BKM Public Health & Community Medicine
Berita Kedokteran Masyarakat

Volume 41 **Number** 11, 2025, **Pages** e24483
DOI: 10.22146/bkm.v41i11.24483

Effectiveness of digital gaming intervention in enhancing adolescents' knowledge and attitudes toward sexual and reproductive health: a systematic review

Reztika Cahyani[1]*, Etty Rekawati[2], Sigit Mulyono[2], Widyatuti[2]

Submitted:
September 10th, 2025
Accepted:
November 25th, 2025
Published:
November 30th, 2025

[1]Magister of Community Nursing, Faculty of Nursing, Universitas Indonesia, Jakarta, Indonesia

[2]Department of Community Nursing, Faculty of Nursing, Universitas Indonesia, Jakarta, Indonesia

***Correspondence:**
cahyanireztika@gmail.com

Abstract

Purpose: Adolescents often lack adequate sexual knowledge, leading to risky behaviors. Traditional sexual health education is usually less effective in enhancing the motivation and engagement of students. Digital gaming interventions offer a promising alternative in the digital era, providing interactive, engaging, and safe learning experiences. This systematic review aims to analyze the effectiveness of digital games in enhancing adolescents' knowledge and attitudes toward sexual and reproductive health education. **Methods:** This systematic review followed the PRISMA guidelines and employed the Joanna Briggs Institute (JBI) critical appraisal. A literature search across ClinicalKey, Cochrane, EBSCO, ScienceDirect, and Scopus identified studies published between 2015 and 2025. The inclusion criteria were original, quantitative studies in English that were freely accessible and focused on digital gaming interventions in adolescent reproductive health. Conventional games or unrelated topics were excluded. Four authors independently screened and reviewed the studies, yielding nine articles for analysis. **Results:** Nine studies with 6,969 adolescents (aged 11–24) from six countries were included. Digital game interventions significantly improved SRH knowledge and attitudes, with effects ranging from modest (6.27% gain; $\beta = 0.05–0.08$) to numerous ($\eta^2 = 0.80$). The small number of studies, design heterogeneity, and cultural differences limit the evidence. **Conclusion:** Digital gaming intervention improves adolescents' SRH knowledge and attitudes across contraception, STI prevention, and healthy relationships. However, the limited number of studies, design heterogeneity, and cultural variations restrict generalizability. Future rigorous studies and integration into schools and community programs are recommended. Registered in PROSPERO, ID CRD4202511 68048.

Keywords: adolescents; digital gaming intervention; health education; sexual and reproductive health; systematic review

INTRODUCTION

Adolescent health (AH) is a crucial aspect of public health, focusing on supporting healthy growth, safety, and overall well-being. Habits formed during this stage strongly influence long-term health and the risk of chronic conditions in adulthood. Adolescence is a critical period of rapid physical, emotional, psycho-social, and cognitive development, as well as sexual and reproductive maturation, making it essential to prioritize health promotion during these years [1]. In general, reproductive health refers to the well-being of the reproductive system for both men and women across all stages of life, including adolescence. Among adolescents, reproductive health risks are often linked to behavioral factors, particularly unsafe sexual practices [2].

According to the World Health Organization (WHO), an estimated 376 million new infections of the four most common sexually transmitted infections (STIs), chlamydia, gonorrhea, syphilis, and trichomoniasis, occur worldwide each year. A similar pattern can be seen in Europe, where the European Center for Disease Prevention and Control (ECDC) reported more than 434,000 cases of chlamydia in 2023, with young women aged 15–25 years being the most affected group [3]. In addition, the global adolescent birth rate remains a pressing concern, with 42 births per 1,000 teenage girls. However, this rate varies significantly across countries, ranging from as low as one to more than 200 births per 1,000 adolescents annually [2].

In recent years in Indonesia, there has been an increasing trend in the number of sexually transmitted infections (STIs) in the 15 to 24-year-old age group. Data in 2018 by Basic Health Research (Riskesdas) reported the highest prevalence of syphilis within this age group (1.2%), while HIV-AIDS was recorded at 0.3%. Furthermore, data from the Directorate General of Disease Prevention and Control, Ministry of Health (2021) indicated that adolescents and young adults aged 20–29 years accounted for more than half of all newly diagnosed HIV cases in the country. Individuals aged 30–39 years (31.4%) and 40–49 years (14.4%). In addition to HIV, syphilis and gonorrhea were predominantly observed among younger populations, with prevalence rates of 64.7% and 63%, respectively [4]. This highlights the need for further interventions to address risky sexual behaviors among adolescents.

Adolescents often lack adequate sexual knowledge, which can lead to risky behaviors and reproductive health issues [5]. This is because adolescents with strong sexual health literacy can persuade others to understand practical guidelines for promoting sexual health and preventing risky sexual behaviors, while also applying this information to their own behaviors accurately and consistently [6]. Nevertheless, numerous challenges persist in implementing sexual health education.

Most sexual health education interventions remain traditional, and these approaches are often less effective in enhancing students' motivation and engagement [7]. Moreover, conventional methods often fail to convey sensitive information engagingly and securely [8]. Adolescents often refrain from accessing sexual health services due to fear of judgment, concerns about confidentiality, and the stigma surrounding sexual health issues [9,10]. Cultural beliefs and traditional norms restrict open discussions on sexual health, thereby hindering the implementation of comprehensive sexual education [9,11].

In the digital era, integrating innovative approaches, such as digital games, offers a potential alternative for sexual health education. Digital games promote interactive learning, which is more effective than passive approaches, through features such as role-playing, narrative-based adventures, and real-life decision-making scenarios [12]. They also create a safe and controlled environment, enabling adolescents to explore and learn about sexual health without fear of judgment or embarrassment [13,14]. Furthermore, the anonymity provided by digital games helps young people to engage freely with sensitive topics, fostering more honest and open learning experiences [13].

Although numerous studies have explored sexual health education, systematic reviews specifically on sexual health education with digital gaming interventions are lacking. Given this gap, there is a need for research that synthesizes scientific evidence on the role of digital games in improving adolescents' knowledge and attitudes. Therefore, this systematic review aimed to analyze the effectiveness of digital gaming interventions in enhancing adolescents' knowledge and attitudes toward sexual and reproductive health education.

METHODS

This systematic review adhered to the PRISMA guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) and was critically appraised by the Joanna Briggs Institute (JBI). This study has been registered in PROSPERO under the ID CRD420251168048. The review process began with the formulation of research questions based on the PICOS framework: P (adolescents), I (digital games in sexual health education), C (conventional education), O (knowledge and attitudes), and S (quasi-experimental

or randomized controlled trial design). The research question is: How effective are digital games in enhancing adolescents' knowledge and attitudes in sexual and reproductive health education?

Eligibility criteria

The following eligibility criteria were applied to ensure the quality and relevance of the selected studies. The inclusion criteria for the studies considered in this review are that the articles must be original quantitative studies published between 2015 and 2025 and use either an RCT or a quasi-experimental design. Only studies written in English and available as free full-text articles will be included. The studies must specifically focus on the application of digital gaming in adolescent sexual and reproductive health education, as this aligns with the research question and scope of this review. Studies will be excluded if they meet any of the following conditions: articles published before 2015 or after 2025, non-original articles (such as reviews or commentaries), articles not available in full text or behind paywalls, and studies that focus on conventional games or topics unrelated to the use of digital gaming for adolescent sexual and reproductive health.

Information sources and search strategy

A systematic search was conducted across multiple databases, including ClinicalKey, Cochrane, EBSCO, ScienceDirect, and Scopus. All databases were accessed through electronic resources from the University of Indonesia. Search strategies included: ("digital games" OR "video games" OR "gaming") AND ("adolescents" OR "teenagers" OR "youth") AND ("sexual" OR "sexual and reproductive health") AND ("knowledge" OR "attitudes"). The search process commenced in February 2025 and concluded in May 2025.

Selection process

The selection process for this systematic review was carried out by four independent reviewers (RC, ER, SM, and W). Each reviewer screened the records retrieved from the database searches, including titles, abstracts, and keywords, to determine whether they met the inclusion criteria. The reviewers worked independently during the initial screening phase to ensure an unbiased selection process. After removing duplicates in Mendeley, the reviewers proceeded to full-text screening of the remaining studies to further assess their eligibility against the inclusion criteria. The team consulted collectively to reach a consensus, ensuring that all decisions were made transparently and consistently.

Data collection process

In this systematic review, four researchers (RC, ER, SM, and W) were all involved in collecting data from the full-text articles selected after the screening process. Each researcher independently extracted key infor- mation from the articles, including study design, sample size, methods, and main findings related to digital gaming interventions in adolescent sexual and reproductive health education. To ensure data accuracy and consistency, the researchers collectively verified the extracted data. Any discrepancies in the data collection were resolved through discussion and consultation with the entire research team. The use of Mendeley facilitated reference management and the efficient removal of duplicates. The team reached out to gather clarification information to ensure the integrity of the data collection process.

Risk of bias assessments and synthesis methods

The risk of bias for the included studies was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Tool for both Randomized Controlled Trials (RCTs) and Quasi-Experimental studies. The tool consisted of a checklist with specific questions: nine for Quasi-Experimental studies and thirteen for RCTs, each with answer options of *yes*, *no*, *unclear*, and *not applicable* [15]. Four reviewers (RC, ER, SM, and W) conducted the risk-of-bias assessment independently, evaluating each study. When discrepancies in the risk-of-bias assessment were identified, the reviewers discussed them collaboratively. They reached a consensus to ensure consistency and accuracy in the final judgment.

In this systematic review, a narrative synthesis approach was employed to summarize the findings from the included studies. The studies were limited to randomized controlled trials (RCTs) and quasi-experimental studies. The synthesis was presented in a table that included the following columns: author, year, purpose, study design, sample size, participant characteristics, intervention and comparator, measured variables, intervention duration, and game description. The narrative analysis step was conducted in accordance with the PRISMA 2020 checklist [16].

RESULTS

The study selection process began with a search in five databases: ClinicalKey (n = 802), Cochrane (n = 6), EBSCO (n = 15), ScienceDirect (n = 247), and Scopus (n = 22), yielding a total of 1,092 records. After removing duplicates (n = 102) and ineligible records flagged by automation tools (n = 4), 688 records were screened. Of these, automation tools excluded 9, and 662 were not

retrieved due to irrelevant titles, leaving 25 reports for eligibility assessment. After review, two reports were excluded for unrelated topics, six for focusing on non-digital gaming, three for not using quasi-experimental or RCT methods, and five for not addressing motivation and attitude outcomes. Ultimately, nine studies were included in the review and assessed for risk of bias and quality. A summary of the findings is presented in Figure 1.

Risk of bias in studies

Although no articles were excluded based on their assessment scores, the JBI tool was used to verify the eligibility of articles concerning the use of games for reproductive health. The findings regarding risk of bias are summarized in Table 1 of the JBI appraisal below.

Table 1. JBI critical appraisal

Author	Yes	No	Unclear	N/A	Conclusion
Bertozzi, et al. (2020)	67	11	22	0	Concerns
Chu, et al. (2015)	78	11	11	0	Low risk
Fiellin, et al. (2017)	85	0	15	0	Low risk
Haruna, et al. (2024)	89	0	11	0	Low risk
Peskin, et al. (2015)	77	0	23	0	Low risk
Raj, et al. (2025)	69	0	31	0	Concerns
Rokicki, et al. (2017)	69	0	23	0	Concerns
Tebb, et al. (2021)	69	0	31	0	Concerns
Von Kotzebue, et al. (2022)	100	0	0	0	Low risk

The studies by Fiellin et al. (2017), Haruna et al. (2024), Peskin et al. (2015), and Von Kotzebue et al. (2022) were categorized as having low risk of bias and meeting most appraisal criteria, with minimal uncertainty [17–20, 24]. In contrast, studies by Bertozzi et al. (2020), Raj et al. (2025), Rokicki et al. (2017), and Tebb et al. (2021) showed concerns, primarily due to a significant number of 'Unclear' responses, particularly regarding whether the treatment was conducted in a blind manner [14,21–23]. This raises concerns about the study's methodological transparency.

Study characteristics

Table 2 presents that the studies included in this review were diverse in terms of location, design, and target populations. Nine studies were included, conducted in India, the United States, Hong Kong, Tanzania, and Ghana. Five studies utilized randomized controlled trials (RCTs), while four employed quasi-experimental designs. Participants ranged in age from 11 to 16 years, with sample sizes varying from 84 to 1,993 individuals. The studies were primarily school-based or community-based, conducted in settings such as schools, after-school programs, and health centers—interventions focusing on sexual health education, contraception, and decision-making regarding sexual behavior. The interventions varied in duration, from a single session to several weeks. Outcomes assessed included sexual health knowledge, attitudes toward sexual behaviors, and knowledge of contraceptive use [14, 17–24].

Digital gaming description in sexual and reproductive health

Table 3 presents an overview of digital games designed for sexual and reproductive health (SRH) education, detailing the authors, game names, devices used, gameplay mechanics, and the associated educational benefits. These games serve as interactive tools aimed at enhancing adolescents' understanding of various SRH topics, including family planning, sexual health, contraception, and consent. The table highlights the diversity of game formats, from role-playing adventures to quizzes, that provide engaging, immersive learning experiences. The integration of mobile devices, tablets, and computers enables flexible, accessible learning environments, making it easier for adolescents to engage with SRH content in a non-traditional yet effective way.

The benefits of these digital games are varied, ranging from increasing knowledge retention to fostering positive attitudes towards sexual health. The games aim to improve decision-making skills regarding sexual behavior and reproductive health, while also promoting safer sex practices and increasing awareness of contraceptive methods. Furthermore, the use of interactive and immersive elements, such as quizzes, puzzles, and narrative-driven gameplay, enhances participants' cognitive and emotional engagement with SRH topics. By combining education with elements of entertainment, these games offer a promising approach to sexual health education that can be tailored to the needs of different populations and settings.

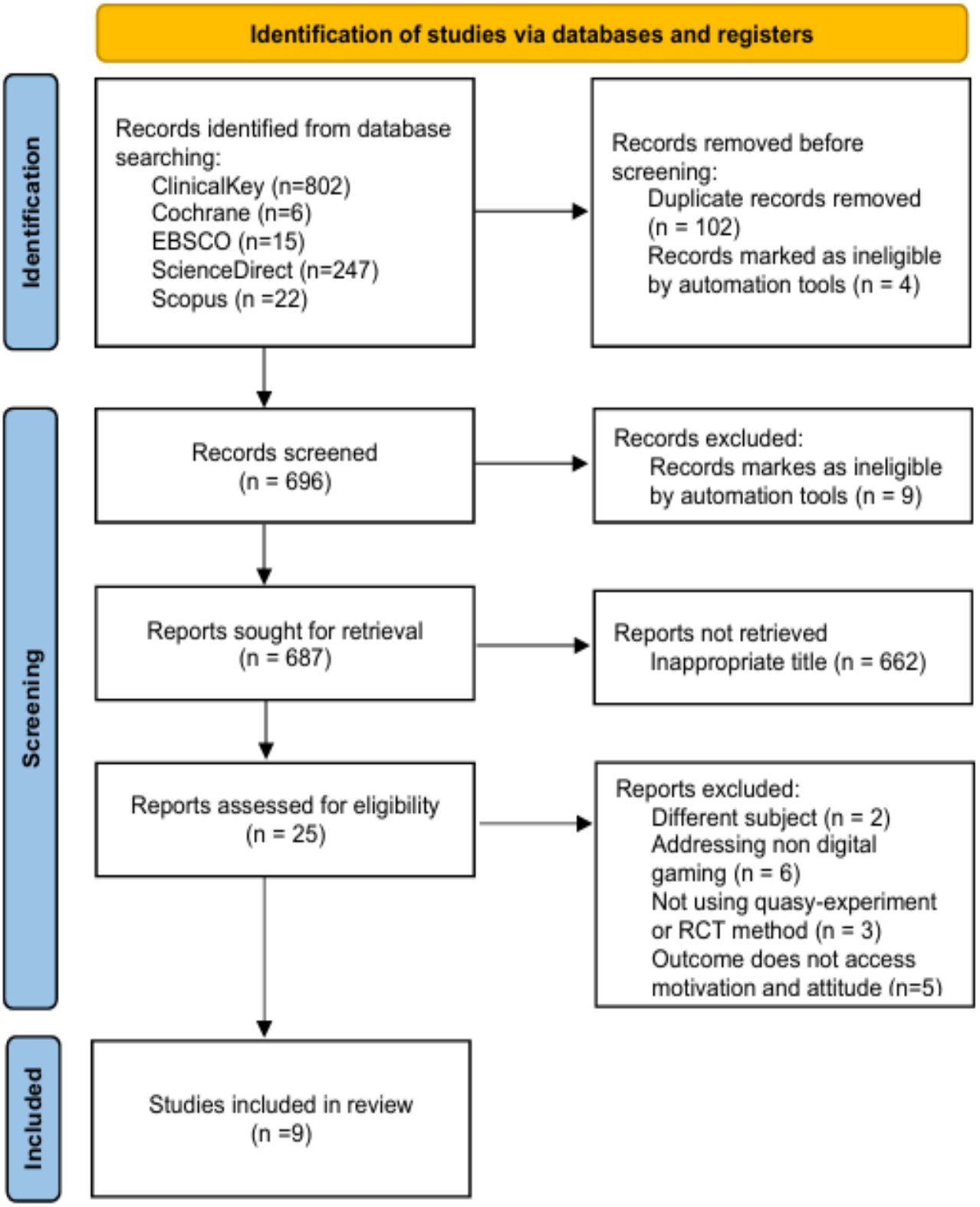

Figure 1. PRISMA flow diagram literature search results

Table 2. Study characteristics of digital gaming in sexual and reproductive health, and the main findings

Author, Year, Country	Study design	Participant characteristics	Sample size	Settings	Intervention (I) and Comparator (C)	Intervention duration	Outcome measured	Main findings
Bertozzi, et al. (2021) [14] India	Quasi-experiment	Students, aged 13-16 years	419 students	School-based	**I**: serious game **C**: -	-	Knowledge of sexual anatomy and processes	Initial findings suggest that knowledge gains from playing the game were modest, as indicated by minimal differences in scores between the pre-test and post-test across various indicators. Of the 246 students (58.7%) who completed the post-test, the average score increased by 6.27 percentage points compared to the pre-test (95% CI: 3.8–8.75; p < 0.001, one-sample t-test), indicating a statistically significant increase. However, the increase was limited.
Chu, et al. (2015) [17] Hong Kong	Quasi-experiment	Secondary school students, aged 12–16 years	788 students	School-based	**I:** "Making Smart Choices" interactive game **C:** -	1 hour per session	Safer sex knowledge and positive attitudes toward sex	The Wilcoxon Signed-Rank test showed a meaningful gain in sex-related knowledge, supported by a significant p-value (P < 0.001) and a moderate effect size of 0.477. More positive perspectives on sex and relationship-related issues were reported as an improved ability to make wise choices regarding love and sex, with average scores ranging from 4.54 to 4.66.
Fiellin, et al. (2017) [18] United States	RCT	Adolescents aged 11-14 years	333 participants (intervention: 166, control: 167)	Community-based on after-school, school, and summer programs	**I:** PlayForward: Elm City Stories interactive video game, designed to promote sexual health risk reduction. **C:** Attention-time control video games (e.g., Angry Birds, Dragonbox, Subway Surfer), with no sexual health content.	6 weeks (2 sessions per week, approximately 1 hour per session)	Sexual health knowledge and attitudes	The PlayForward intervention proved effective in enhancing sexual health attitudes and knowledge among racial/ethnic minority adolescents, with improvements lasting up to 12 months. The PlayForward group showed a significant increase in sexual health attitudes compared to the control group (LS mean difference = 0.37, 95% CI = 0.01-0.72, p = 0.03). Additionally, the PlayForward group demonstrated a significant increase in sexual health knowledge over 12 months (LS mean difference = 1.13, 95% CI = 0.64-1.61, p < 0.001), with both boys and girls showing similar improvements (girls: LS mean difference = 1.16, p = 0.001; boys: LS mean difference = 1.10, p = 0.001).
Haruna, et al. (2024) [19] Tanzania	Quasi-experiment	Adolescents aged 11-15	108 students (36 serious games group, 36 gamification group, and 36 traditional class group)	School-based	**I:** Serious Game and Gamification **C:** Traditional class	5 weeks, 40 minutes per week	Knowledge acquisition and attitude change	This study found that participants in the gamified learning classes demonstrated greater improvement in attitudes toward sexual health behaviors than those in the traditional learning group. Statistically significant differences were found between conditions: affective attitude, F (2, 105) = 201.72, p < 0.001; and cognitive attitude, F(2, 105) = 222.71, p < 0.001. Additionally, this study observed a significant enhancement in adolescents' sexual health knowledge through gamified platforms compared to non-gamified classes, with differences in mean scores across knowledge constructs between condition groups (p < 0.001).
Peskin, et al. (2015) [20] United States	RCT	8th-grade students	1.374 students (Intervention: 768 (10 schools); Control: 606 (10 schools)	School-based	**I:** IYG-Tech, a computer-based sexual health education program **C:** State-approved health education (textbook-based)	Approximately 6-8 weeks with 13 lessons, each 35-45 minutes	Knowledge and skills for condom and contraception use, and	Participants in this intervention group showed significant improvements in psychosocial outcomes compared to controls: they showed greater knowledge about STIs (β = 0.05, SE = 0.02) and condom knowledge (β = 0.07, SE < .04), expressed more positive beliefs about abstinence (β = 0.07, SE = 0.04) and waiting until

Author, Year, Country	Study design	Participant characteristics	Sample size	Settings	Intervention (I) and Comparator (C)	Intervention duration	Outcome measured	Main findings
							attitudes about abstinence	marriage to have sex (β = 0.08, SE =0.03), and perceived their friends as holding more positive beliefs about abstinence.
Raj, et al. (2025) [21] India	RCT	Adolescent girls, aged 15–19 and unmarried	1993 participants (Intervention: 997; Control: 996)	Community-based	**I**: Go Nisha Go mobile game (encouraged to play) **C**: Control group (did not receive any encouragement)	Ten weeks	Contraception knowledge	The intervention group experienced improvements in awareness of oral contraceptive pills (OCPs), condoms, and emergency contraceptive pills (ECPs), with odds ratios of 7.04 (95% CI: 4.60–10.78), 4.88 (95% CI: 3.78–6.28), and an exceptionally high 121.33 (95% CI: 16.86–872.99), respectively. Additionally, the proportion of participants in the intervention group who expressed the attitude of refusing sex when not ready rose substantially, from 61% to 85% ($p < 0.0001$). Moreover, individuals who played the intervention game were 2.4 times more likely to refuse sex if they felt unprepared (95% CI: 2.68–4.33, $p < 0.0001$), underscoring the effectiveness of the intervention in promoting sexual autonomy and informed decision-making.
Rokicki & Fink (2017) [22] Ghana	RCT	Female students, aged 14–24 years	498 students (Intervention: 205; Control: 293)	School-based	**I**: Interactive mHealth program using weekly text-message quizzes about sexual and reproductive health (SRH), with rewards (airtime) for correct answers. **C**: The Control group received messages on malaria instead of SRH.	8 weeks	Sexual and reproductive health knowledge	The mHealth program significantly improved reproductive health knowledge across all subgroups at both the 3-month and 15-month follow-ups, with no evidence of differences in effects between groups. Greater engagement was linked to larger knowledge gains, with each additional quiz response associated with an increase in knowledge z-score of 0.11 (95% CI: 0.08–0.14) at 3 months and 0.07 (95% CI: 0.02–0.13) at 15 months
Tebb, et al. (2021) [23] USA	RCT	Latina female adolescents, aged 14-1 years	1360 participants from 18 school-based health centers (Intervention: 9 clinics, control: 9 clinics)	School-based	**I:** Health-E You mHealth app **C:** Control group using iPads to answer baseline survey	1 session	Contraceptive knowledge	Health-E You significantly enhanced contraceptive knowledge at the 6-month follow-up. The app increased knowledge, with the average number of correct responses rising from 3.3 (±1.6) at baseline to 4.6 (±1.7) immediately after app use (b = 1.62, 95% CI 1.43–1.82, $p < 0.001$).
Von Kotzebue, et al. (2022) [24] Austria	Quasi-experiment	Students, aged 12-16 years	84 participants (42 in each group)	School-based	**I:** Digital Educational Escape Room (DEER) with sequential learning aids (scaffolding) **C:** DEER without additional learning aids	1 session for 100 minutes	Knowledge acquisition and knowledge-related self-confidence	The results indicate that game-based learning, particularly through escape rooms, effectively enhances motivation and knowledge acquisition. Specifically, knowledge increased substantially from pre-test to post-test ($F(1, 82) = 324.71$, $p < 0.001$; $\eta^2 = 0.80$).

Table 3. Digital gaming description in sexual and reproductive health

Author, Year	Game name	Devices	How to play	Benefits
Bertozzi, et al. (2021) [14]	My Future Family (MFF)	Android tablets and headsets	The game involves interactive gameplay where adolescents make decisions about family planning, including choosing when to marry, when to have children, and using contraceptive methods. Players also answer questions related to human sexual anatomy and reproduction through drag-and-drop activities.	Provides knowledge on human sexual anatomy, reproductive processes, and sexual health. Promotes engagement in sex education.
Chu, et al. (2015) [17]	Making Smart Choices (MSC)	iPad, Facebook, Web-based	The game consists of five mini-games where players make decisions about love, intimacy, sexual impulses, safer sex, and unwanted pregnancies. Each scenario presents choices, and educational messages are provided based on responses.	Enhances safer sex knowledge, promotes positive attitudes toward sex, and supports decision-making in sexual behavior. Students find it engaging, fun, and informative.
Fiellin, et al. (2017) [18]	PlayForward: Elm City Stories	iPad tablets	A role-playing adventure game where players create an avatar and navigate through life situations, making decisions in scenarios involving sexual health, risky behaviors (substance use, academic dishonesty), and other life challenges. Players see the outcomes of their choices.	Improves sexual health attitudes, knowledge, and intentions. Specifically, it showed improvements in sexual health knowledge and attitudes about sexual health, particularly in boys and younger adolescents.
Haruna, et al. (2024) [19]	My Future Begins Today	Computers, Mobile Phones	Players use avatars to interact with various scenarios related to sexual health and wellness. They complete quizzes, engage in thinking tasks, and participate in activities related to sexual health, including sexual responsibility, decision-making, and HIV/AIDS prevention. The game encourages active learning through educational challenges that require decision-making in realistic situations.	My Future Begins with today's game enhances students' understanding of sexual health, fosters positive attitudes toward healthy behaviors, and increases emotional and cognitive engagement. It provides a safe, interactive environment that reduces risky sexual behaviors and improves knowledge retention, supporting better sexual-health decision-making.
Peskin, et al. (2015) [20]	It's Your Game-Tech	Laptop computers	The program consists of 13 lessons (35-45 minutes each), delivered through a mall-like virtual environment. Animated narrators guide students to interact with scenarios, watch peer-modeling videos, complete quizzes, and engage in role-play activities.	Enhances knowledge of STI prevention, improves self-efficacy for condom use, strengthens beliefs about abstinence, and increases perceptions of peers' behaviors regarding sexual health.
Raj, et al. (2025) [21]	Go Nisha Go	Android-based smartphone	The game follows the protagonist, Nisha, on a self-discovery journey across Indian cities. Players make choices that affect Nisha's life, including menstrual health, contraception, consent, and marriage negotiation. Each of the five levels provides learning outcomes related to health behaviors.	Increases awareness of menstrual health, contraception, and decision-making agency. Promotes negotiation skills for marriage and sexual activity, improving overall reproductive health knowledge and confidence.
Rokicki & Fink (2017) [22]	Interactive mHealth Quiz Game	Mobile phones (SMS)	Participants receive a weekly multiple-choice quiz question on sexual and reproductive health (SRH) via SMS. For each correct answer, they earn airtime (mobile phone credit). The game is designed to be interactive, providing feedback on answers and reinforcing SRH knowledge.	Increases SRH knowledge, improves engagement with health content, incentivizes participation with rewards (airtime), and encourages regular interaction with health information.
Tebb, et al. (2021) [23]	Health-E You/ Salud iTu	iPads	The app begins with a contraceptive knowledge assessment (Myth-Buster's game), followed by questions about attitudes and experiences relevant to contraceptive selection. Based on responses, it recommends "top choice" contraceptive methods. Users can learn about the recommended methods through brief descriptions and videos. The app ends with a post-knowledge assessment and encourages condom use, along with providing information on emergency contraception.	Increases contraceptive knowledge, improves self-efficacy in decision-making, supports contraceptive choice, and enhances patient-provider communication.
Von Kotzebue, et al. (2022) [24]	Digital Educational Escape Room (DEER)	iPads	The DEER is a virtual escape room game in which students work through a series of sequential puzzles related to sex education topics, such as contraception and pregnancy. Players must solve puzzles within a set time limit (45 minutes). In the scaffolding version, hints are provided as additional support when players encounter difficulties. Players are guided through the game with a narrative that creates a sense of urgency and immersion.	Enhances knowledge acquisition, motivation, and situational interest in sex education topics. Improves knowledge-related self-confidence.

DISCUSSION

This systematic review aimed to evaluate the effectiveness of digital games in improving adolescents' knowledge and attitudes regarding sexual and reproductive health (SRH). Although this review incorporates relevant studies, it has limitations in its article search and selection process. Some studies may have been excluded due to limitations in the databases used or the selection criteria applied. Furthermore, although no articles were excluded based on their assessment scores, limitations in the quality of reports in some studies may affect the validity of the findings. These limitations could impact the diversity of studies included in this review. Nevertheless, this review aims to identify and incorporate relevant studies.

Based on an analysis of various studies, digital games have significant potential in increasing knowledge and positive attitudes towards SRH among adolescents. This study describes multiple types of digital games, such as *My Future Family Game (MFF)*, *Making Smart Choices (MSC)*, *PlayForward*, *My Future Begins Today*, *It's Your Game-Tech (IYG-Tech)*, *Go Nisha Go*, *mHealth program*, *Health-E You*, and *DEER*, which are designed to educate adolescents on sexual and reproductive health topics through engaging, interactive, and gamified learning experiences [14,17–24].

Topics covered include family planning, sexual anatomy, reproductive health, STI prevention, contraception, healthy relationships, menstrual awareness, and decision-making regarding risky sexual behavior. The main goal of these games is to increase adolescents' knowledge about sexual health, improve their attitudes toward healthy sexual behavior, and empower them to make knowledgeable decisions about their future sexual health. Each game aims to provide an interactive and enjoyable learning experience, conveying essential and relevant information through engaging methods that encourage adolescents to be more actively involved in the learning process [14,17–24].

This systematic literature review found that digital games are significantly effective in increasing knowledge about sexual and reproductive health. Most interventions produced statistically significant improvements, with effect sizes ranging from small (β = 0.05) to very large (η^2 = 0.80. Bertozzi reported an average increase of 6.27 percentage points in knowledge scores (95% CI: 3.8–8.75; $p < 0.001$), reflecting a statistically significant but limited effect [14]. Peskin et al found small but significant improvements in psychosocial outcomes, with effect sizes ranging from β = 0.05 to 0.08 [20].

Fiellin et al found significant increases in sexual health attitudes (LS mean difference = 0.37) and knowledge (LS mean difference = 1.13) [18]. Tebb et al found an increase in contraceptive knowledge scores b = 1.62; 95% CI: 1.43–1.82; $p < 0.001$) [23]. Haruna reported highly significant differences in both affective and cognitive attitudes (F values > 200; $p < 0.001$) and considerable knowledge gains in the gamified group [19]. Raj et al found attitudes toward refusing sex when not ready also improved substantially (from 61% to 85%, $p < 0.0001$) [21]. Kotzebue et al. reported a large effect size (η^2 = 0.80; $F(1,82) = 324.71$; $p < 0.001$) for knowledge acquisition through escape-room game-based learning [24]. This heterogeneity in the results may be attributable to differences in study design (RCT vs. quasi-experimental), intervention type, cultural and educational contexts, and variations in sample characteristics (age range, gender distribution, and country of origin).

Participants in the digital gaming intervention can enjoy the game while interacting with the learning content. This results in more meaningful knowledge acquisition and more lasting information, which can be potentially effective in reducing risky sexual behaviors and achieving better health outcomes. Sexual health education is typically a sensitive topic in these learning environments. Consequently, gamified platforms create a safe and non-judgmental space where adolescents can effectively learn and acquire the information needed to make informed choices about their sexual health practices [25]. Gamified learning platforms enable students to independently acquire knowledge and concentrate on their studies, facilitating long-term retention. By engaging the brain through interactive exercises and scenarios that encourage problem -solving, this approach also supports enhanced memory retention and the effective retrieval of stored information [19].

This systematic literature review also found that digital games are effective in promoting positive attitudes towards sexual and reproductive health among adolescents. This may be attributed to the privacy, security, and risk-free environment of gamified learning platforms, which enable adolescents to engage in gameplay, practice decision-making skills, and navigate real-time scenarios that closely mirror real-life situations with minimal or no negative consequences [17].

Furthermore, digital games offer practical pedagogical methods for studying sexual health issues because they take into account social and cultural sensitivities [7]. Digital games feature engaging

elements, including a variety of interactive components designed to enhance engagement and knowledge retention. For example, *PlayForward* combines story-based scenarios and challenges that allow players to make decisions that affect the story's outcome. At the same time, *Go Nisha Go* offers role-playing simulations in which the main character explores various cities and learns about menstrual health and contraception [18,21]. *Health-E You* features contraceptive knowledge assessments, myth-busting games, and personalized recommendations based on player choices [23]. Many games also include mini-games, quizzes, animated videos, and live feedback, similar to the *mHealth* program, which rewards students with phone credits for correct answers to maintain student participation. All of these features not only support enjoyable learning but also enable students to apply their knowledge in practical, real-world contexts, thereby enriching their educational experience.

Research shows that compared to traditional methods, learning through games successfully improves adolescents' understanding of sexual health [19]. Conventional teaching methods were reported to be less effective than expected. Learning was reported to be passive and unengaging. Adolescents recognized that socio-cultural factors influence sexual health challenges within their communities; however, conventional teaching methods often omit critical information, which contributes to negative perceptions of these educational approaches [7]. However, with digital games, participants learn independently using the provided resources. Information on Digital games is a practical pedagogy for learning about sexual health issues because they consider social and cultural sensitivities [19]. By engaging in games and interacting with learning materials, participants gained lasting knowledge and a more meaningful understanding. One of the main advantages of Game-Based Learning (GBL) is that it enables individuals to oversee their own behaviors through the support of an interactive design [24].

The findings of this review suggest that integrating digital games into sexual and reproductive health education can significantly enhance adolescents' knowledge and attitudes. Policymakers and educators should consider incorporating gamified learning approaches into comprehensive health education programs to create more engaging, accessible, and culturally sensitive learning environments. Digital games offer a valuable opportunity to address sensitive topics in a non-judgmental space, empowering adolescents to make informed decisions. However, further research is needed to explore the long-term effectiveness of these interventions, particularly in terms of behavior change, and to refine game designs for broader applicability across diverse cultural and socio-economic contexts.

CONCLUSION

In conclusion, digital gaming interventions positively influence adolescents' sexual and reproductive health (SRH) knowledge and attitudes, showing improvements across topics such as contraception, STI prevention, and healthy relationships. However, this review is limited by the small number of studies, design heterogeneity, and variations in cultural and educational contexts, which may affect generalizability. Future research should employ rigorous methodologies and long-term evaluations. Practically, integrating digital games into school curricula, adolescent health programs, and community-based initiatives could provide engaging, safe, and culturally sensitive approaches to strengthen adolescent SRH education.

REFERENCES

1. Akinwale OD, Bello CB, Elemile MG. Adolescent health issues. Journal of Integrative Nursing. 2023; 5(1):59–65.
2. World Health Organization. Adolescent and young adult health. 2025. Available from: [Website]
3. Navarro Gómez ML, Ojeda Velázquez I. Aumento de infecciones de transmisión sexual en adolescentes: un desafío urgente (Increase in sexually transmitted infections in adolescents: an urgent challenge). Anales de Pediatría. 2025;102:503828.
4. Vatrisya G, Febliyanti D, Anggraini D. Infeksi menular seksual pada remaja di Indonesia: prevalensi, faktor resiko dan upaya pencegahan. Journal of Public Health Science (JoPHS). 2024;1(2): 3047–632.
5. Fubam RM, Tendongfor N, Olayemi O, Odukogbe A-TA. Sexual and reproductive health knowledge of secondary school adolescents in Fako, Cameroon. The Pan African Medical Journal. 2022;41:340.
6. Benchamas J, Senahad N, Padchasuwan NH, Laoraksawong P, Phimha S, Banchonhattakit P. Factors associated with risky sexual behaviors among undergraduate students in Thailand. BMC Public Health. 2024;24(1):2967.
7. Haruna H, Hu X, Chu SKW, Mellecker RR, Gabriel G, Ndekao PS. Improving sexual health education programs for adolescent students through game-based learning and gamification. International Journal of Environmental Research and Public Health. 2018;15(9):2027.

8. O'Brien RT, Gagnon KW, Egan JE, Coulter RWS. Gaming preferences and motivations among bullied sexual and gender minority youth: an interview study. Games for Health Journal. 2022;11(2):79–84.
9. Jallow B, Awolude OA, Bah HT, Solomon MT, Bampoque L, Nshimirimana I. Adolescents' knowledge and perceptions of sexual and reproductive health rights and access to services in the greater Banjul Area, the Gambia. The Pan African Medical Journal. 2025;51:2.
10. Decker MJ, Atyam TV, Zárate CG, Bayer AM, Bautista C, Saphir M. Adolescents' perceived barriers to accessing sexual and reproductive health services in California: a cross-sectional survey. BMC Health Service Research. 2021;21(1):1263.
11. Ezenwaka U, Mbachu C, Ezumah N, Eze I, Agu C, Agu I, et al. Exploring factors constraining utilization of contraceptive services among adolescents in Southeast Nigeria: an application of the socio-ecological model. BMC Public Health. 2020;20: 1162.
12. Fu C, Ma J, Liang X, Zhao S, Luo Q, Zhang H. Application of digital games for interventions to reduce risky sexual behavior among adolescents :a systematic review. Chinese Journal of School Health. 2024;45(12):1811–4.
13. Sara M, Guay L. Toward a social-constructivist view of serious games: practical implications for the design of a sexual health education video game. engaging with videogames: play, theory and practice. Brill. 2014.
14. Bertozzi E, Bertozzi-Villa A, Padankatti S, Sridhar A. Outcomes assessment pitfalls: challenges to quantifying knowledge gain in a sex education game. Gates Open Research. 2021;4:73.
15. JBI. JBI critical appraisal tools. Available from: [Website]
16. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372:n71.
17. Chu SK, Kwan AC, Reynolds R, Mellecker RR, Tam F, Lee G, et al. Promoting sex education among teenagers through an interactive game: reasons for success and implications. Games for Health Journal. 2015;4(3):168–74.
18. Fiellin LE, Hieftje KD, Pendergrass TM, Kyriakides TC, Duncan LR, Dziura JD, et al. Video game intervention for sexual risk reduction in minority adolescents: randomized controlled trial. Journal of Medical Internet Research. 2017;19(9):e314.
19. Haruna H. A comparative analysis of gamified and non-gamified interventions' effectiveness in teaching adolescent students about healthy sexual practices in Tanzania. Sexuality Research and Social Policy. 2024;22(1):435–50.
20. Peskin MF, Shegog R, Markham CM, Thiel M, Baumler ER, Addy RC, et al. Efficacy of it's your game-tech: a computer-based sexual health education program for middle school youth. The Journal of Adolescent Health. 2015;56(5):515–21.
21. Raj A, Shankar L, Dixit A, Saha A, Battala M, Khan N, et al. Enhancing reproductive health among adolescent girls in India: results of an individualized RCT to study the efficacy of the go Nisha go mobile game. Reproductive Health. 2025; 22:48.
22. Rokicki S, Fink G. Assessing the reach and effectiveness of mHealth: evidence from a reproductive health program for adolescent girls in Ghana. BMC Public Health. 2017;17:969.
23. Tebb KP, Rodriguez F, Pollack LM, Adams S, Rico R, Renteria R, et al. Improving contraceptive use among Latina adolescents: A cluster-randomized controlled trial evaluating an mHealth application, Health-E You/Salud iTu. Contraception. 2021;104(3): 246–53.
24. Von Kotzebue L, Zumbach J, Brandlmayr A. Digital escape rooms as game-based learning environments: a study in sex education. Multimodal Technologies and Interaction. 2022;6(2):8.
25. D'Cruz J, Santa Maria D, Dube S, Markham C, McLaughlin J, Wilkerson JM, et al. Promoting parent–child sexual health dialogue with an intergenerational game: parent and youth perspectives. Games for Health Journal. 2015;4(2): 113–22.