

Strategies for Utilising Technology to Improve Reproductive Health Knowledge among Adolescents: A Scoping Review

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Received: November 18, 2025; Accepted: December 20, 2025; Available online: January 16, 2026

ABSTRACT

Background: Adolescents are a vulnerable age group when it comes to reproductive health issues due to their lack of knowledge and limited access to accurate and comprehensive information. With the rapid development of digital technology, adolescents are increasingly active in using social media, applications, and the internet to search for information, including information related to reproductive health. This study aims to explore scientific evidence on strategies for leveraging technology to enhance reproductive health knowledge among adolescents.

Subject and Method: A scoping review approach was employed, following the Arksey & O'Malley framework, which includes the following steps: identifying research questions, identifying relevant articles, selecting articles, mapping data, compiling data, summarising, and reporting results. The search strategy used Boolean operators and MeSH with keywords: ("Strategy" OR "Digital Intervention") AND ("Reproductive Health") AND ("Adolescent" OR "Teenager") AND ("Sexual Health Knowledge"). This review identified 881 articles that were selected based on inclusion and exclusion criteria found using databases such as PubMed, ScienceDirect, EBSCO, and grey literature from relevant websites from Taylor & Francis, Google Scholar, and Research Rabbit, resulting in 12 articles.

Results: The synthesis results grouped technology utilisation strategies into three main themes: (1) digital innovations such as social media, interactive applications, and SMS, which play an effective role in increasing adolescents' knowledge; (2) supportive social roles, such as the involvement of parents, teachers, and peers as facilitators of educational technology utilisation; and (3) structural and social barriers such as limited access, cultural norms, and low family involvement, which hinder the delivery of reproductive health information.

Conclusion: The use of digital technology has proven to be a relevant and effective strategy in improving reproductive health knowledge among adolescents, especially when supported by the active role of families, educational institutions, and the social environment to ensure its effectiveness in shaping healthy behaviour among adolescents in the digital age.

Keywords: reproductive health, adolescent, health education, sexual health knowledge

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Cite this as:

Nova WI, Astuti AW, Ismail D (2026). Strategies for Utilising Technology to Improve Reproductive Health Knowledge among Adolescents: A Scoping Review. *J Health Promot Behav.* 11(01): 92-111. <https://doi.org/10.26911/thejhp.2026.11.01.08>.



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BACKGROUND

Knowledge is an individual's awareness of facts, practical skills, and familiarity with certain objects or situations. Knowledge can be acquired in various ways, including through sensory perception, introspection of mental states, and social and environmental interactions (Ardini, 2025). In the context of health education, knowledge plays a central role in shaping healthy attitudes and behaviours, including in the area of adolescent reproductive health (Nopyanti *et al.*, 2023).

Globally, adolescents aged 10–19 face significant challenges related to reproductive health. More than 16 million adolescent girls in this age group give birth each year, and adolescent pregnancy is the leading cause of death among young women in developing countries. This alarming statistic highlights the urgent need for improved access to education, healthcare, and support services. By empowering young people with knowledge and resources, we can work towards reducing adolescent pregnancies and fostering healthier futures for all (World Health Organization, 2018). Less than 50% of adolescents worldwide receive comprehensive sexual health education, leaving them unprepared to deal with bodily changes, the risk of sexually transmitted infections, and sexual abuse (UNESCO, 2021). Policy facilitators play a crucial role in promoting the integration of digital technology into reproductive health education strategies. They recommend digital approaches as a means of reaching increasingly digitized youth populations, while emphasizing the importance of participatory, evidence-based interventions that are sensitive to local cultures (UNICEF, 2023). Sex education remains fragmented and is not structurally supported by progressive policies, so technology-based interventions often run independently

without support from formal education or health systems (UNFPA, 2022).

Lack of coordination among stakeholders, limited training for teachers and health workers, and the lack of parental involvement in the educational process are obstacles to creating a holistic and sustainable approach (Sewak *et al.*, 2023). In Southeast Asia, the issue of adolescent knowledge about reproductive health is also still very concerning. More than 60% of adolescents do not understand the function of reproductive organs, the process of puberty, or how to maintain reproductive health in general. And most adolescents do not maintain their reproductive health properly. Approximately 30% of adolescent girls and 43% of adolescent boys do not pay attention to their reproductive health, and some have been exposed to deviant sexual behavior (Balumbi *et al.*, 2025). This internet access is utilized by adolescents not only for socializing through social media platforms such as Instagram, Facebook, TikTok, WhatsApp, and Telegram, but also for seeking information, including health-related information (Huda, 2021).

Teenagers are often not very selective in choosing valid and reliable sources of information. Digital technology is an important skill that teenagers must have in order to understand and utilize information appropriately and effectively (Sawedi, 2025). Therefore, integrative psychosocial education and health services are essential to build resilience among adolescents in these vulnerable situations (Jumiati, 2025). Teenage girls' knowledge about reproductive health remains relatively low. Many of them are unaware of the importance of maintaining reproductive organ health due to limited access to information or because they feel embarrassed to ask teachers, parents, or peers (Goh *et al.*, 2022). However, knowledge about reproductive health

is crucial as a foundation for developing healthy and responsible behavior. The lack of understanding contributes to high rates of reproductive health issues, including high maternal and infant mortality rates during childbirth (Rajasa *et al.*, 2020).

Knowledge and understanding of reproductive health are important to instill in adolescents, especially millennials who are growing up amid rapid developments in the digital world. Although their access to technology is increasingly widespread, adolescents' level of knowledge about reproductive health is still relatively low (Dowling *et al.*, 2025). The lack of formal education in this area makes adolescents vulnerable to misinformation, risky sexual behavior, and online sexual harassment. On the other hand, digital technology has great potential as an educational tool if used strategically and wisely. Therefore, integrating technology into educational strategies presents an important opportunity to enhance knowledge, raise awareness, and prevent sexual misconduct and various reproductive health challenges faced by adolescents in the digital age (Aventin *et al.*, 2020).

Based on the above phenomena, it is necessary to scope a topic that specifically discusses strategies for utilizing technology to improve reproductive health knowledge among adolescents. The purpose of this study is to explore scientific evidence on strategies for utilizing technology to improve reproductive health knowledge among adolescents by incorporating relevant evidence sources from each article found.

SUBJECTS AND METHOD

1. Study Desain

This study employed a scoping review design guided by Arksey & O'Malley's methodological framework and reported according to the PRISMA-ScR guideline.

This approach allows researchers to systematically map existing literature on a topic to identify key concepts, research gaps, and evidence types (Arksey and O'Malley, 2005). This review is guided by the question 'How can technology be utilized to improve reproductive health knowledge among adolescents?' which aims to map the literature on the topic of technology utilization strategies to improve reproductive health knowledge among adolescents.

2. Population and Sample

This review used the Population, Concept, Context (PCC) framework to define its focus and guide the search strategy, with adolescents as the (Population), digital interventions to improve reproductive health knowledge as the (Concept), and studies from all regions as the (Context). Articles were included (1) if they were published in English between 2015 and 2025; (2) in peer-reviewed or open-access journals; (3) reported primary research on technology-based strategies to enhance reproductive health knowledge. Studies were excluded if they were reviews, commentaries, opinion papers, or conference abstracts without full data.

3. Study Variables

The key variables examined across the included studies consisted of:

Reproductive and sexual health knowledge, assessed through indicators such as improvements in awareness, attitude, and practices related to puberty, menstruation, contraception, pregnancy prevention, and sexually transmitted infections.

Technology-based interventions, referring to the use of digital tools and strategies such as mobile applications, SMS or text messaging, social media platforms, interactive websites, and other online resources designed to enhance adolescents' reproductive health knowledge.

Adolescents, defined as individuals aged 10-19 years according to the WHO definition. Studies involving a broader age group were included if adolescents represented the majority of participants or if subgroup data specific to this age group were reported.

4. Study Instruments

Data for this review were obtained from PubMed, ScienceDirect, EBSCO, and supplementary sources such as Taylor & Francis, Google Scholar, and Research Rabbit. A structured keyword search was conducted using Boolean operators and MeSH terms. The core keywords included: “strategy” OR “digital intervention” AND “reproductive health” AND (“adolescent” OR “teenager”) AND “sexual health knowledge”. Filters were applied to limit results to namely articles published in the last 10 years (2015-2025) and articles in English, as well as exclusion criteria, namely review articles, opinion articles, and previously determined review articles. This search strategy was systematically developed to capture all relevant literature on the use of digital and technology-based interventions for improving reproductive and sexual health knowledge among adolescents.

5. Data Analysis

Data from the selected studies were synthesised through a systematic process. Two independent reviewers conducted the screening, extraction, processes to minimise bias and enhance validity. Any disagreements were resolved through discussion until consensus was reached. The analysis process followed the scoping review framework, and the overall selection of articles was documented using a PRISMA-ScR flowchart was applied to illustrate the process of article identification, screening, eligibility assessment, and final inclusion of studies.

6. Study Selection

Based on Figure 1, the study selection process began with a comprehensive search

across multiple sources. Articles were identified through three main databases: PubMed (n = 191), ScienceDirect (n = 185), and EBSCO (n = 171). In addition, grey literature was explored through Taylor & Francis (n = 157), Google Scholar (n = 164), and Research Rabbit (n = 13). This process resulted in a total of 881 records identified. During the initial screening, 58 duplicate records were removed, leaving 823 articles for further review. Titles and abstracts were then screened for relevance, which led to the exclusion of 755 articles that were not aligned with the research focus or objectives. The remaining 68 full-text articles were assessed for eligibility. After a detailed evaluation, 56 articles were excluded due to various reasons, such as inappropriate study settings, non-adolescent populations, irrelevant interventions, or being review articles. At the end of this process, 12 studies met all criteria and were included in the final synthesis.

7. Included Studies

The studies included in this review were conducted across diverse geographical settings, with the majority originating from developing countries. A total of 12 studies came from developing countries, including Indonesia (n = 5), India (n = 1), Nigeria (n = 1), Uganda (n = 1), and African (n = 2) and developed countries United States (n= 1) and New York (n=1). In contrast, only one study was conducted in a developed country, namely the United States. This distribution shows that research on the use of technology to improve adolescent reproductive health knowledge has been more extensively explored in developing countries, where gaps in formal reproductive health education and access to reliable information remain significant challenges. Meanwhile, the single study from a developed country provides a comparative perspective, highlighting differences in resources, digital

infrastructure, and implementation approaches.

8. Critical Appraisal

Following the selection process, the methodological quality of the included studies was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal tools and the Mixed Methods Appraisal Tool (MMAT), which were applied according to the type of research design. This process aimed to ensure that the evidence synthe-

sised in this review was based on reliable and well-structured studies. The included studies represented a variety of research designs, consisting of qualitative studies, randomized controlled trials (RCTs), quasi-experimental studies, cross-sectional studies, and mixed-methods studies. Most studies demonstrated strong methodological quality, with clear research objectives, appropriate study designs, and comprehensive reporting.

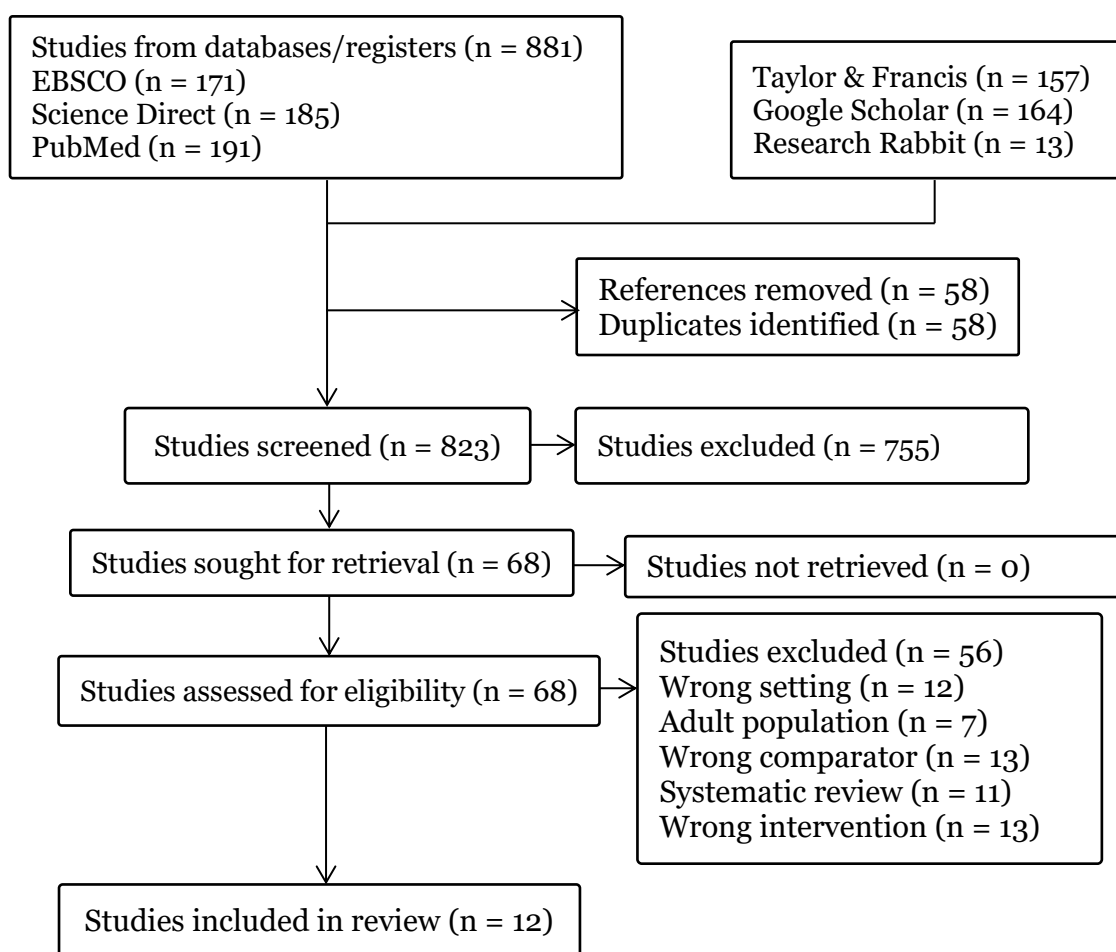


Figure 1. Prisma Flow Chart Diagram

RESULTS

The flowchart illustrates the step-by-step process of article identification, screening, eligibility, and final inclusion. It begins with records gathered from multiple databases and additional sources, followed by the removal of duplicates. Titles and abstracts

were then screened to exclude irrelevant studies, and full-text articles were assessed in detail using predefined inclusion and exclusion criteria. This process ensured a transparent and systematic selection, resulting in the final studies included for synthesis.

Based on Table 1, twelve studies were included in this review, examining a range of digital and technology-based interventions designed to enhance adolescents' knowledge of reproductive health. Setianti et al. (2017) explains this descriptive qualitative study explored the role of social media in adolescent reproductive health education. Findings revealed that while social media is a key source of information, cultural taboos and parental resistance limit open discussions. The study highlights the need for a blended approach combining technology with interpersonal communication and family involvement. This indicates that social media alone cannot fully address reproductive health knowledge gaps. Cilubai and Maheswari, (2024) using the Solomon Four Group design, this study demonstrated that animated videos and interactive content on platforms like YouTube and Instagram significantly improved adolescent reproductive health knowledge. The varying levels of effectiveness across platforms suggest that the choice of medium influences learning outcomes. This finding is particularly relevant in tailoring interventions to adolescents' digital habits. Chernick et al. (2022) through an exploratory qualitative design, this study introduced Instagram-based digital comics co-created with adolescents. The participatory approach enhanced content relevance and engagement, as participants reported the materials to be relatable and educational. This underscores the value of youth involvement in designing digital interventions to increase their impact and acceptance.

Martínez-García et al. (2023) this randomized controlled trial evaluated the Crush mobile application, showing improvements in knowledge, attitudes, and confidence regarding contraceptive use. However, behavior change was limited due to the low sexual activity levels of participants.

These results suggest that digital interventions may need extended follow-up and integration with other strategies to influence behaviors effectively. Ismail et al. (2024) focusing on the Flo menstrual tracking app, this qualitative study found that adolescents valued features such as cycle prediction and symptom tracking. Barriers included premium feature restrictions and complex medical terminology. This emphasizes the importance of accessibility and language simplicity in developing technology for health education. Djannah et al. (2020) using a one-group pretest-posttest design, this study demonstrated that audio-visual media effectively improved reproductive health knowledge among students. The findings support the integration of multimedia tools into both formal education and informal counseling sessions to enhance learning outcomes.

Kosasih et al. (2024) this quasi-experimental study compared LINE and WhatsApp-based interventions, both of which successfully improved adolescents' knowledge, attitudes, and behaviors related to reproductive health. LINE yielded slightly better results, suggesting that platform selection should be guided by usability and adolescent preferences to maximize effectiveness. Wirsy et al. (2022) an RCT in a low-resource setting showed that weekly SMS interventions significantly enhanced knowledge, attitudes, and practices related to reproductive health. The high satisfaction rates among participants demonstrate that SMS is a cost-effective and scalable solution for areas with limited internet access, addressing digital inequality in health education.

Francis et al. (2019) using mixed-methods study revealed high mobile phone ownership and internet access among adolescents. While many sought reproductive health information, a significant know-

ledge gap remained, particularly regarding available youth-friendly services. This highlights the importance of connecting digital information to tangible health resources and services.

Macharia et al. (2021) the study identified challenges with traditional SRH information sources, such as incomplete or biased content and lack of privacy. Adolescents expressed a need for discreet and reliable digital platforms, pointing to mobile technology as a promising alternative. This aligns with the global push for private and accessible reproductive health solutions. Byansi et al. (2023) Qualitative findings indicated that economic pressures and peer

influence drive adolescent sexual activity. While basic knowledge of reproductive health was present, myths and stigma persisted, particularly regarding HIV. This demonstrates the necessity for culturally sensitive digital tools that address misinformation while respecting local values. Syam et al. (2021) This cross-sectional study found widespread social media use for reproductive health information, with Instagram and websites being the most popular platforms. Despite high usage, varying knowledge levels indicated that access alone does not guarantee understanding, emphasizing the need for structured and accurate digital education content.

Table 1. Data charting

No	Authors (Year)	Country	Study Design	Population (P)	Concept (C)	Context (C)	Key Notes
A1	Setianti et al. (2017)	Indonesia	Descriptive Qualitative	Adolescents and key informants with knowledge of reproductive health communication	Use of social media for reproductive health education	Urban setting with cultural taboos surrounding reproductive health	Adolescent awareness of reproductive health remains low due to cultural taboos and parental attitudes. Social media serves as the main channel for seeking reproductive health information, enabling access to resources and consultations with youth volunteers. However, social media alone is insufficient to change behavior; a combination of interpersonal communication, family involvement, and credible information sources is needed for effective interventions.
A2	Cilubai and Maheswari (2024)	India	Experimental - Solomon Four Group Design	Adolescents using various social media platforms	Social media-based interventions	Online platforms popular among teenagers	Social media-based interventions significantly improved adolescents' reproductive health knowledge. Animated videos on YouTube were the most engaging format, while interaction through comments increased learning. Differences in effectiveness were noted across platforms, showing that platform preference plays a role in successful delivery of health information.
A3	Chernick et al. (2022)	New York	Exploratory Qualitative	Female adolescents aged 14–19	Female adolescents aged 14–19	Urban, high-income setting with active social media engagement	Peer-generated digital comics on Instagram addressed topics such as pregnancy prevention, condom negotiation, myths about contraception, and healthy relationships. Most participants found the content relatable and educational, suggesting that interventions co-designed with adolescents increase acceptance and impact.
A4	Martínez-García et al. (2023)	United States	Randomised Controlled Trial (RCT)	1,210 adolescent girls aged 14–18	Mobile application ("Crush")	Online recruitment through social media ads, U.S. context	The Crush mobile app improved confidence, self-efficacy, and attitudes toward contraceptive use at three and six months. However, behavior change was limited because many participants were not sexually active. The study demonstrated that digital interventions can influence knowledge and attitudes, but behavior shifts may require longer follow-up or additional strategies
A5	Ismail et al. 2024)	Indonesia	Descriptive Qualitative	Female adolescents aged 14–19 actively using Flo app	Menstrual health tracking app for education and awareness	Technology adoption in adolescent menstrual health management	The Flo menstrual tracking app increased confidence in managing menstrual health and provided useful features such as cycle prediction and symptom tracking. Challenges included limited access to premium features and complex medical terminology, indicating the need for further development to improve usability and accessibility.

No	Authors (Year)	Country	Study Design	Population (P)	Concept (C)	Context (C)	Key Notes
A6	Djannah et al. (2020)	Indonesia	One-Group Pretest-Posttest (Experimental)	153 students (grades 1–3 high school)	Audio-visual media	Formal school education setting	Audio-visual media significantly increased reproductive health knowledge among students. The study recommended using such media in schools and informal counseling to enhance adolescents' understanding of sexual and reproductive health (SRH) topics.
A7	Kosasih (2024)	Indonesia	Quasi-Experimental	154 high school students (two intervention groups)	LINE vs. WhatsApp-based interventions	High school adolescents at risk of early marriage, drugs, and HIV/AIDS	LINE and WhatsApp interventions effectively improved knowledge, attitudes, and behaviors related to the Adolescent Reproductive Health Triad (ARH Triad). LINE showed slightly greater improvements in outcomes, suggesting that platform selection may influence effectiveness.
A8	Wirsiy et al. (2022)	Afrika	Randomized Controlled Trial (RCT)	398 adolescent girls	SMS-based education	Low-resource setting with limited internet access	Weekly SMS messages significantly improved knowledge, attitudes, and practices related to SRH among adolescent girls in Cameroon. The majority of participants were satisfied with this method, showing that SMS is a low-cost, scalable solution in areas with limited internet access.
A9	Franciset al. (2019)	Nigeria	Mixed-Methods (Quantitative & Qualitative)	1,342 adolescents aged 10–24, both in and out of school	Mobile technology use for accessing SRH information and services	Rural and urban adolescents in diverse settings	Around 66% of adolescents reported internet access, with over 75% owning mobile phones. 42.7% sought SRH information or services in the past year, mainly related to HIV prevention, contraception, pregnancy, and menstruation. Despite high access, many adolescents were unaware of youth-friendly health service locations, showing a gap between information availability and practical use.
A10	Macharia et al. (2021)	Afrika	Exploratory Qualitative	133 adolescents aged 15–19	Mobile phone technology as alternative source of SRH information	Areas with limited privacy and access to reliable SRH information	Adolescents primarily relied on traditional media, schools, peers, and parents for SRH information. However, these sources were often incomplete or biased. Limited privacy and cultural barriers hindered help-seeking behaviors, highlighting the need for private, reliable, and technology-based solutions.
A11	Byansi et al. (2023)	Uganda	Descriptive Qualitative	32 adolescent girls aged 14–17, secondary school students	Exploring SRH behaviors and literacy to inform mHealth solutions	Family and school environment with sociocultural influences	Adolescent girls in Uganda reported engaging in sexual activity mainly for economic reasons. Peer pressure and lack of parent–child communication were also influential factors. While knowledge of pregnancy and contraception was moderate, myths and stigma persisted, especially regarding HIV. This emphasizes the need for culturally sensitive digital education.

No	Authors (Year)	Country	Study Design	Population (P)	Concept (C)	Context (C)	Key Notes
A12	Syam et al. (2021)	Indonesia	Cross-Sectional Quantitative	100 high school students	Social media utilization for reproductive health information	School setting with high social media penetration	Social media was widely used for reproductive health information, with 91% of respondents reporting usage. Instagram and websites were the most popular platforms. Despite high usage rates, knowledge levels varied, with 40% showing moderate knowledge, 34% good, and 26% poor, suggesting that access alone does not guarantee understanding.

Table 2 summarises the results of the critical appraisal for each included study using the Joanna Briggs Institute (JBI) Critical Appraisal Tools and the Mixed Methods Appraisal Tool (MMAT). The researcher categorised the value of the article based on the total score obtained from the critical appraisal results. This aims to determine the quality of the reviewed articles. Critical appraisal is used to systematically and quickly assess the relevance of an article and transform professionals in making important clinical decisions for the next step (Al-Jundi and Sakka, 2017). The researcher's reference in using critical appraisal is to

determine the category or value criteria for each question with the following limitations: 0= No answer, 1 = Narrated but not done, 2= Narrated but unclear/incomplete, and 3= Narrated, complete, and detailed. The total score was then compared to predetermined ranges to classify studies into A (Very Good), B (Good), or C (Less Good). Most studies were rated Grade A, indicating high methodological quality, while a few were rated Grade B and no studies received a Grade C, showing that all included evidence was methodologically acceptable for synthesis.

Table 2. Critical Appraisal Scores of Included Studies

Authors (Year)	Research Method	Total Questions	Score Range (Grade)	Results (Article)
(Setianti et al., 2017)	Qualitative	10	A = 25–30 B = 19–24 C ≤ 18	28 (A)
(Cilubai and Maheswari, 2024)	Quasi-experimental	9	A = 22–27 B = 16–21 C ≤ 15	21 (B)
(Chernick et al., 2022)	Qualitative	10	A = 25–30 B = 19–24 C ≤ 18	25 (A)
(Martínez-García et al., 2023)	RCT (Randomized Controlled Trial)	13	A = 31–39 B = 23–30 C = ≤22	34 (A)
(Ismail et al., 2024)	Qualitative	10	A = 25–30 B = 19–24 C ≤ 18	22 (B)
(Djannah et al., 2020)	Quasi-experimental	9	A = 22–27 B = 16–21 C ≤ 15	20 (B)
(Kosasih, 2024)	Quasi-experimental	9	A = 22–27 B = 16–21 C ≤ 15	23 (A)
(Wirsiy et al., 2022)	RCT (Randomized Controlled Trial)	13	A = 31–39 B = 23–30 C = ≤22	33 (A)
(Francis et al., 2019)	Mixed-methods	27	A = 65–81 B = 49–64 C ≤ 48	77 (A)
(Macharia et al., 2021)	Qualitative	10	A = 25–30 B = 19–24 C ≤ 18	27 (A)

Authors (Year)	Research Method	Total Questions	Score Range (Grade)	Results (Article)
(Byansi et al., 2023)	Qualitative	10	A = 25–30 B = 19–24 C ≤ 18	27 (A)
(Syam et al., 2021)	Cross-sectional	8	A = 19–24 B = 13–18 C ≤ 13	20 (A)

Theme

Based on the analysis of article themes conducted after data analysis through data charting and quality assessment of research articles, the themes of the selected research articles were identified.

Based on the analysis of the included studies, three main themes were identified, each highlighting critical aspects of technology-based strategies for improving adolescent reproductive health education.

Digital Innovation in Adolescent Health Education This theme focuses on the use of digital platforms to enhance reproductive health knowledge. Social media such as YouTube, Instagram, and WhatsApp (A1, A2, A3, A7, A12) served as effective tools for delivering educational content and facilitating peer discussions. Interactive applications like Crush and Flo (A4, A5, A6) provided personalized features for learning and menstrual health management. Meanwhile, mobile technology and SMS interventions (A8, A9, A10) were valuable for

reinforcing health messages, particularly in low-resource settings with limited internet access.

Social Roles in Supporting Adolescent Health Education Family, schools, and peers play a vital role in supporting adolescents’ engagement with digital education. Families and educational institutions (A2, A5, A6, A9, A12) guide safe and meaningful use of technology, while peer networks (A1, A3, A7, A12) act as trusted sources of information and emotional support, encouraging open discussion of sensitive reproductive health topics.

Constraints in Delivering Reproductive Health Education Several barriers limit the effectiveness of digital interventions, including restricted access to reliable information and resources (A6, A10, A11). These challenges are often linked to cultural taboos, socioeconomic disparities, and inadequate digital infrastructure, emphasizing the need for comprehensive and accessible strategies.

Table 3. Analysis and Mapping of Research Article Themes

No	Theme	Sub Theme	References
1.	Digital Innovation in Adolescent Health Education	1. Social media as a tool for adolescent reproductive health education 2. Interactive media application for adolescent reproductive health education 3. Mobile technology and SMS for information reinforcement	A1, A2, A3, A7, A12 A4, A5, A6 A8, A9, A10
2.	Social roles in supporting adolescent reproductive health education	1. The Role of Family and Educational Institutions in Accompanying the Use of Educational Technology	A2, A5, A6, A9, A12

No	Theme	Sub Theme	References
		2. Peer Relationships as a Source of Information and Emotional Support	A1, A3, A7, A12
3.	Constraints in the Delivery of Adolescent Reproductive Health	1. Limited access to information & education 2. Influence of cultural norms and non-open communication 3. Economic support and family involvement in reproductive health education	A6, A10, A11 A1, A9, A11 A9, A11

DISCUSSION

A. Digital Innovation in Adolescent Health Education

1. Social media as a means of adolescent reproductive health education

Social media plays a crucial role as an easily accessible communication channel for adolescents to obtain information about reproductive health. Platforms such as Instagram, YouTube, TikTok, and Facebook enable the rapid, interactive, and visual dissemination of information, making it easier for adolescents to understand sensitive issues such as menstruation, puberty, healthy sexual relationships, and sexually transmitted infections (Hu, 2024). Additionally, social media helps reach adolescents in remote areas who may have limited access to formal health services. Accessing information through social media also creates a safer and more comfortable space for adolescents to learn about topics that are difficult to discuss directly with parents or teachers (Ardini, 2025).

Research shows that social media has both positive and negative impacts on adolescent health. The use of social media among adolescents carries risks, including cyberbullying, mental health issues, sexting, and privacy concerns. However, if used wisely, social media can enhance opportunities for collaboration, communication, health promotion, and the provision of important health information for adoles-

cents, such as reproductive health (Allem, 2024).

2. Interactive Media Applications for Adolescent Reproductive Health Education

One innovation that can be developed to improve adolescent reproductive health education is through digital applications in interactive learning. These applications are specifically designed to address important topics relevant to adolescents' lives, such as puberty and the three main issues in the Adolescent Reproductive Health Triad, namely sexuality, HIV/AIDS, and substance abuse (Jaya and Kumalasari, 2022). The content is presented in an engaging manner through visual illustrations, short videos, and interactive interfaces that are easily accessible via smartphones. With this approach, teenagers not only receive accurate and comprehensive information but also become more interested and less bored while learning. The use of digital media they are familiar with and use daily can be an effective strategy to enhance knowledge and foster positive behavior related to reproductive health (Huda, 2021).

3. Mobile Technology and SMS for Information Reinforcement

Text messages via short message service (SMS) are a cost-effective and non-invasive communication tool that can be used to convey health-related messages and enable the delivery of personalized and timely information according to users' needs. With

its wide reach and ease of access, SMS is a strategic tool for reaching adolescents who are difficult to reach through conventional health services (Mbuagbaw *et al.*, 2017). For many adolescents, particularly girls in developing countries, puberty often marks the onset of increased vulnerability to various risks such as early pregnancy, HIV infection, school dropout, child marriage, sexual exploitation, coercion, and violence. Text message-based program can enhance adolescents' knowledge of reproductive health and have the potential to reduce the risk of pregnancy among sexually active adolescent girls (Wirsiy *et al.*, 2022). In various studies on adolescent sexual and reproductive health program in low- and middle-income countries, it was found that the majority of projects (approximately 70%) rely on SMS as the primary medium for disseminating sexual and reproductive health information. These program demonstrate that SMS is a widespread and effective means of disseminating information and facilitating knowledge exchange on various aspects of adolescent reproductive health (Rokicki *et al.*, 2018).

B. The Social Role in Supporting Adolescent Reproductive Health Education

1. The Role of Families and Educational Institutions in Supporting the Use of Educational Technology

Family involvement, especially that of parents, determines how safely and effectively adolescents use applications, websites, or mobile messages about reproductive health. Previous research shows that when parents are provided with digital materials (animated films, fact sheets) and assigned to complete app-based 'homework' with their children, 67% of them found conversations about sex to be easier, and 87% rated the materials as good to very good (Aventin *et al.*, 2020). Similar findings also

confirm that parents support the development of SRH apps specifically for teenagers because they are private while also allowing parents to monitor the content of messages received by their children (Ochieng *et al.*, 2022).

On the other hand, schools and teachers act as gatekeepers of digital literacy. Beyond merely delivering content, teachers also play a role in fostering critical digital literacy among students. In the context of reproductive health, teenagers' ability to discern accurate information is crucial, given the abundance of misleading or even risky online content (Jin *et al.*, 2021). Teachers can teach students how to evaluate the credibility of information sources, understand the medical or ethical context of sexual topics, and direct students to verified educational applications or platforms (Jaya and Kumalasari, 2022). Comprehensive and participatory education in schools will be more successful when teachers are trained to manage sensitive material with a non-judgmental and rights-based approach. This helps create a safe, open learning space that supports active youth engagement (Cynthia and Sihotang, 2023).

2. Peer Relationships as a Source of Information and Emotional Support

Communication between friends tends to be open and free from fear of judgement, creating a comfortable space for exchanging ideas and sharing information on topics that are considered sensitive. Peers not only serve as a source of information but also as an important provider of emotional support. When adolescents feel supported and understood by their peers, they are more confident in making decisions related to their reproductive health. These interactions help them reduce anxiety, decrease feelings of shame, and strengthen positive self-

perception. Therefore, strengthening the role of peers as part of an educational strategy, either directly through discussion or indirectly through role modelling, can be an effective approach in shaping awareness and healthy behaviour among adolescents (Nurmala, 2025).

C. Social Barriers to Adolescent Reproductive Health Education

1. Limited access to information and education

One of the main challenges in delivering reproductive health information to adolescents is the limited access to comprehensive information and education. Many adolescents, especially in rural areas or areas with limited resources, do not have access to accurate, scientific, and age-appropriate reproductive health education materials (L'Engle *et al.*, 2016). The results also show that male and female adolescents respond differently to sexual education interventions, in terms of knowledge, attitudes, and dating styles. These findings reinforce the argument that digital interventions such as apps, SMS, and social media need to be designed with gender sensitivity in mind in order to better address the needs and characteristics of adolescents (Hartati D, 2021). Research shows that adolescents with limited access to reproductive health information tend to have lower levels of knowledge and are more vulnerable to unintended pregnancies and sexually transmitted infections. Therefore, improving access to comprehensive, evidence-based reproductive health education is crucial for empowering adolescents to maintain their health (Chandra-mouli and Lane, 2015).

2. Influence of cultural norms and lack of open communication

The lack of formal sex education in schools and the minimal involvement of parents and teachers in discussions about sexuality cause adolescents to seek information from

unreliable sources, such as peers or the unfiltered internet. In addition, social and cultural norms also play a role in limiting access to such information (Venty, 2020). In many communities, discussions about sexuality are still considered taboo, limiting open and educational discussion spaces for adolescents. Conservative cultural norms often suppress adolescents' initiatives to seek help or information they need regarding reproductive health. This lack of communication not only closes opportunities for healthy education but also increases the risk of misconceptions, risky sexual behavior, and inappropriate decision-making regarding adolescent reproductive health (Maesaroh *et al.*, 2022).

3. Economic support and family involvement in reproductive health education

Family economic factors play a crucial role in determining the extent to which a teenager can access reproductive health information and services. Teenagers from low-income families tend to have limited access to formal education, including reproductive health education, and find it difficult to access quality healthcare services (Dowling *et al.*, 2025). This disparity exacerbates ignorance and increases the risk of unsafe sexual behaviour, especially in resource-limited areas. This situation also makes adolescents less able to access adolescent-friendly and rights-based reproductive health services, which should be able to prevent various health risks (Permatasari *et al.*, 2024).

Beyond economic factors, family involvement—particularly parental involvement—in reproductive health education significantly influences adolescents' behavior and understanding. Research indicates that open communication between parents and children about reproductive issues can enhance adolescents' understanding of

sexual risks and strengthen positive attitudes toward self-protection (Wamoyi *et al.*, 2020). Conversely, family disengagement or indifference towards sex education often encourages adolescents to seek information from unreliable sources and increases the likelihood of them engaging in risky behavior (Chandra-mouli and Lane, 2015).

This study was conducted as a review by mapping various published studies and did not conduct primary research. The use of digital technology as an educational strategy has proven to be a relevant and effective approach in improving reproductive health knowledge among adolescents in the digital age. Various forms of intervention, such as mobile applications, educational videos, social media, and online platforms, show great potential in reaching adolescents in a broad, interactive, and flexible manner. However, the success of this strategy is greatly influenced by factors such as digital literacy, access to technology, and the involvement of relevant parties, including educators, families, and health institutions. Therefore, the use of technology must be integrated, contextual, and based on the needs of adolescents in order to create optimal and sustainable educational impact. Collaboration between the government, educators, health workers, and technology developers is needed to create an attractive, accurate, and easily accessible reproductive health education platform for adolescents. Digital education should be complemented by an interactive approach, based on local needs, and taking into account digital literacy and youth culture. In addition, the development of technology-based education program needs to be balanced with periodic evaluations to ensure the effectiveness and relevance of the content in addressing the challenges of adolescent reproductive health in the digital age.

FINANCIAL SUPPORT AND SPONSORSHIP

This study is self-funded.

ACKNOWLEDGEMENT

The researcher would like to thank all parties who participated in the preparation of this article. Also thanks to the database providers PubMed, ScienceDirect, EBSCO, Taylor & Francis, Research Rabbit and Google Scholar.

CONFLICT OF INTEREST

There are no conflicts of interest.

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