

RESEARCH ARTICLE

Exploring Adolescent Reproductive Health Education Needs for Digital Application Development: A Qualitative Needs Assessment

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ABSTRACT

Introduction: Adolescent reproductive health (ARH) education is an effort to improve health literacy and support healthy behaviours. However, many adolescents still experience limited access to credible information on reproductive health due to inadequate school-based education, sociocultural stigma, and barriers to open communication. Although digital education approaches are increasingly promoted, evidence regarding adolescents' educational needs and stakeholder perspectives to inform contextually relevant digital interventions remains limited. This study aims to explore adolescent reproductive health education needs and identify considerations for the future development of a digital educational application.

Methods: A qualitative needs assessment design was employed. Data were collected between September and November 2025 through semi-structured interviews and focus group discussions involving junior high school students (n = 6), teachers (n = 3), and health and government stakeholders (n = 8), who were purposively selected. All interviews and discussions were audio-recorded, transcribed verbatim, and analysed using Braun and Clarke's six-phase thematic analysis framework, with NVivo 15 used to support data management and coding.

Results: Six major themes were identified: reproductive health literacy gaps, adolescent behavioural risks, barriers in school-based reproductive health education, limitations in teacher capacity and learning resources, challenges in policy and programme implementation, and the need for innovative digital reproductive health education applications. These findings revealed a mismatch between adolescents' preference for private, practical, and digitally accessible reproductive health information and the limited readiness of schools, teachers, families, and existing support systems to provide structured, credible, and non-stigmatising education. Participants emphasised the need for age-appropriate content, confidential access to information, interactive learning features, stronger teacher support, and better integration with existing school and health programmes.

Conclusion: This study provides formative empirical evidence regarding adolescent reproductive health education needs and preliminary requirements for digital application design. The findings may inform the development of adolescent-centred educational technologies and support future strategies to strengthen school-based reproductive health education, teacher capacity, and cross-sector collaboration.

Keywords: Reproductive Health Education; Adolescent; Health Literacy; Behavioural Risks; Sexual and Reproductive Health Need

INTRODUCTION

Reproductive health education plays a critical role in improving literacy and shaping healthy behaviours among adolescents. This education has a beneficial impact on students' knowledge, attitudes, and practices and is very important for reproductive health decision-making (1). Adolescent reproductive health literacy strongly supports behavioural change; however, reproductive health literacy among Indonesian adolescents remains relatively low to moderate, with many adolescents lacking comprehensive knowledge. A large population-based study reported an average reproductive health knowledge score of only 53 out of 100, with younger age and lower educational attainment being significantly associated with poorer knowledge (2,3). Differences have also been observed across school types, with students attending public schools demonstrating higher levels of reproductive health knowledge than those in religious schools, suggesting disparities in programme implementation and access to information (4). Although comprehensive school-based sexuality education has been proven to enhance knowledge and attitudes, particularly among girls and adolescents living in urban settings (5), misconceptions and communication barriers continue to limit adolescents' understanding of reproductive and sexual health issues (6).

Online media has become one of the main sources of information for teenagers. Compared to conventional means of communication, adolescents increasingly access information through digital platforms and social media environments (7). In educational settings, commonly used digital learning modalities include videos, mobile applications, and interactive multimedia platforms (8). Previous studies have shown that application-based learning media can improve engagement and understanding by providing interactive and self-directed learning opportunities (9). Digital reproductive health education interventions have also demonstrated potential to improve adolescents' knowledge and access to information (10,11).

However, increasing access to digital information does not necessarily guarantee access to accurate or appropriate reproductive health knowledge. Many adolescents receive limited sexual and reproductive health education from parents and schools and consequently search for information from peers, social media, and other online sources of varying quality (12). Information obtained through these channels may be incomplete, inaccurate, or misleading, increasing the risk of misconceptions, anxiety, and unhealthy decision-making (13,14). In addition, teachers often report limited confidence, inadequate training, and insufficient guidance for delivering reproductive health education, particularly when discussing culturally sensitive topics. These challenges suggest that the benefit of digital technologies depends not only on accessibility but also on the quality, credibility, privacy, and educational support systems surrounding their use.

Early adolescence, typically spanning ages 10–14 years, represents a unique developmental stage characterised by the onset of puberty, increasing body awareness, stronger peer influence, growing curiosity about sexuality, and expanding exposure to digital media. Unlike older adolescents, early adolescents often have limited autonomy, restricted access to reliable health information, and greater discomfort discussing reproductive health issues, making education on these topics particularly important and pedagogically challenging during the junior high school years (5,6). At this stage, adolescents require educational approaches that are age-appropriate, psychologically safe, developmentally relevant, and responsive to their everyday concerns.

Recent international evidence suggests that digital sexual and reproductive health interventions can provide convenient, accessible, and engaging learning opportunities for adolescents (15,16). However, digital technologies should not be viewed as inherently beneficial. Although previous studies have demonstrated the potential of digital reproductive health education interventions (15,16), important concerns regarding confidentiality, safeguarding, stigma, teacher readiness, and integration with school and health-service systems remain insufficiently addressed (16,17). Furthermore, evidence from comprehensive sexuality education programmes suggests that implementation challenges continue to occur, particularly in relation to teacher preparedness and institutional support (18). Limited evidence is available regarding how these issues are experienced by early adolescents and how stakeholder perspectives can inform the design of contextually appropriate digital reproductive health education applications. Most existing studies focus on older adolescents, evaluate educational outcomes after implementation, or examine general youth populations. Consequently, little is known about what junior high school students specifically need from reproductive health education or how educational tools can be effectively embedded within the realities of schools, teachers, families, and local health systems.

This study was based on the Socio-Ecological Model (SEM), which recognises that adolescent health behaviours and educational needs are influenced by various levels of interacting factors, at individual, interpersonal, organisational, community, and policy levels (19,20). The SEM has been widely applied in adolescent health research because it recognises that knowledge, attitudes, and behaviours are influenced by individual characteristics, family relationships, interactions with peers, school environments, health services, and broader policy contexts (19,20).

In the context of adolescent reproductive health education, the SEM offers a useful model for explaining how various levels of influence interact to shape educational needs and access to educational information. At the individual level, adolescents' reproductive health literacy, information-seeking behaviour, and perceived risks influence their understanding of reproductive health issues. At the interpersonal level, peer influence, family communication, and parental supervision affect adolescents' attitudes, behaviours, and willingness to seek reproductive health information. At the organisational level, teacher capacity, learning resources, and implementation of reproductive health education in schools influence the quality as well as accessibility of educational support available to adolescents. Community-level influences include health services, youth-friendly programmes, and community support mechanisms, while policy-level influences encompass educational regulations, reproductive health programmes, governance structures, and implementation support systems. The SEM was used as a conceptual lens for interpreting the findings of this study and understanding how educational needs emerge across multiple levels of influence. Consistent with this perspective, the study explored not only adolescents' knowledge gaps and behavioural

risks but also broader contextual factors, including teacher preparedness, family involvement, school readiness, health-service support, and policy implementation challenges.

There remains a significant knowledge gap regarding context-based evidence and stakeholder input on the reproductive health educational needs of junior high school students as well as the design considerations required for future digital applications. Perspectives from teachers, health professionals, and policymakers are essential to ensure that such interventions are educationally appropriate, culturally acceptable, and feasible within existing systems. Therefore, this study aimed to explore the reproductive health education needs of junior high school students and relevant stakeholders to identify educational priorities, contextual barriers, and preliminary design considerations for a future digital reproductive health education application.

METHODS

This study used a qualitative design to examine adolescents' needs for reproductive health education and to identify the key considerations in the development of digital educational applications. This approach was chosen to gather in-depth information from students, teachers, health professionals, and policymakers regarding educational content needs, learning preferences, implementation barriers, and desired application features. This design was considered appropriate because the primary objective of the study was to identify stakeholder-informed educational needs and contextual factors that may inform future application development rather than to evaluate an existing intervention. Data were collected between September and November 2025 through semi-structured interviews and focus group discussions (FGDs). The interview and discussion transcripts were analysed thematically following Braun and Clarke's framework with NVivo 15 used to facilitate data management, coding, retrieval, and organisation of the qualitative data. This study was reported in accordance with the Consolidated Criteria for Reporting Qualitative Research (COREQ) guideline, and the completed COREQ checklist is provided as supplementary material.

Participants

Seventeen participants were purposively recruited from groups directly involved in adolescent reproductive health education. Potential participants were approached through their respective schools, health institutions, and government agencies after obtaining institutional permissions. Eligible individuals were invited to participate by the researchers, provided with information about the study, and those who agreed voluntarily were enrolled in the study. Eligible participants included professionals involved in adolescent reproductive health education, adolescent health services, and educational governance, as well as junior high school students attending school in the study area. Participants who were unable to participate in discussions or interviews or who declined informed consent were excluded from the study. The participants comprised junior high school students ($n = 6$), teachers ($n = 3$), health-sector stakeholders ($n = 6$), and government stakeholders ($n = 2$). The student participants represented different grade levels and included both male and female adolescents. Teachers were actively involved in school-based educational activities and student guidance. Health-sector stakeholders included professionals involved in adolescent health services, reproductive health programmes, and public health initiatives. Government stakeholders represented local authorities responsible for educational governance and adolescent development programmes. All identifying information was removed from the dataset before analysis. Participants were identified only by anonymous alphanumeric codes (P1–P17), while institutional affiliations were reported in generalised form as shown in Table 1.

Research Location

The study was conducted in Semarang Regency, Central Java Province, Indonesia. This setting was selected because of its active implementation of school-based reproductive health initiatives involving collaboration among educational institutions, local health services, and government agencies.

Instruments and procedures

Data for this study were generated through focus group discussions (FGDs) and semi-structured interviews. Separate FGDs were held with junior high school students, teachers, and health-sector stakeholders to capture the perspectives of each participant group. Government stakeholders took part in individual semi-structured interviews, providing more detailed insights into policy development and programme implementation. The FGDs with junior high school students and teachers were conducted at their respective schools, while the FGD with health-sector stakeholders was conducted in a meeting room at Universitas Ngudi Waluyo. Individual semi-structured interviews with government stakeholders were conducted at their respective offices. Each FGD lasted approximately 60–90 minutes, while interviews generally required 45–60 minutes.

Each participant group took part in a separate data collection session to promote open discussion and reduce potential power imbalances, particularly when sensitive issues related to reproductive health were discussed. The interview and discussion guides were informed by a review of the literature together with relevant national policies addressing adolescent reproductive health literacy, information-seeking practices, reproductive health risk among adolescents, barriers to reproductive health education, implementation challenges, existing policies and programmes, and expectations for a future digital education application. The interview and FGD guides were not pilot-tested prior to data collection.

All FGDs and interviews were facilitated in Indonesian by the first author, who had experience in qualitative research and adolescent reproductive health. With participants' permission, each session was audio-recorded and later transcribed verbatim. Field notes documenting contextual observations and non-verbal interactions were prepared to complement the

transcripts. To minimise social desirability bias, participants were informed that all responses would be treated confidentially and would have no influence on their relationships with schools, health services, or government institutions.

Data Analysis

Data were analysed using Braun and Clarke's six-phase thematic analysis framework, with NVivo 15 software supporting data management throughout the analytical process. An inductive–deductive approach guided the coding, allowing themes to emerge from the data while remaining informed by the study objectives. The researchers began by reading the interview and FGD transcripts repeatedly to develop familiarity with the dataset. Meaningful text segments related to adolescents' reproductive health education needs and digital application design were then coded and compared across participants. Codes with similar meanings were subsequently clustered into categories, which were further interpreted and integrated into broader themes reflecting educational needs and application design requirements.

Throughout the analysis, emerging themes were continually checked against the original transcripts to ensure conceptual coherence and faithful representation of participants' accounts. The coding framework evolved iteratively as new insights emerged from the data. NVivo facilitated the organisation, retrieval, and management of coded materials, whereas the interpretation and refinement of themes remained the responsibility of the researchers. Initial coding was undertaken by the first author, and coding decisions together with the final themes were reviewed through regular discussions among the research team to strengthen analytical consistency and credibility.

Trustworthiness

The credibility of the findings was strengthened by integrating perspectives from multiple participant groups, including junior high school students, teachers, health-sector stakeholders, and government stakeholders. Combining focus group discussions with semi-structured interviews enabled methodological triangulation and provided a more comprehensive understanding of adolescents' reproductive health education needs. Field notes captured during data collection enriched the interview and FGD transcripts by documenting contextual information and relevant non-verbal observations.

Rather than relying on a predetermined sample size, participant recruitment continued until the information obtained across stakeholder groups was sufficiently rich and repetitive to address the study objective. Data collection concluded when additional interviews and discussions no longer contributed meaningful new insights or expanded the developing thematic framework.

Researcher Reflexivity

The research team consisted of university lecturers and researchers with expertise in health sciences and experience in qualitative research and adolescent reproductive health. All focus group discussions and interviews were conducted by the first author, a female researcher with experience in qualitative research and adolescent reproductive health. Recognising the sensitive nature of the topic, the researchers maintained a neutral and non-judgemental stance throughout data collection and analysis. Before each focus group discussion and interview, participants were informed that there were no right or wrong answers and were encouraged to share their experiences and perspectives openly in a respectful and supportive environment. Throughout the research process, the research team engaged in ongoing reflexive discussions to consider how their professional backgrounds, prior knowledge, and assumptions might influence data interpretation and theme development.

Ethical Approval

This study received ethical approval from the Health Research Ethics Committee, Faculty of Medicine, Universitas Negeri Semarang (Approval No. 164/KEPK/FK/KLE/2025). Before data collection, all participants were provided with a clear explanation of the study objectives, procedures, potential risks, and their rights as research participants. Written informed consent was obtained from all adult participants. For participating students aged under 18 years, written informed consent was obtained from their parents or legal guardians, and written assent was obtained from the students before participation.

To protect participants' privacy, all interview and focus group transcripts were de-identified, and participants were assigned anonymous alphanumeric codes (P1–P17). Institutional affiliations were reported in generalised form to minimise the risk of identification. Confidentiality was further maintained through secure data storage, restricted access to research data, and the use of coded identifiers throughout the analysis and reporting process. Participants were informed that they could decline to answer any question or withdraw from the study at any stage without penalty. In the event that disclosures related to abuse, harassment, bullying, psychological distress, or other issues affecting participant wellbeing arose during data collection, the researchers were prepared to refer participants to appropriate school-based support services or local health professionals in accordance with approved ethical procedures and institutional guidelines.

Data Availability Statement

The de-identified qualitative data generated and analysed during this study are not publicly available because they contain information from interviews and focus group discussions that may pose a risk of indirect participant identification. De-identified data may be made available by the corresponding author upon reasonable request for academic or research purposes, subject to approval by the Health Research Ethics Committee of Universitas Negeri Semarang and compliance with applicable ethical and confidentiality requirements.

RESULTS

Participant characteristics are presented in Table 1.

Table 1. Participant characteristics

Participant code	Category
P1–P6	Students
	Male students (n = 3)
	Female students (n = 3)
	Grade 8 (n = 3) Grade 9 (n = 3)
P7–P9	Guidance counsellor teachers
	Teaching experience: 5–18 years
P10–P15	Health-sector stakeholders
P16–P17	Government stakeholders

Source: Primary Data

As shown in Table 1, this study involved 17 participants representing four stakeholder groups: students (n = 6), teachers (n = 3), health-sector stakeholders (n = 6), and government stakeholders (n = 2). To ensure confidentiality, participants were assigned anonymous codes (P1–P17). Institutional affiliations and specific job titles were described in general terms to prevent potential identification, especially for participants who held unique administrative positions. This classification allowed for cross-sector comparisons during thematic analysis while maintaining participant anonymity.

Table 2. Thematic structure and code distribution

Theme	Category	Codes	n codes
Adolescent Reproductive Health Literacy	Resources	Natural Science lessons as the main resource; Social media; Google; Clue App	4
	Level of comprehension	Knowledge of Human Papillomavirus; Knowledge of the menstrual cycle	2
	Information needs	Genital Hygiene; Menstrual pain (dysmenorrhea) management	2
Adolescent risk behaviour	Sexual behaviour	Sexual relations in junior high school; Post A Picture (PAP) body organ; Access to pornography; Influence of boyfriends/girlfriends	4
	Violence and bullying	The victim does not recognise bullying, pulling down pants/harassment; Violence against children with disabilities	3
	Other risky behaviours	Reported among male students: smoking, alcohol use, consumption of extreme foods.	3
Challenges in Reproductive Health Education	Teacher limitations	Teachers find it difficult to convey taboo subjects; teachers are confused because students know more from social media; there are no competency guidelines for teachers providing guidance and counselling on reproductive health; and there is difficulty in adjusting lesson plans.	4
	Role of parents	Parents do not supervise cell phones; they are cared for by grandparents/other family members. Lack of parental understanding	3
	Culture and society	Early marriage still occurs; Normalization of intense dating	2
Implementation of Reproductive Health Education	Sources of educational material	Reproductive health educational material in science classes; Reproductive health material in guidance counselling; Community health centres as the main source of information; No reproductive health guidelines from the Education, Youth, and Sports Agency; Teachers search for educational materials independently.	5
	Learning methods	Classical counselling guidance; Case-based issues; Hands-on practice preferred by students; Online learning is not uniform	4
Adolescent Reproductive Health Policies and Programmes	Regional and national policies	Marriage age limit of 19 years; Marriage dispensation and its causes; Maturity of Marriage Age; Premarital health screening and preparedness programme (ELSIMIL) as a requirement for marriage; Reproductive health in Natural Sciences, Physical Education, Sports and Health, Guidance Counselling	5
	Cross-sector programmes	Youth Information and Counselling Centre for Schools & Communities; Genre Ambassadors; Community Health Centre Outreach; School Health Program Development; Youth Red Cross; Collaboration between the Health Office, Department of Women's Empowerment, Child Protection, and Family Planning, Community Health Centres, Schools.	6
Educational Application Requirements	Student expectations	Pastel-coloured app; short and clear videos; points-based reward system; anonymous question feature	4
	Teachers' expectations	Structured reproductive health material; Easy language; Content tailored to adolescent psychology	3
	Implementation challenges	The school does not yet have a digital learning system; teachers need training in how to use the application.	2

Source: Primary Data

Note: n codes refer to the number of distinct codes identified within each category during thematic analysis and do not represent frequency of occurrence.

As shown in Table 2, the thematic analysis identified six main themes from the interviews: (1) Adolescent Reproductive Health Literacy, (2) Adolescent risk behaviour, (3) Challenges in Reproductive Health Education, (4) Implementation of Reproductive Health Education, (5) Adolescent Reproductive Health Policies and Programmes, (6) Educational Application Requirements.

Theme 1. Adolescent Reproductive Health Literacy

Adolescent reproductive health literacy emerged from formal and informal information channels. Formal learning was primarily obtained through school subjects, particularly science classes, which served as the main source of reproductive health knowledge. One student stated: *"Natural sciences cover reproductive anatomy"* (P3). Students also reported actively seeking reproductive health information through digital platforms, including social media and search engines, and menstrual-tracking applications. These findings suggest that reproductive health learning extends beyond classroom settings and frequently occurs through independent information-seeking practices. As one student explained: *"I usually look it up myself. There are apps for menstrual cycles. They show the different phases. Then we can fill in how we feel today. So, there is data on how many days the cycle lasts and when we will menstruate again. It is in the Clue app."* (P1)

The code "Google as a confidential information-seeking tool" reflected the role of digital platforms not only as information sources but also as private spaces for asking sensitive questions. Students described feeling more comfortable seeking reproductive health information online because digital platforms provided confidentiality and reduced feelings of embarrassment. As one student explained: *"If I use an app to share my feelings, I will not feel embarrassed...it is safer...I feel as if I am telling someone else."* (P4)

Students' reproductive health knowledge focused primarily on selected biomedical topics, particularly Human Papillomavirus (HPV) and the menstrual cycle. Several students described their understanding as follows: *"It is on the homepage, like how the HPV vaccine prevents cancer"* (P2). *"I also use an app. When I get my period, I enter it into the app so I know how many cycles I have had."* (P4)

Although students demonstrated awareness of these topics, their educational needs extended beyond factual knowledge. Students expressed a strong need for practical information related to everyday reproductive health concerns, including genital hygiene, menstrual pain management, self-care practices, and healthy relationships. For example, students stated: *"Maintain reproductive health, do not abuse it, like maintaining relationships."* (P1) *"How to maintain hygiene, for example, during menstruation; sometimes I get stomach aches. How to deal with that. Alternatively, what causes it."* (P4)

These findings reveal a gap between the reproductive health information provided through formal education and the information adolescents perceive as directly relevant to their daily lives. More importantly, the findings suggest a shift in informational authority from traditional educational sources toward private digital information-seeking practices. Rather than acting as passive recipients of information, adolescents actively seek reproductive health information through digital platforms that offer privacy, immediacy, and reduced social judgement. The findings further indicate that adolescents' educational needs extend beyond biomedical knowledge and encompass practical reproductive health literacy, including self-care, menstrual management, personal hygiene, healthy relationships, and confidential access to reliable information. This mismatch between formal educational content and adolescents' everyday information needs highlights the importance of providing developmentally appropriate, practical, and confidential reproductive health education.

Theme 2. Adolescent Risk Behaviour

The theme of adolescent risk-taking behaviour encompassed several interconnected areas, including sexual behaviour, exposure to sexual content, peer influences, bullying, harassment, and other health-risk behaviours. Teachers reported cases suggesting that some junior high school students had already engaged in sexual intercourse. One teacher described the situation as follows: *"He has a girlfriend; he already has a girlfriend. We asked him about it, and it turns out he has already done that. Like that... and at his house."* (P7). Some students reportedly engaged in requests for or sharing of intimate body images (commonly referred to as PAP): *"Well, what happens here again, there are many things, for example, what model is it now... PAP this part, so children ask for it to be like that"* (P7, P9). These statements indicate the existence of explicit behaviour among adolescents and knowledge influenced by the media. The influence of intimate relationships (boyfriends/girlfriends) indicates the presence of risky relationships.

Adolescents are also vulnerable to violence and bullying. The codes indicate that some forms of bullying may be perceived as harmless by those who experience them, while other codes capture sexual harassment and the risks faced by adolescents with disabilities, as conveyed by a participant: *"The school accepts children with disabilities. There is one child who is now in 8th grade... well, ... their friend pulled down his pants like that... considering that his intellectual capacity is below that of his peers. So, that is also a challenge for us... Their friends teased him, "Did you just come from the bathroom? From the toilet yet?" "Yes..." "I do not believe you." He proves it by pulling down his pants in front of his friends"* (P7). This finding emphasises that adolescent reproductive health education, especially in school settings, cannot be separated from broader issues of protection and psychosocial support.

Participants also identified several health-risk behaviours among adolescents, including smoking, alcohol use, and the consumption of extreme foods. These accounts reflected participants' observations and experiences rather than objective measures of prevalence. According to participants, smoking was perceived to be relatively common among male students and was considered socially acceptable within some peer groups (P5).

Taken together, these findings extend beyond individual behavioural risks and reveal broader concerns related to adolescent safety and safeguarding. Exposure to pornography, requests for intimate images, peer pressure within romantic relationships, bullying, sexual harassment, and the vulnerability of students with disabilities indicate the presence of complex social and

digital risk environments. These findings suggest that reproductive health education should not be limited to biological knowledge but should also address bodily autonomy, consent, digital safety, respectful relationships, help-seeking behaviour, and protective support mechanisms within schools and communities.

Theme 3. Challenges in Reproductive Health Education

Teachers reported several challenges in delivering reproductive health education, particularly when discussing topics that are often perceived as culturally sensitive or taboo. These perceptions created difficulties in communicating reproductive health information openly while avoiding misunderstandings among students and the wider community. One teacher explained: *"Sometimes there are people who consider it taboo. So, our challenge there is to convey to children that it is not taboo or wrong, and that they should not misunderstand what we are saying. That is the challenge."* (P7)

Teachers also described difficulties in responding to adolescents who had broader and more immediate access to reproductive health information through social media and other digital platforms. Some teachers felt uncertain when students appeared to possess information that exceeded or differed from the content available in formal educational settings. One teacher stated: *"Sometimes children are smarter, so we become confused. Sometimes we try to communicate according to their level, but in general they already know more from social media. They are much smarter."* (P7)

These findings suggest that teachers face a professional role challenge in which they are expected to provide accurate reproductive health guidance while simultaneously navigating rapidly changing digital information environments, limited instructional resources, and sociocultural sensitivities. The findings also indicate that reproductive health education is influenced by factors beyond the classroom. Participants reported limited parental supervision of digital media use, caregiving arrangements involving grandparents or other family members, and varying levels of parental understanding regarding adolescent reproductive health. These family-related factors may reduce opportunities for effective communication and guidance outside school settings.

The findings in this theme reflect interconnected pedagogical, sociocultural, and family-related barriers that influence the delivery of reproductive health education. These challenges affect the confidence, preparedness, and capacity of educators and caregivers to provide consistent, developmentally appropriate, and supportive reproductive health guidance for adolescents.

Theme 4. Implementation of Reproductive Health Education in Schools

Participants described reproductive health education as being delivered through a combination of curricular and extracurricular activities, but implementation varied significantly. Reproductive health content was incorporated into several subjects, including Natural Sciences, Guidance and counselling, and Physical Education, Sports, and Health. In addition, health promotion activities were provided by the local Community Health Centre, particularly during student orientation and the beginning of the academic year. Several participants indicated that Community Health Centre outreach activities served as one of the primary sources of reproductive health information for students.

Despite these efforts, participants reported limited availability of formal guidelines and structured educational resources to support reproductive health education within schools. As a result, teachers often relied on self-directed searches for educational content and adapted materials independently. One stakeholder explained: *"No, the existing guidelines on School Health Programs and Youth Red Cross"* (P16). Similarly, a teacher noted: *"Not yet. Because sometimes, due to the large amount of information, sometimes there are some things that are limited in terms of socialization, so maybe we have not gotten there yet"* (P8).

These findings suggest that the absence of clear guidance and standardised educational resources may contribute to variation in the quality, depth, and consistency of reproductive health education across schools. Educational delivery relied primarily on classroom-based guidance and counselling sessions, supplemented by case-based discussion addressing emerging adolescent issues. Students expressed a preference for practical, interactive, and participatory learning approaches, indicating that conventional didactic methods may not fully address their learning needs.

Participants further highlighted variations in digital learning infrastructure and teacher readiness to use educational technologies. These differences suggest that schools may have unequal capacity to implement digital reproductive health education initiatives, emphasising the need for flexible and context-sensitive implementation strategies.

In contrast to the previous theme, which focuses on pedagogical, sociocultural, and family-related barriers, this theme highlights institutional implementation processes within schools. The findings indicate that institutional reproductive health education is currently fragmented across multiple subjects, extracurricular activities, and external health-service programmes. This fragmentation may result in inconsistencies in content delivery, learning progression, teacher support, and referral mechanisms. Consequently, future educational applications should not only provide educational content but also support more coordinated, structured, and integrated implementation across schools, teachers, and health-service providers.

Theme 5. Adolescent Reproductive Health Policies and Programmes

Government and health-sector stakeholders identified several national and regional policies and programmes intended to support adolescent reproductive health and prevent early marriage. These included regulations establishing the minimum legal age of marriage, Marriage Age Maturity programmes, and premarital readiness initiatives, such as ELSIMIL (Electronic Ready for Marriage and Pregnancy), a national digital platform used to support premarital health screening and reproductive health preparedness among prospective couples. Stakeholders described these policies and programmes as important mechanisms for promoting reproductive health awareness and preventing early marriage. One government stakeholder

described the implementation of these policies as follows: *"The current understanding is that the requirement for marriage is to have an ELSIMIL certificate, which stands for Electronic Ready to Marry Pregnant Women, one of the requirements that is submitted to the Office of Religious Affairs or the civil registry office if the regional policy is automatic because teenagers are entering into marriage. Especially with reproductive health, the understanding is that one must marry at the required age of 19. Maturity in marriage age is important. Even though now there are still many who ask for marriage recommendations below that (below 19 years old), they use dispensation. Even though the law has been raised from 16 years old to 19 years old"* (P17). Health-sector stakeholders also highlighted the importance of premarital health screening as part of reproductive health promotion efforts: *"Pregnancy screening and health screening for prospective brides and grooms."* (P13, P10)

Although stakeholders were able to identify a range of national and regional reproductive health policies and programmes, the findings suggest that policy availability does not necessarily translate into effective implementation at the school level. Teachers and other participants reported limited awareness of existing guidelines, inconsistent dissemination of information, and variable access to reproductive health programmes. These findings indicate a policy-practice gap, whereby supportive policies and programmes exist but are not always experienced consistently by junior high school students, teachers, or schools. This gap highlights the importance of strengthening coordination among educational institutions, health services, and policymakers to ensure that reproductive health initiatives are effectively translated into educational practice.

Theme 6. Educational Application Requirements

Adolescent junior high school students, as the target audience for adolescent reproductive health education, expressed clear design preferences and content requirements for educational applications. They emphasised the importance of engagement and accessibility through visuals, including pastel colour schemes, short and clear videos, point-based reward systems, and anonymous question features. Overall, these preferences indicate that adolescents value discreet access, simplicity, and interactive learning experiences, and that anonymous support channels for questions can overcome barriers related to taboos and fear of judgement. The following quotations illustrate students' perspectives: *"Colourful...pastel colours...pink..."* (P1, P4, P5). *"Short videos, brief but clear."* (P1, P2, P6) *"Then give lots of points if it is correct,"* (P1, P3). *"If I use the app, I will not be embarrassed to confide; it is safer."* (P1)

Teachers expressed a preference for educational applications with a pedagogical structure, grade-appropriate content, straightforward language, and alignment with adolescent psychology, as illustrated by the following statement: *"I want material on puberty, definitely, maybe from my own perspective, perhaps the psychological aspect."* (P7)

Implementation limitations included the limited availability of digital learning systems in schools and the need for teacher training. The application preferences expressed by students should not be interpreted solely as aesthetic design choices. Preferences for anonymous communication features, short videos, and concise information reflect broader needs for privacy, emotional safety, accessibility, and engagement. Anonymous features were particularly important because they provided opportunities for help-seeking without fear of embarrassment or judgement. At the same time, these preferences highlight the need for safeguarding mechanisms to ensure that disclosures related to abuse, coercion, sexual exploitation, or psychological distress can be managed appropriately.

Importantly, students and teachers expressed complementary expectations regarding application design. While students emphasised accessibility, confidentiality, and engagement, teachers highlighted the need for structured content, age-appropriate language, and pedagogical support. Together, these findings suggest that future digital reproductive health education applications should be designed not only as learning tools for adolescents but also as educational support resources for teachers and schools.

DISCUSSION

Summary of findings and contributions of the study

The central finding of this study is the existence of a mismatch between adolescents' reproductive health information-seeking practices and the readiness of existing educational systems to meet those needs. Adolescents increasingly seek reproductive health information through private digital channels because these platforms provide confidentiality, immediacy, accessibility, and reduced fear of judgement. However, schools, teachers, families, and existing support systems often lack the resources, confidence, structured guidance, and institutional support required to provide developmentally appropriate, comprehensive, and psychologically safe reproductive health education. This mismatch helps explain why adolescents rely on digital information sources while simultaneously expressing a need for credible guidance, practical information, and trusted support. The findings further demonstrate that adolescent reproductive health education needs to operate across multiple socio-ecological levels. At the individual level, adolescents reported gaps in practical reproductive health literacy and concerns related to self-care, menstrual management, and healthy relationships. At the interpersonal level, peer influence, limited parent-adolescent communication, and concern about embarrassment shaped information-seeking behaviour. At the organisational level, teachers reported discomfort discussing sensitive topics, limited pedagogical guidance, and inconsistent access to educational resources. Community and policy-level influences were reflected in the availability of school health programmes, youth counselling services, and reproductive health policies that were not always translated into consistent implementation at the school level. These findings support the relevance of the Socio-Ecological Model in understanding adolescent reproductive health education needs and highlight the importance of addressing multiple interacting levels of influence rather than focusing solely on individual knowledge deficits (19,21).

An important contribution of this study is the identification of trust, privacy, and psychological safety as central requirements for adolescent reproductive health education. Consistent with recent evidence, adolescents often prefer digital platforms because they provide opportunities to seek sensitive information without fear of embarrassment, stigma, or judgement (16). The findings, therefore, suggest that digital reproductive health education should not be viewed simply as an alternative mode of information delivery. Rather, it should be understood as a response to limitations within existing communication channels and educational systems. However, digital innovation alone is insufficient. The potential value of educational applications depends on the quality of content, safeguarding mechanisms, teacher integration, referral pathways, and alignment with existing educational and health-service systems (15,17).

The findings also indicate that adolescent reproductive health education cannot be reduced to biological knowledge alone. Participants described concerns related to pornography exposure, requests for intimate images, bullying, harassment, peer pressure, and the vulnerability of students with disabilities. These issues extend beyond traditional reproductive health literacy and highlight the need to integrate child protection, bodily autonomy, consent, digital safety, and help-seeking skills within educational interventions. This interpretation is consistent with the International Technical Guidance on Sexuality Education, which emphasises that comprehensive sexuality education should address healthy relationships, violence prevention, gender equality, personal safety, and decision-making skills in addition to biomedical knowledge (22).

Overall, this study contributes stakeholder-informed evidence from the Indonesian junior high school context and proposes that effective digital reproductive health education requires four interrelated design domains: (1) credible and developmentally appropriate educational content, (2) confidential and stigma-sensitive access to information, (3) safeguarding, guidance, and referral mechanisms, and (4) integration with school, health-service, and policy support systems. These domains provide a conceptual foundation for future application development and extend existing understanding of adolescent reproductive health education beyond knowledge acquisition toward a broader socio-ecological and implementation-oriented perspective.

Adolescent reproductive health literacy: the shift of information authority to the digital realm and practical daily needs

The findings indicate that schools remain an important source of foundational reproductive health information. However, adolescents increasingly rely on digital platforms to address sensitive, practical, and personally relevant reproductive health concerns. This is in line with findings showing that social media, mobile apps, text messages, and websites have become the primary means of accessing reproductive health information, offering broad access, privacy, and ease of use (15,23). This pattern suggests a shift in information environments. Importantly, adolescents are not passive recipients of information. Rather, they actively seek reproductive health information through platforms that offer privacy, convenience, immediacy, and reduced fear of embarrassment, including the use of online forums and open communities to ask sensitive questions anonymously (13,24,25). Similar findings have been reported in recent studies showing that adolescents frequently use online platforms to seek sexual and reproductive health information because these environments offer greater confidentiality and autonomy than traditional communication channels (15,16,26).

An important insight emerging from this study is that adolescents' educational needs extend beyond biomedical knowledge. Although participants demonstrated awareness of topics such as HPV and menstruation, their primary concerns focused on practical reproductive health literacy, including menstrual pain management, personal hygiene, self-care, healthy relationships, and decision-making in everyday situations, as demonstrated by menstrual health literacy and life-skills programmes in Ethiopia, Mexico, and other contexts (27–29). This distinction is important because educational programmes often prioritise biological concepts while providing less attention to practical skills required for daily reproductive health management. Consistent with the International Technical Guidance on Sexuality Education, effective reproductive health education should combine factual knowledge with life skills, critical thinking, self-care practices, communication skills, and help-seeking competencies (22).

Beyond information access, the findings also highlight the importance of trust in adolescent reproductive health education. Participants did not necessarily reject guidance from teachers or parents; rather, available communication channels were often perceived as embarrassing, judgemental, or insufficiently private. The popularity of Google searches, social media platforms, and anonymous communication features reflects adolescents' need for confidential, non-judgemental communication. They also reflect the need for psychologically safe environments where sensitive questions can be explored. This finding extends existing research by suggesting that trust, privacy, and emotional safety are not merely desirable characteristics of digital interventions but fundamental conditions for adolescent engagement in reproductive health education (16).

These findings support the argument that future digital reproductive health education applications should not simply replicate existing educational content in digital form. Instead, they should address the gap between adolescents' practical information needs and current educational approaches by providing credible, age-appropriate, confidential, and skills-oriented learning experiences that complement existing school-based education and facilitate access to trusted support services (15,17).

Adolescent reproductive health education is closely linked to child protection, digital safety, and safeguarding.

An important finding of this study is that adolescent reproductive health education needs to extend beyond knowledge acquisition and encompass broader issues of safety, protection, and well-being. Participants reported exposure to pornography, requests for intimate images, peer pressure within romantic relationships, bullying, harassment, and vulnerabilities among adolescents with disabilities. These findings suggest that reproductive health education should not be

narrowly conceptualised as biological or disease-prevention education. Rather, it should be understood as part of a broader child protection and safeguarding agenda.

The increasing use of digital technologies has created new opportunities for adolescent learning, but it has also introduced new forms of risk. Previous studies have shown that adolescents are frequently exposed to sexually explicit content, online coercion, cyberbullying, and inappropriate digital interactions, often without adequate guidance or protection mechanisms (15,22). Similar patterns emerged in the present study, where requests for intimate images and exposure to inappropriate content reflected the growing intersection between reproductive health, digital behaviour, and adolescent vulnerability.

The findings also highlight the importance of bodily autonomy, consent, and healthy relationship education. Adolescents require opportunities to develop skills that enable them to recognise inappropriate behaviour, establish personal boundaries, communicate consent, and seek help when faced with harassment, coercion, or abuse. This need is particularly important for vulnerable groups, including adolescents with disabilities, who may face additional risks due to limited understanding of boundaries and reduced access to protective support systems. Comprehensive sexuality education frameworks consistently emphasise that reproductive health education should include relationship skills, consent, personal safety, and violence prevention in addition to biomedical knowledge (22).

These findings suggest that future digital reproductive health education applications should incorporate safeguarding-oriented features alongside educational content. Such a feature may include information on digital safety, guidance regarding consent and healthy relationships, clear help-seeking pathways, referral information for professional support services, and mechanisms that enable adolescents to access assistance when needed. Consequently, reproductive health education applications should be viewed not only as information-delivery tools but also as components of a broader support system that promotes adolescent safety, well-being, and protection.

Teacher readiness and institutional support as core conditions for implementation

The findings demonstrate that teachers play a critical role in adolescent reproductive health education, extending beyond their function as information providers. Teachers act as gatekeepers, facilitators, role models, and intermediaries between students, schools, families, and health services. Consequently, the effectiveness of reproductive health education depends not only on the availability of educational resources but also on teachers' confidence, competence, and institutional support. Participants reported discomfort discussing topics perceived as sensitive or taboo, uncertainty when students obtained information from social media, and limited access to structured reproductive health education guidelines. These findings suggest the presence of professional role tension in which teachers are expected to provide reproductive health guidance while simultaneously lacking adequate training, pedagogical resources, and implementation support. Similar challenges have been documented in previous studies, which found that teachers often experience uncertainty when addressing sexuality-related topics due to cultural sensitivities, insufficient training, and concerns regarding parental or community reactions (18,22).

Importantly, the findings indicate that teacher readiness should not be viewed as a secondary consideration in digital application development. Educational technologies cannot compensate for systemic implementation barriers if teachers remain unsupported. Previous research has shown that the successful integration of digital reproductive health education depends on teachers' engagement, curriculum alignment, institutional commitment, and ongoing professional development (17). Without these supporting conditions, digital innovations risk reproducing existing educational inequalities in a new technological format.

The findings further suggest that future reproductive health education applications should include teacher-facing resources alongside lesson plans, age-specific content maps, discussion guides, frequently asked questions, case-based learning activities, referral guidance, and training materials. Such features may help reduce teachers' pedagogical burden while increasing confidence in addressing sensitive reproductive health topics. Therefore, teacher support should be considered a central design and implementation requirement rather than an optional supplementary feature.

Family communication, parental support, and sociocultural influences.

The findings indicate that family communication remains an important but often underutilised component of adolescent reproductive health education. Participants described limited parental supervision, inadequate reproductive health knowledge among parents, and caregiving arrangements involving grandparents or other relatives. These circumstances may reduce opportunities for consistent communication regarding reproductive health and increase adolescents' reliance on peers, social media, and online information sources.

Consistent with previous research, parent-adolescent communication has been associated with improved reproductive health knowledge, delayed sexual initiation, safer decision-making, and increased help-seeking behaviour among adolescents (22,30). However, discussions about reproductive health are often hindered by cultural norms, embarrassment, generational differences, and perceptions that sexuality-related topics are inappropriate for adolescents. Similar barriers appeared in the present study, where reproductive health was frequently perceived as a sensitive or taboo subject, limiting open communication within families.

Importantly, the findings suggest that adolescents' preference for digital information sources should not be interpreted as a rejection of adult guidance. Rather, it may reflect the absence of communication environments that are perceived as safe, supportive, and non-judgemental. This observation reinforces the importance of trust as a central component of reproductive health education and highlights the need for communication approaches that support both adolescent autonomy and adult guidance.

The findings further suggest that future digital reproductive health education applications should complement, rather than replace, family involvement. Parent-facing resources may help strengthen communication between adolescents and caregivers by providing developmentally appropriate information, discussion prompts, frequently asked questions, and guidance on how to address sensitive topics. Such resources should be culturally sensitive and flexible enough to accommodate diverse family structures, including households where adolescents are primarily cared for by grandparents or other relatives.

Overall, these findings suggest that effective adolescent reproductive health education requires collaboration among adolescents, families, schools, healthcare providers, and community stakeholders. Educational applications may facilitate this process by serving as a bridge between adolescents' information needs and the support provided by adults to promote their learning and well-being.

Policy availability does not necessarily ensure effective educational practice.

The findings demonstrate that Indonesia has established a range of national and regional policies and programmes intended to support adolescent reproductive health, including regulations regarding the minimum legal age of marriage, premarital health readiness initiatives, school health programmes, youth counselling services, and cross-sector collaborations involving education and health institutions. However, the findings also suggest that the existence of policies and programmes does not automatically translate into consistent implementation within school settings.

Participants reported limited awareness of available guidelines, inconsistent dissemination of reproductive health education materials, and variable access to reproductive health programmes across schools. Teachers frequently relied on self-developed materials, while several stakeholders described challenges in ensuring that policies and educational resources reached schools effectively. These findings indicate the presence of a policy–practice gap, whereby supportive policies exist but are not always translated into structured classroom guidance, teacher competence, or equitable access to reproductive health education.

Similar implementation challenges have been reported internationally. Studies of school-based reproductive health and sexuality education programmes have shown that policy support alone is insufficient to ensure educational quality when implementation is constrained by limited teacher preparedness, inadequate resources, competing institutional priorities, and weak coordination among stakeholders (17,18), including a lack of training and teachers' discomfort, community resistance, and inadequate financial support (31–33). Thus, the effectiveness of policy implementation is determined not only by the existence of regulations, but also by the readiness and capacity of schools and supporting institutions to translate policy objectives into everyday educational practices.

An important implication of the present findings is that future digital reproductive health education applications should not be developed as standalone interventions detached from existing systems. Rather, they should be integrated with school health programmes, guidance and counselling services, adolescent-friendly health services, and existing reproductive health policies. Such integration may strengthen continuity of care, improve access to trusted information, support referral pathways, and increase the sustainability of educational interventions.

From a socio-ecological perspective, policies create enabling environments for adolescent reproductive health education, but meaningful impact occurs only when policy objectives are translated into coordinated action at organizational, interpersonal, and individual levels. Therefore, improving adolescent reproductive health education requires not only technological innovation but also stronger alignment among policy frameworks, schools, teachers, health services, families, and community stakeholders.

Implications for educational application development.

This study provides guidance for the development of a reproductive health education app for junior high school students, based on students' needs and stakeholder input. These findings should not be taken as evidence of the app's effectiveness. Rather, they identify educational needs, contextual barriers, implementation considerations, and design requirements that can serve as a reference for the development of future interventions. Based on these findings and the socio-ecological perspective adopted in this study, five interrelated design domains emerged.

Content Domain: The findings indicate that adolescents require both biomedical knowledge and practical reproductive health literacy. Future applications should therefore include age-appropriate information on puberty, reproductive anatomy, menstruation, genital hygiene, dysmenorrhea management, HPV prevention, healthy relationships, consent, digital safety, pornography literacy, bullying prevention, and help-seeking pathways. Educational content should extend beyond factual knowledge to include practical skills, self-care guidance, and decision-making competencies consistent with comprehensive sexuality education principles (22).

Pedagogical Domain: Participants expressed preferences for short videos and practical examples. These features should not be incorporated solely for engagement purposes. Rather, they should support active learning, self-efficacy development, knowledge retention, and skills acquisition. Previous studies suggest that interactive digital learning approaches may improve adolescent engagement and learning outcomes when combined with age-appropriate educational strategies and practical scenarios (15).

Privacy, trust, and safeguarding domain: One of the strongest findings of this study relates to adolescents' need for privacy and confidential communication. Features such as anonymous question submission may encourage help-seeking by reducing embarrassment and stigma. However, anonymous communication also introduces ethical responsibilities. Future applications should include safeguarding protocols, moderation procedures, privacy protection measures, emergency guidance, and

referral pathways for situations involving abuse, coercion, violence, exploitation, pregnancy concerns, self-harm, or psychological distress. Consequently, anonymous communication features should be considered high-value but high-responsibility components of application design.

Teacher-support domain: The findings indicate that teachers require structured support for reproductive health education implementation. Therefore, future applications should include teacher-facing resources such as lesson plans, age-specific content maps, classroom discussion guides, frequently asked questions, case-based learning activities, referral guidance, and professional development materials. These resources may reduce pedagogical burden while strengthening teacher confidence and implementation consistency. Given the sensitivity of reproductive health topics, teacher-support features should be designed to facilitate culturally appropriate, developmentally relevant, and evidence-based educational practices.

Implementation and system integration domain: The potential value of digital reproductive health education depends not only on application features but also on integration within existing educational and health-service systems. Applications should therefore be aligned with school health programmes, guidance and counselling services, adolescent-friendly health services, and relevant policy frameworks. Such integration may improve sustainability, facilitate referral pathways, strengthen implementation feasibility, and support coordinated reproductive health education efforts across schools, families, health services, and communities (17).

Taken together, these findings suggest that effective digital reproductive health education applications should function not merely as information-delivery tools but as integrated educational and support platforms that address adolescents' learning needs while simultaneously strengthening implementation capacity within schools and health systems.

Scientific contribution

This study contributes to the literature by offering a stakeholder-informed socio-ecological perspective on adolescent reproductive health education in culturally sensitive school settings. Based on the experiences of students, teachers, health workers, and policymakers, the findings of this study illustrate how the need for reproductive health education emerges through the interaction between students' information-seeking practices, family communication, teacher readiness, institutional support, and policy implementation. This study also indicates that adolescent reproductive health education needs to be strengthened not only by providing access to digital information but also by ensuring confidentiality, teacher support, institutional protection and readiness, and integration with the educational system. Overall, these insights provide an evidence-based foundation for the design and implementation of future digital reproductive health education programmes in school settings.

Transferability and broader relevance.

Although some findings reflect characteristics of the Indonesian educational and policy context, including school health programmes, youth counselling initiatives, and marriage-related regulations, several findings may have broader relevance. Issues related to privacy, trust, digital information-seeking, teacher preparedness, safeguarding, and implementation readiness have also been reported in studies conducted in other countries. Therefore, while the findings should be interpreted within the Indonesian context, they may provide useful insights for adolescent reproductive health education initiatives in other culturally sensitive educational settings.

Limitations and Cautions

Several limitations should be acknowledged when interpreting the results of this study. The evidence was generated from self-reported accounts provided by adolescents and other stakeholders during focus group discussions and semi-structured interviews. Given the sensitive nature of reproductive health, participants may have been reluctant to disclose certain experiences or opinions because of social desirability, embarrassment, moral concerns, or apprehension about discussing personal issues. As a result, topics related to sexuality, reproductive health, harassment, and risk behaviours may not have been explored in full, despite efforts to provide a confidential, respectful, and supportive environment throughout the data collection process.

Another limitation relates to the study setting and participant composition. The research was undertaken in a single regency in Central Java, Indonesia, and included a relatively small but diverse group of stakeholders. In keeping with the purposes of qualitative inquiry, the study sought to develop an in-depth understanding of participants' perspectives rather than produce statistically generalisable findings. Consequently, the results are best interpreted as being transferable to settings with comparable educational, cultural, and health-system contexts, rather than as representative of all junior high school students or school environments across Indonesia.

This study focused on identifying educational needs, contextual barriers, stakeholder perspectives, and preliminary design considerations for a future digital reproductive health education application. The study did not include prototype development, usability testing, acceptability assessment, implementation evaluation, or measurement of educational outcomes. Consequently, the findings should not be interpreted as evidence of application effectiveness, user engagement, behavioural change, or implementation success.

Recommendations for Future Research

Future research should build upon the findings of these qualitative needs assessment through a staged and iterative development process. The next strategic step is the development of a prototype digital reproductive health education application based on the stakeholder-informed design requirements identified in this study. Subsequent research should

evaluate usability, acceptability, and user experience among adolescents, teachers, and other relevant stakeholders to ensure that the application is developmentally appropriate, engaging, and feasible for implementation in school settings. Following prototype refinement, pilot and feasibility studies are needed to examine implementation processes and preliminary educational outcomes. Future evaluations may assess changes in reproductive health literacy, self-efficacy, help-seeking behaviour, digital health literacy, and student engagement. Given the importance of trust, privacy, and safeguarding identified in this study, future research should also evaluate the effectiveness of referral pathways, safeguarding procedures, confidentiality protections, and mechanisms for responding to disclosures related to bullying, harassment, coercion, violence, or other situations that may place adolescents at risk.

In addition, implementation research is needed to examine how digital reproductive health education applications can be integrated within existing school-based reproductive health education, guidance, and counselling services, school health programmes, adolescent-friendly health services, and relevant policy frameworks. Studies focusing on implementation feasibility, fidelity, adoption, contextual adaptation, and sustainability may help ensure that digital innovations strengthen rather than increase the burden on teachers and educational systems.

Finally, future effectiveness studies, including quasi-experimental and randomised controlled designs where appropriate, are needed to evaluate the impact of digital reproductive health education interventions on educational, behavioural, and health-related outcomes. Such research will be important to determine whether the stakeholder-informed design principles identified in this study translate into meaningful improvements in adolescent reproductive health education and wellbeing.

CONCLUSION

This study provides formative qualitative evidence regarding the reproductive health education needs of junior high school students and the perspectives of teachers, health professionals, and policymakers. The findings indicate that adolescents require reproductive health education that is credible, practical, age-appropriate, confidential, and responsive to their everyday concerns. The findings also highlight important contextual factors, including teacher preparedness, family communication, school readiness, safeguarding needs, and the availability of institutional support systems.

The study further identifies key considerations for the future development of a digital reproductive health education application. These include the provision of developmentally appropriate content, interactive and adolescent-friendly learning approaches, privacy-sensitive communication features, teacher-support resources, safeguarding and referral mechanisms, and integration with existing school and health-service systems. The findings suggest that digital reproductive health education applications may serve as complementary educational tools when embedded within broader educational and support structures.

However, the present study does not evaluate application usability, acceptability, feasibility, implementation processes, or effectiveness. Therefore, the findings should be interpreted as informing future application development rather than demonstrating intervention success. Future research should involve co-design activities with adolescents and teachers, prototype development, expert validation, usability and acceptability testing, safeguarding review, pilot implementation, and outcome-based evaluation to determine the educational and behavioural impact of digital reproductive health education interventions in school settings.

DECLARATIONS

Author contributions: Eti Salafas: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing – original draft, Writing – review & editing; Haryono: Conceptualization, Methodology, Supervision, Validation, Writing – review & editing; Irwan Budiono: Methodology, Validation, Supervision, Writing – review & editing; Evi Widowati: Methodology, Validation, Supervision, Writing – review & editing. All authors approved the final manuscript and accept accountability for the work.

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