:

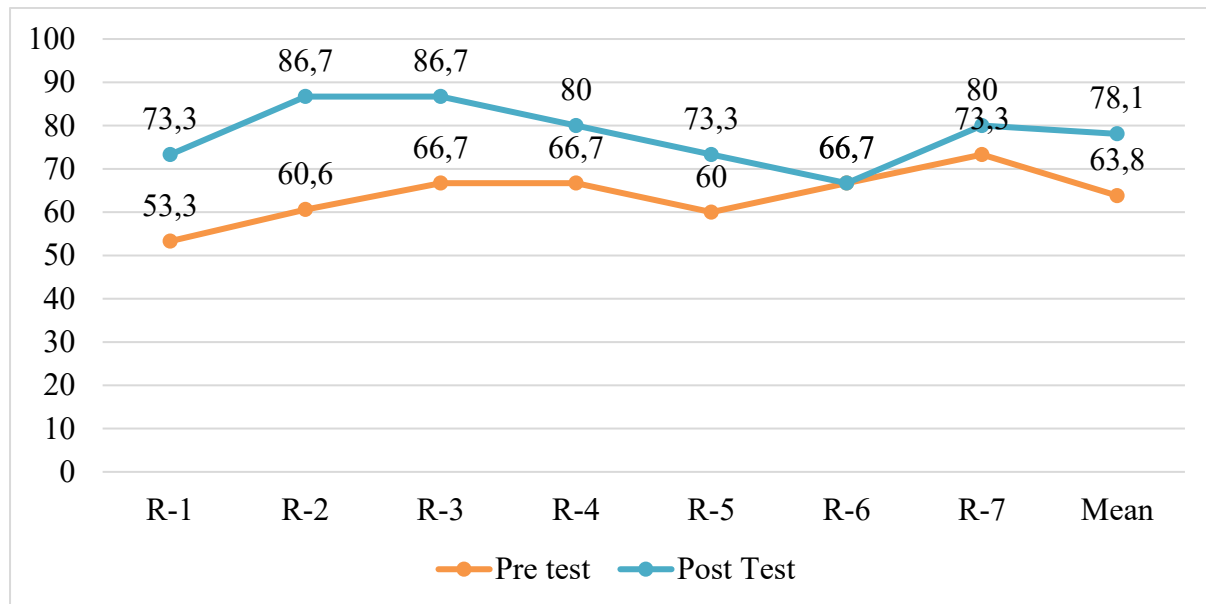


Figure 2. Comparison of the Results of Small-Scale Trials in the Reproduction Class Based on Pre-Test and Post-Test Results.

Figure 2 shows a comparison of pre-test and post-test scores for adolescent girls in a reproduction class during the small-scale trial involving seven participants, who were presented with number symbols 1–7. Overall, there was an increase in scores for all respondents after the learning intervention. In the pre-test, participants' scores ranged from 53.3 to 73.3, with an average of 63.8. After the intervention, post-test scores increased to a range of 66.7 to 86.7, with an average of 78.1. Improvements were consistent across nearly all participants, with scores increasing by 6.7 to 20 points. The highest score on the post-test was 86.7, which was

already high on the pre-test but continued to increase. The learning intervention in the reproduction class proved effective in improving the knowledge of adolescent girls, as demonstrated by significant increases between pre-test and post-test scores, both individually and on a group average (Zaimy et al., 2025). The results of the small-scale trial also revealed that some participants, particularly those in the sixth position, had not yet made any progress. Specifically, this participant underwent in-depth study with exercises and assignments until he or she achieved a passing score of 70 (Pijanowski, 2018; Balayong, 2024; Balalle, 2024).

Table 2. The results of a limited-scale trial in the Reproduction Class based on the pre-test and post-test scores.

Assessment	Mean	Min	Max	SD	SE	Average increase	Correlation	Sig	CI 95%	
									Lower	Upper
Pretest	66.7	13.3	80.0	11.9	1.5	15.1	0.121	0.000	-18.3	-11.6
Posttest	81.7	66.6	93.3	7.1	0.9					

Table 2 shows that the learning process in the limited-scale test proceeded quite well. This achievement is evidenced by the average increase in participants' scores, which reached 15 points. This average score represents a 0.7-point increase compared to the small-scale test. Furthermore, the correlation value was also weakly significant at 0.121. Next, an effectiveness test was conducted, yielding an N-Gain score of 0.56, which falls into the moderate effectiveness category. Next, an effectiveness test was carried out, resulting in an N-Gain score of 0.56, which falls within the moderate effectiveness category.

Table 3. The results of a large-scale trial in the Reproduction Class based on pre-test and post-test scores.

Assessment	Mean	Min	Max	SD	SE	Average increase	Correlation	Sig	CI 95%	
									Lower	Upper
Pretest	67.3	33.0	93.0	9.4	0.4	15.5	0.185	0.000	16.6	14.4
Posttest	82.8	47.0	100	7.8	0.4					

The learning outcomes shown in Table 3 demonstrate that the learning process in the Reproduction Class was not significantly different from the previous experiment. The average score increase achieved by participants was 15.54 points, a 0.45-point increase compared to the previous trial. These results indicate that the initially designed class provided benefits, despite only having a weak correlation of 0.185. Based on the N-Gain calculation, the Digital Reproduction Class demonstrated moderate effectiveness with a score of 0.47.

Next, to obtain an overview of participants' assessments of the reproduction class, an evaluation of the application was conducted based on their experiences during the class. The results of this study are presented in Table 4.

Table 4. Participants' Assessments of the Reproductive Classes.

Participant testimonials	Indicator	%
General assessment of adolescents towards reproductive classes	Boring class	14.3
	Innovative classroom	72.5
	An important class for adolescent	98.0
	Add insight	100.0
The material in reproductive health classes that inspired adolescents	Healthy lifestyle	97.0
	Reproductive health	94.0
	Menstrual hygiene management	61.1
	Balanced nutrition	79.0
	Anemia	46.2

The likelihood of participants recommending this class to their friends	★★★★★	38.4
	★★★★	42.4
	★★★	19.2
Reasons participants recommend reproduction classes	The class is cool	87.2
	A trusted source of insight	100
	Increases insight	97.0
	Relieves anxiety	76.0
	Raises awareness of the importance of reproductive health	84.0

Table 4 presents information regarding respondents' assessments of the Reproduction Class. All respondents stated that the Reproduction Class broadened their knowledge, particularly regarding reproductive health. Furthermore, they acknowledged that the materials in the Reproduction Class were a reliable source of information.

In the digital 4.0 era, web-based learning has become one of the most popular educational methods, especially among teenagers. This is because today's youth grow up in an environment that is highly familiar with technology, such as smartphones, tablets, and laptops (Simanjuntak, 2024). This method combines modern technology with the learning process, creating a flexible and interactive learning experience that suits the needs of the younger generation. Web-based learning aligns with the habits of those who frequently use these devices to search for information, play games, or communicate, making it feel more natural and engaging (Bujang et al, 2020; Haleem et al., 2022). One advantage of web-based learning is that it can be accessed anytime and anywhere as long as there is an internet connection (Pour, 2024). This gives teenagers the flexibility to learn on their own schedule, without being tied to a physical location like a school or formal classroom. Web-based learning allows teenagers to access educational resources from around the world, including online courses, video tutorials, and articles from reputable educational institutions (Raouna, 2025).

Web-based learning, rich in information and communication technologies, has become a key foundation of modern education (Hemajothi & Jain, 2022). The introduction of digital classrooms has become a crucial component of the educational landscape. This transformation not only replaces traditional learning methods but also enhances more engaging, personalized, and accessible learning experiences (WHO, 2019; Zou et al., 2023), including social development (Cloete, 2017). Furthermore, digital learning provides an alternative to health promotion activities in preventive efforts (Stark et al, 2022). The future of digital learning presents promising opportunities, with new technologies set to revolutionize healthcare education practices (Zou et al., 2023; Kumbo et al., 2023).

Web-based learning has evolved into a strategic tool for public health promotion and education. This is evident in the availability of digital platforms such as Learning Management Systems (LMS), webinars, mobile apps, and educational social media. Through these platforms, health information can be disseminated quickly, widely, and sustainably (Hendriyanto, 2025). Digital learning models are highly relevant to the context of health system transformation, particularly in the primary care transformation pillar that emphasizes prevention and promotion. The use of web-based learning as a medium for health promotion is essential because it can reach populations who have difficulty accessing health facilities, shorten service times, reduce the burden of curative services, and strengthen public health literacy (Sembada et al., 2022; Alperin, 2023; Hasyim, 2024).

On the one hand, discussions about reproductive health require privacy and separate spaces for each individual, including adolescents. This is because some aspects of reproductive health are still considered taboo. There is a perception in society that sensitive topics surrounding reproductive health are forbidden to discuss openly. As a result, many adolescents struggle to obtain valid information, including the health services they need (Nurjanah, 2024).

In response to this situation, breakthroughs are needed in reproductive health promotion efforts. One such innovation is the digital learning space. This digital reproductive classroom has the potential to serve as an interactive, technology-based learning environment that can bridge the gap between information needs and the digital lifestyles of today's adolescents. Digital learning can provide a more personalized and engaging experience (Zou et al., 2023). Personalization can increase student engagement by up to 30% and reduce training time by nearly 40% (McKinsey, 2021).

Testimonials from participants in the reproductive health classes indicate that attending the classes increased their knowledge and reduced concerns about conflicting information regarding reproductive health. They strongly support the ongoing development and dissemination of these classes as a platform for learning and discussion. Furthermore, the classes provide inspiration, especially in guiding adolescents toward a healthy lifestyle. Overall, these results did not differ significantly from previous research. Android-based mHealth applications have been shown to be beneficial in supporting public health, improving maternal knowledge and practices related to child growth, development, and feeding (Siswati et al., 2024); improving health status and behavioral changes in hypertensive patients (Sun et al., 2024); increasing knowledge about pre-conception preparation (Fibrila et al., 2023); improving patient knowledge about wound care and reducing anxiety related to dressing changes (Chang et al, 2020); improving health-promoting behaviors in the community (Lee et al., 2018); and supporting asthma self-management in adolescents (Kosse et al., 2017).

This study has several advantages, including: 1) Android phones are becoming more useful as a promotional tool to improve health status, as supported by user testimonials stating that reproductive health classes are important for adolescents in the context of reproductive health; 2) The digital class is easy to use, from installation to participation in the learning process; 3) This digital reproductive class not only increases user knowledge but also inspires behavioral change; 4) This digital class is flexible because it can be adjusted to the needs and schedules of users; and 5) This digital class provides awards in the form of certificates for users who have completed and passed the course. One of the successes of utilizing digital applications is their ease of installation and various functions (Rajak & Shaw, 2019; Balalle, 2024). In addition to being a source of information for users, this application is also equipped with a facility to assess the nutritional status of adolescents, allowing users to apply the information learned in real life. Although the reproductive class has many benefits in improving health knowledge, there are still shortcomings that need to be addressed. Some participants felt bored with the classroom learning; this may be due to the lack of interactive and engaging learning media. The monitoring feature is still not available, so some participants did not complete the entire class. Another drawback is that implementing classes in different locations can produce differences in generalizable results. Personalized digital learning is not just a trend but has become a dynamic necessity. Implementing comprehensive e-learning in health promotion efforts can be a more engaging learning alternative. It's time to embark on personalized health promotion as a transformative step toward achieving a healthy and vibrant generation.

4. CONCLUSION

Based on the analysis, this reproduction class has proven effective in increasing adolescent knowledge regarding reproductive health. Widespread use of this application can support adolescent health programs, thereby encouraging the achievement of Sustainable Development Goal 3 (Good Health and Well-Being) by promoting vaccination programs for adolescents and Goal 4 (Quality Education), which utilizes the digitalization of education and internet access as one of the health promotion efforts. Furthermore, the use of this application supports the vision of the Ministry of Health, as outlined in the first pillar, namely the transformation of the primary care sector that focuses on preventive and promotive efforts, and

the sixth pillar, the transformation of health technology. Global implementation of this reproduction class requires widespread socialization among adolescent health program drivers, advocacy with stakeholders, and policy support from local and central governments.

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