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DEVELOPMENT AND VALIDATION OF SIMANIS MOBILE APPLICATION FOR EARLY STI DETECTION AMONG ADOLESCENTS : A DIGITAL HEALTH PROMOTION AND INNOVATION STUDY

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ABSTRACT

The increasing incidence of sexually transmitted infections (STIs) has become more significant among the productive age group. The World Health Organization (WHO) reports that more than one million people are diagnosed with STIs every day, making early detection a crucial step. Preventive efforts include improving knowledge and promoting early detection of STI symptoms; however, many individuals still face difficulties in accessing information related to symptoms, prevention, and treatment. Feelings of shame and the perception that seeking care at health facilities is taboo often result in STI cases being identified at a more advanced stage. Evaluation of health promotion media shows that more than 50% are no longer relevant in the digital era. This study aims to help the public better understand information related to STIs. To develop an Android-based mobile application for the early detection of sexually transmitted infections. This study employed a Research and Development (R&D) design using the 4D model: Define, Design, Develop, and Disseminate. The first year involved evaluating existing health promotion media and identifying strategic issues through focus group discussions (FGDs), followed by application design, expert appraisal, and trials involving 30 respondents. The evaluation revealed that most existing health promotion media were no longer relevant in terms of content, format, and timeliness. The "SIMANIS" mobile application was developed with six main menus: definition, types, symptoms, impacts, transmission, prevention, and self-detection, plus a knowledge questionnaire on STIs. Content validity testing (CVI) by three experts confirmed the application's validity, while the reliability test yielded a Cronbach's Alpha value of 0.728. The "SIMANIS" mobile application is valid, reliable, and can be used by adolescents as well as healthcare institutions. The dissemination phase is planned for 2026

ABSTRAK

Peningkatan insiden infeksi menular seksual (IMS) semakin signifikan di kalangan usia produktif. WHO melaporkan lebih dari satu juta orang didiagnosis IMS setiap hari, sehingga deteksi dini menjadi langkah krusial. Upaya pencegahan mencakup peningkatan pengetahuan dan deteksi dini gejala IMS, namun banyak individu kesulitan mengakses informasi terkait gejala, pencegahan, dan penanganan. Rasa malu dan anggapan tabu untuk mencari pengobatan di fasilitas kesehatan menyebabkan kasus IMS sering ditemukan pada tahap lanjut. Evaluasi terhadap media promosi kesehatan menunjukkan lebih dari 50% sudah tidak relevan di era digital. Penelitian ini diharapkan membantu masyarakat memahami informasi IMS dengan lebih baik. Mengembangkan aplikasi mobile berbasis Android untuk deteksi dini infeksi menular seksual. Penelitian ini menggunakan pendekatan Research and Development (R&D) dengan empat tahap 4D: Define, Design, Develop, dan Disseminate. Tahun pertama mencakup evaluasi media promosi kesehatan dan formulasi isu strategis melalui FGD, dilanjutkan perancangan, penilaian ahli, serta uji coba aplikasi terhadap 30 responden. Hasil evaluasi menunjukkan sebagian besar media promosi kesehatan tidak lagi relevan dari segi isi, format, dan ketepatan waktu. Aplikasi "SIMANIS" dikembangkan dengan enam menu utama: pengertian, jenis, gejala, dampak, penularan, pencegahan, serta deteksi dini mandiri, ditambah menu kuesioner pengetahuan IMS. Hasil uji validitas konten (CVI) oleh tiga pakar menyatakan aplikasi valid, dengan nilai reliabilitas Cronbach Alpha 0,728. Aplikasi "SIMANIS" valid, reliabel, dan dapat digunakan oleh remaja maupun institusi kesehatan. Tahap diseminasi direncanakan pada tahun 2026.

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INTRODUCTION

Sexually Transmitted Infections (STIs) remain one of the major global public health challenges and continue to attract serious attention. According to the World Health Organization (WHO), more than one million new cases of STIs occur every day worldwide (WHO, 2019). This figure highlights the urgency of comprehensive prevention efforts. Adolescents aged 15–24 years are among the most vulnerable groups due to risky sexual behaviors, limited access to reproductive health services, and inadequate knowledge about STI prevention. Previous research has reported that as many as 8% of adolescent boys and 2% of adolescent girls engage in premarital sexual activity, making this group particularly vulnerable to STIs.

In Indonesia, the prevalence of STIs among adolescents remains relatively high and is considered a critical issue. Various national and regional health surveys show an increasing number of cases, with impacts that extend beyond physical health to psychosocial aspects such as stigma, social discrimination, and decreased quality of life (Khairunnisa & Laksmi, 2021; Maharati, E. F., Simanungkalit, K. D., Aritonang, T. W. C., Ingrit, B. L., Silalahi, 2024). Additionally, untreated STIs can lead to severe complications including infertility, pelvic inflammatory disease, and cervical cancer (Puspasari et al., 2023). These complications not only affect individuals but also impose broader public health consequences and long-term economic burdens (Anguzu et al., 2019).

Efforts to reduce the incidence of STIs have largely focused on health promotion and early detection using conventional media such as leaflets and posters. However, adolescents today rely more on online platforms (e.g., websites, Instagram, and other social media) as their main source of reproductive health information rather than conventional media alone (Mohebi et al., 2018). This preference was also reflected in an evaluation at the Plaosan Community Health Centre, where more than 60% of adolescents rated existing health promotion media as irrelevant in terms of information accuracy, format, usability, and timeliness.

With the advancement of digital technology, mobile health innovations are increasingly recognized as effective tools for health education. Mobile health applications (mHealth) have been shown to improve adolescent health literacy and support preventive behaviors (Puspasari et al., 2023; Maharati, E. F., Simanungkalit, K. D., Aritonang, T. W. C., Ingrit, B. L., Silalahi, 2024). Such applications enable adolescents to access accurate health information independently, confidentially, and conveniently, while addressing barriers such as shame or cultural taboos related to visiting health facilities. However, many existing applications still lack educational content and cultural adaptation. Therefore, this study contributes to adolescent health promotion by developing a validated, interactive, and culturally relevant digital tool.

Based on these considerations, this research aims to develop an Android-based mobile application called SIMANIS (Sexually Transmitted Infection Information System). This application is designed not only as an educational medium but also as a self-screening tool for early detection of STI symptoms among adolescents. By integrating expert validation and input from adolescents, teachers, and healthcare providers, SIMANIS is expected to serve as an innovative, valid, contextual, and relevant intervention to address STIs among adolescents in Indonesia.

METHOD

This study employed a Research and Development (R&D) approach using the 4D model: Define, Design, Develop, and Disseminate (Thiagarajan, S., Sammel, D. S., Sammel, 1974 ; Sugiyono, 2020). The Cronbach's Alpha value of 0.728 indicates that the SIMANIS mobile application demonstrates good internal consistency, meaning that the items within the questionnaire measure the same underlying construct of knowledge and awareness related to STIs. This reliability level meets the generally accepted threshold (≥0.70), confirming the stability and dependability of the instrument.

Type of Research

The research applied the R&D approach with the 4D model (Define, Design, Develop, and Disseminate) (Thiagarajan, S., Sammel, D. S., Sammel, 1974 ; Sugiyono, 2020). The study was designed to span two years (2025–2026). In the first year, the focus was on the Define, Design, and Develop stages, which included needs assessment, focus group discussions (FGDs), and expert evaluation. The Disseminate stage, covering dissemination, implementation, and evaluation of application effectiveness, is planned for 2026.

Place and Time of Research

The study was conducted in the working area of Plaosan Community Health Center, Magetan Regency, East Java, from June to September 2025.

Population and Sample

Participants in the needs assessment through FGDs consisted of 20 high school students, 5 teachers, and 5 midwives. For application trials, 30 respondents were involved. In the Focus Group Discussion (FGD) stage, researchers used purposive sampling, which selects participants based on specific criteria relevant to the research objectives. During the application testing phase (developmental testing), simple random sampling was used to select adolescents who would try the SIMANIS application.

Data Collection

Data collection was conducted through several stages in accordance with the 4D model, consisting of three main phases define Phase, evaluation of existing health promotion media (leaflets) was conducted among adolescents, teachers, and midwives using a questionnaire that assessed aspects such as content, information accuracy, format, ease of use, and timeliness. Design Phase, focus Group Discussions (FGDs) were held with adolescents, teachers, and midwives to explore informational needs and formulate strategic issues for developing the "SIMANIS" application. Develop Phase, expert consultations were carried out with three specialists (in IT, reproductive health, and media) to validate the prototype of the "SIMANIS" application. The experts provided feedback regarding technical design, accuracy of health information, and user-friendliness of the media. The instruments used in this study included a structured questionnaire, FGD guidelines, and expert validation sheets. Secondary data from the Plaosan Community Health Center (Puskesmas Plaosan) were also used to describe the research location.

Data Analysis and Processing

Data analysis was conducted using both quantitative and qualitative approaches, which included is descriptive Analysis the characteristics of respondents and results of the evaluation of previous health promotion media were presented in frequency and percentage distribution tables. Content Validity, the application's content was validated using the Content Validity Index (CVI) by three experts. The application was considered valid if CVI > 0.80 (Yusoff, 2019). Reliability Testing, the questionnaire instrument within the application was tested using Cronbach's Alpha, with the reliability criterion being $\alpha \geq 0.70$ (Kadang et al., 2025). Qualitative Analysis, FGD data were analyzed thematically to identify strategic issues and adolescents' information needs. The results of this analysis were used as the basis for developing the application's content and design (Sugiyono, 2020).

RESULT

1. Define Stage

The initial stage in the 4D model is the Define stage, which relates to identifying the requirements for development. This stage involves conducting a needs analysis. In developing the application, the researchers began by gathering information on the extent to which the application development was necessary. The first step, namely the Define stage, was to evaluate the utilization of existing health promotion media. This evaluation was carried out among adolescents, teachers, and midwife practitioners. The following is a flowchart of this study.

The characteristics of the participants involved in evaluating the use of existing health promotion media are presented in Table 1.

Table 1. Characteristics of participants in the evaluation of existing health promotion media (Leaflet on reproductive health)

Characteristics	f (x)	%
Gender		
Male	10	33.3
Female	20	66.7
Age		
15 - 20 years	20	66.7
21 - 25 years	0	0
26 - 30 years	0	0
31 - 35 years	0	0
35 - 40 years	10	33.3
Education		
Senior High School	20	66.7
Diploma (D3)	2	6.6
Diploma (D4)	3	10
Bachelor's	2	6.7
Master's	3	10
Status		
Student	20	66.7
Civil servant	10	33.3

Table 1 shows that the majority of respondents were aged 15–20 years, had student status, and were at the secondary education level.

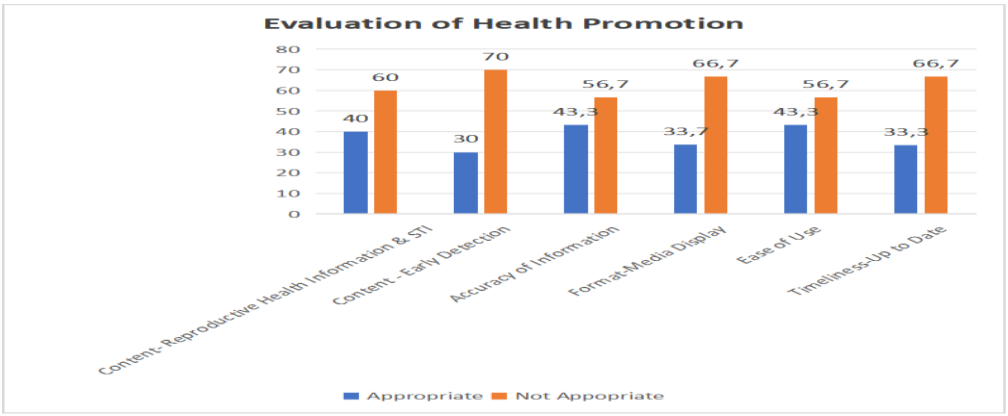

Figure 1. Evaluation of Health Promotion

2. Design Stage

The second stage in the 4D model is the design stage, which consists of four main steps: constructing criterion-referenced tests, media selection, format selection, and initial design. The results of FGD regarding the development of the Android-based mobile application are summarized in Table 2 below:

Table 2. Results of FGDs on the development of the Android-based mobile application

No	Strategic Issue	Possible Causes	FGD Results	Researcher's Review
Content				
1	The understanding that adolescents need education on how to independently detect STIs early	Lack of information on early detection of STIs	Adolescents need education on definition, types, impacts, causes, transmission, and how to independently detect STIs early	Adolescents need education on the definition, types, impacts, causes, and how to independently detect STIs early
2	The understanding that adolescents need support from family and health professionals	Lack of information on early detection of STIs	Adolescents need support to be able to independently detect STIs early	Adolescents need support to understand the definition, types, impacts, causes, and transmission, as well as how to independently detect sexually transmitted infections early.
Accuracy				
1	Have not received education on early detection of STIs	Promotional media used is still conventional	Information delivered must be in accordance with the needs of the target group	Accuracy is needed in the use of media and promotional methods
Format				
1	Existing health promotion media is less communicative	Promotional media used is still conventional	Information delivered should be more communicative (two-way/with feedback)	The promotional media used should be more communicative
Ease of use				
1	Difficulty in understanding information through conventional media	Promotional media used is still conventional	Information should be easy to understand	Ease in understanding information
Timeliness				
1	Information through conventional media is not in line with current developments	Promotional media used is still conventional	Information should be adapted to current developments	Information should be up to date

3. Development Stage (Development of the "SIMANIS" Mobile Application)

The third stage in the 4D model of mobile application development is the development stage (*develop*). This stage consists of two main steps: expert appraisal (expert consultation with revision) and developmental testing (development trials). Expert Appraisal (Expert Consultation)

Consultations with experts were conducted to obtain input for the development of an Android-based mobile application. Two consultations were conducted, involving three experts—one in information technology (IT), one in content, and one in media. Each expert was consulted individually at different times. The recommended menu for the Sexually Transmitted Infections (STIs) application is as follows: one definition, two types, three symptoms, four impacts, five transmission processes, six prevention methods, and seven questionnaires for early detection.

Result of the development of the "SIMANIS" mobile application :

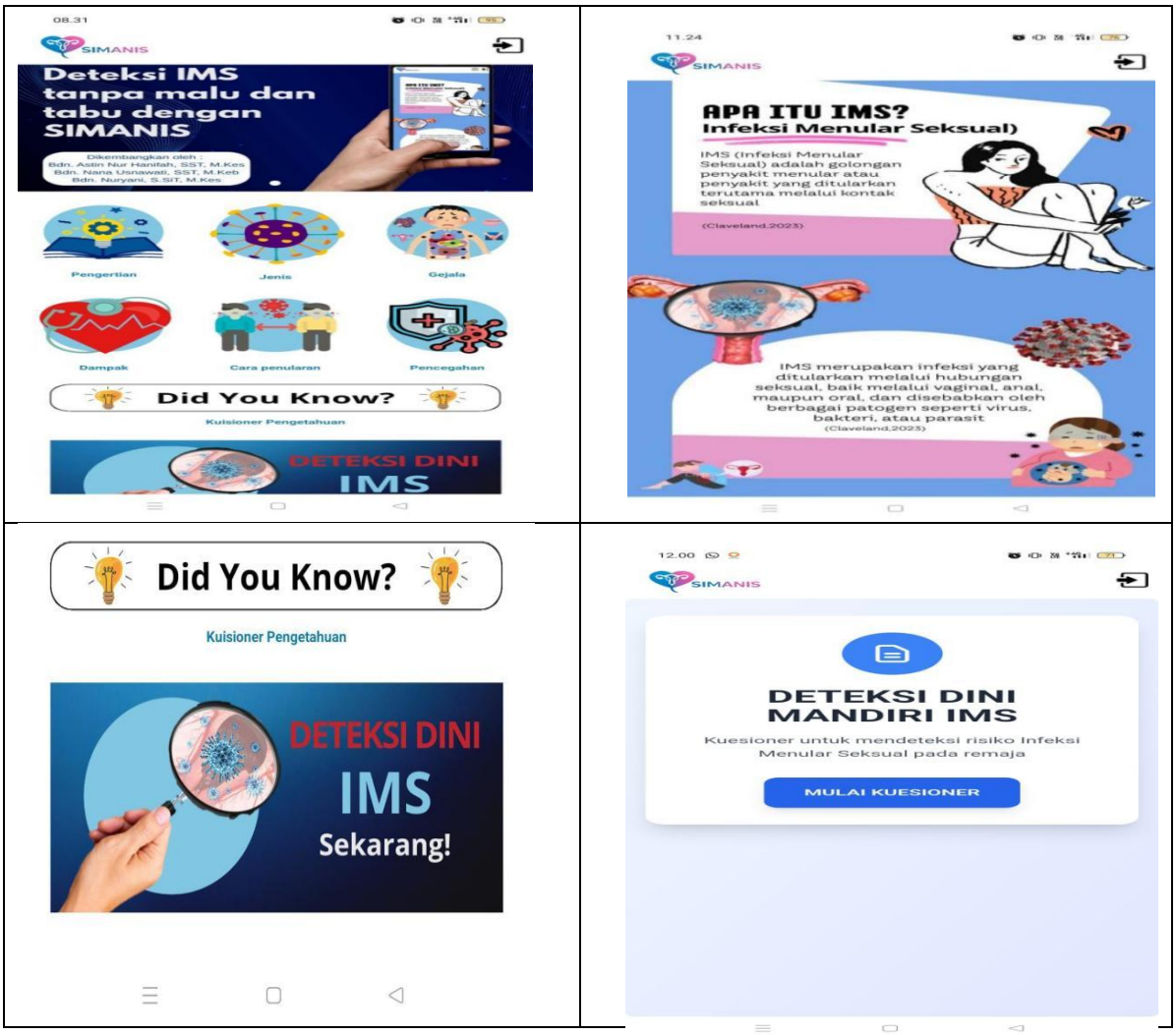

Figure 2 the "SIMANIS" mobile application

The trial of the Android-based mobile application "SIMANIS" was conducted on September 8, 2025. The validity of the application was tested using the Individual Content Validity Index (I-CVI) method. The assessment involved three experts, one in IT, one in content, and one in media, who evaluated each item based on content, accuracy, format, ease of use, and timeliness. Based on the I-CVI results, the "SIMANIS" mobile application was declared valid.

Reliability testing was also conducted to ensure the consistency and dependability of the application, using the Cronbach's Alpha method. The test involved 30 respondents, most of whom were aged 15–20 years, unemployed, and students at the secondary education level. The reliability test produced a Cronbach's Alpha value of 0.728, indicating that the "SIMANIS" mobile application is reliable.

Validity testing of the application was carried out using the Individual Content Validity Index

(I-CVI). Three experts, in IT, content, and media, assessed each item according to the aspects of content, accuracy, format, ease of use, and timeliness. Based on the I-CVI results, the "SIMANIS" mobile application was declared valid. The results are presented in Table 3.

Table 3. Results of the Validity Test of the Android-Based "SIMANIS" Mobile Application

No.	Assessed Aspect	Validity Test Result	Conclusion
1	Content	1.00	Valid
2	Accuracy	1.00	Valid
3	Format	1.00	Valid
4	Ease of use	1.00	Valid
5	Timeliness	1.00	Valid

The reliability test of the Android-based "SIMANIS" mobile application involved a questionnaire administered to 30 adolescent participants. The test was conducted using Cronbach's Alpha to assess the consistency of the instrument. The result showed a Cronbach's Alpha value of 0.728, thus the "SIMANIS" mobile application was declared reliable.

DISCUSSION

1. Define

The initial stage in the 4D model is defining, which relates to identifying development requirements. This stage represents the needs analysis process. In developing the application, the researchers began by collecting information on the extent to which the application development was required. The first stage, define, involved evaluating the utilization of existing health promotion media. This evaluation was conducted on 30 respondents consisting of teachers, adolescents, and midwifery practitioners. The characteristics of the respondents in the evaluation of existing health promotion media (reproductive health leaflet) indicated that most were 15–20 years old, students, and had a secondary education level.

The evaluation of the existing health promotion media was measured using a questionnaire based on five aspects: content, accuracy, format, ease of use, and timeliness, each categorized as *appropriate* or *not appropriate*. The results showed that most respondents stated that the existing health promotion media were not appropriate in terms of these five aspects.

Leaflets are small printed sheets used to convey information briefly and attractively, typically printed on art paper or art carton and often folded in two or more parts. They are commonly used in promotional, educational, or outreach activities by companies, organizations, or individuals. In health promotion, leaflets help health workers avoid repeatedly explaining health information since key messages are already written. When community members ask about a health issue, health workers can simply provide a leaflet so that individuals can read and understand the information independently. However, leaflets also have several limitations compared to other health promotion media. Due to their small size and concise design, the information conveyed must be highly condensed, which can make explanations of complex health topics insufficiently detailed.

In contrast, booklets are health promotion media presented in the form of small books containing both text and images. Booklets allow health workers to provide explanations efficiently, as the information is already written. When community members have questions, health workers can provide booklets that contain the relevant material. However, booklets also have drawbacks, including limited distribution, delayed feedback from target audiences, and the need for more personnel to handle distribution. Additionally, booklets cannot stimulate audio or motion effects, and they are easily damaged, folded, or torn.

Reproductive health books are also used as printed educational media, carefully designed with illustrations and written in simple, concise, and easy-to-understand language. Nevertheless, they are limited by the restricted amount of information they can contain and the lack of specificity in some topics.

2. Design

The second stage of the 4D model is design. This stage involves four steps: constructing criterion-referenced tests, media selection, format selection, and initial design. This development research resulted in an Android-based educational medium in the form of a mobile application developed using the Jagel application-building software. The Jagel.id platform allows users to easily create Android applications without requiring technical knowledge of servers, coding, or other complex programming processes. Applications can be developed quickly and published on the Google Play Store in a relatively short time. The mobile application was developed in the Apk format. Apk (Android Package Kit) is the file format used by the Android operating system for the installation and distribution of mobile applications. The Apk file is a ZIP archive containing all files and directories necessary for installing an application on an Android device. Some of the important functions of an Apk file include: a) Application distribution – Apk files are used to distribute Android applications and games, which users can download and install directly. b) Installation flexibility – Users can install applications without accessing the Google Play Store, which is beneficial for individuals with limited internet access or devices not registered with Google Play. c) Application updates – Apk files allow developers to release optimized versions and update applications with new features without going through the Play Store.

The educational mobile application developed in this study can run on smartphones with the Android operating system. The information displayed in the application focuses on the early detection of Sexually Transmitted Infections (STIs). The content was designed based on the results of Focus Group Discussions (FGDs) regarding user needs, with supporting information obtained from various reproductive health and STI references. The developers of this application were the researchers: Astin Nur Hanifah, Nana Usnawati, and Nuryani.

3. Develop (Development of the Android-Based Mobile Application)

The development of the mobile application was carried out through FGDs and expert consultations. This process was based on the evaluation of existing health promotion media. The application was designed around strategic issues identified in the FGDs, with particular attention to aspects of content, accuracy, format, ease of use, and timeliness. The recommendations emphasized the importance of including information about the early detection of sexually transmitted infections, ensuring that the information delivered was accurate, relevant, targeted, and up to date, while using a more communicative and user-friendly medium.

The validity test of the application was conducted using the Individual Content Validity Index (I-CVI). The assessment was performed by three experts in information technology, content, and media, who evaluated each item based on content, accuracy, format, ease of use, and timeliness. The results showed that the SIMANIS mobile application was valid. Reliability testing was conducted using Cronbach's Alpha to ensure the application's consistency. This test involved 30 respondents, most of whom were adolescents aged 15–20 years, unemployed, students, and with secondary education. The results yielded a Cronbach's Alpha value of 0.728, indicating that the SIMANIS mobile application was reliable.

Two principles must be considered in the development of instruments: validity and reliability. Validity refers to the accuracy and precision of measurement results. There are three types of validity: content validity, criterion validity, and construct validity. Content validity is defined as the extent to which the elements of an assessment instrument are relevant to and represent the construct being measured for a particular purpose. It is commonly assessed through rational analysis by a competent panel or expert judgment. Reliability, on the other hand, refers to the consistency of measurement results when the same variables are measured repeatedly at different times. Both the tools and methods used in measurement play a crucial role. Testing validity and reliability is essential to ensure that an instrument accurately measures what it intends to measure and provides credible data.

The Android-based mobile application developed by the researchers was designed based on field studies to help users access comprehensive information on reproductive health and early detection of STIs. The study revealed that conventional health promotion media such as leaflets were perceived as less relevant by adolescents in terms of content, accuracy, format, and ease of use. More than 60% of respondents stated that leaflets did not meet their needs for accurate and up-to-date information. These findings are consistent with (Khairunnisa & Laksmi, 2021), who emphasized that health promotion media must adapt to technological developments and adolescent preferences to be effective.

The results also indicated that conventional media were no longer relevant for STI education. This finding aligns with (Puspasari et al., 2023), who reported that adolescents are more responsive to digital media. The development of a mobile application as a health education medium corresponds with the increasing trend of smartphone use in Indonesia (Wijaya, 2014). The SIMANIS application supports efforts to improve adolescents' knowledge of STIs, consistent with the studies of (Khairunnisa & Laksmi, 2021; Maharati, E. F., Simanungkalit, K. D., Aritonang, T. W. C., Ingrit, B. L., Silalahi, 2024), who emphasized the importance of technology-based educational interventions. The application has the potential to become an innovative tool for STI prevention, although its effectiveness must still be proven through field trials and evaluations of user behavior (Sondhi & Devgan, 2013; Wayne & Ritvo, 2014).

The FGDs also revealed that adolescents prefer educational media that are interactive and easily accessible. This is consistent with (Maharati, E. F., Simanungkalit, K. D., Aritonang, T. W. C., Ingrit, B. L., Silalahi, 2024), who highlighted the importance of digital health promotion in improving knowledge and preventive behaviors among adolescents. Similarly (Puspasari et al., 2023) found that mobile applications can enhance health literacy and adolescent engagement in reproductive health programs. The app has been shown to effectively maintain adolescent reproductive health knowledge and attitudes (Anggela et al., 2022; Benoit et al., 2022). A related study in Thailand on reproductive health education via mobile messaging for 24 weeks showed a significant increase in the intervention group's health literacy scores ($p<0.05$), while no changes were observed in the control group. Significant improvements were seen across all four domains of sexual health literacy (Kumar et al., 2021).

The application has proven to be a flexible and efficient learning medium, helping improve students' understanding of human reproduction through interactive features and comprehensive educational materials (Djunaedi et al., 2024; Yusti et al., 2019; Angesti et al., 2025; Hermawan, Aan; Daniah, Daniah; Sabaruddin, 2023). Results also indicated that digital methods (serious games and gamified learning) were far more effective in increasing student knowledge, motivation, and participation than traditional methods, supporting the notion that adolescents are more responsive to technology-based media (Haruna et al., 2021).

The development of the SIMANIS application as an Android-based medium with seven main menus—definition, types, symptoms, impacts, transmission, prevention of STIs, and a knowledge questionnaire—directly addresses these needs. The high content validity index (CVI > 0.8) obtained from expert assessments indicates that the application has strong validity in terms of content, media, and technology. This aligns with the findings of (Mohebi et al., 2018), which showed that teenagers rely more on online platforms (such as websites and Instagram) as sources of reproductive health information than on conventional media.

Although the SIMANIS application has not yet undergone field testing, the development results demonstrate that digital applications can overcome the limitations of conventional media. This is supported by (Risma Oktaria & Evi Martha, 2023), who reported that mobile health applications are effective in reaching young populations that are more familiar with smartphones than printed media. Therefore, the SIMANIS application is expected to improve adolescents' understanding and preventive behaviors related to STIs. Its implementation and evaluation in 2026 will be crucial to assess its real-world impact.

CONCLUSION AND SUGGESTION

The SIMANIS mobile application was successfully developed up to the development stage and validated by experts. A field trial is scheduled for September 2025. The evaluation of existing health promotion media revealed that most were not appropriate in terms of content, accuracy, format, ease of use, and timeliness. The development of the SIMANIS mobile application includes six main menus providing information on the definition, types, symptoms, impacts, transmission, prevention, and self-detection of sexually transmitted infections, supplemented with a knowledge questionnaire. The SIMANIS application offers interactive, accurate, and adolescent-oriented information on STIs. The validation and reliability tests confirmed that the SIMANIS mobile application is valid, reliable, and user-friendly.

The SIMANIS mobile application is expected to serve as an effective tool for adolescents to access information on reproductive health and early detection of sexually transmitted infections. It can

also be utilized by midwifery practitioners and applied in schools, community health centers (Puskesmas), and adolescent health programs as an educational medium for reproductive health and early STI detection. The dissemination stage of the application will be conducted in the second year (2026), encompassing application outreach, implementation, expert consultation and revision, and the development of recommendations for broader use.

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