INNOVATIVE EDUCATIONAL MEDIA FOR IMPROVING ADOLESCENT REPRODUCTIVE HEALTH KNOWLEDGE : A LITERATURE REVIEW

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Abstract

Adolescent reproductive health knowledge is essential for informed decision-making regarding puberty, menstruation, contraception, and sexually transmitted infections (STIs). This literature review aimed to synthesize evidence on educational media used to improve reproductive health knowledge among adolescents. A structured search was conducted in PubMed, ScienceDirect, and Google Scholar for studies published between January 1, 2020, and October 19, 2026. Of the 86 records identified, 44 came from PubMed, 36 from ScienceDirect, and 6 from Google Scholar. Nineteen reports underwent full-text eligibility assessment. Three were excluded for being outside the review scope, leaving 16 primary studies for synthesis. The included studies evaluated messaging platforms, mobile applications, short message service (SMS), animated videos, interactive electronic modules, social media, web-based interventions, and blended educational approaches. Several studies reported improvements in short-term knowledge outcomes, although comparative effectiveness varied across interventions and comparators. A digital menstrual hygiene intervention reported a difference-in-differences estimate of 12.5 points (95% confidence interval [CI], 10.2–14.7; $p < 0.001$), whereas the HEROIC application did not demonstrate a statistically significant advantage over a printed booklet. Interpretation of the findings is limited by heterogeneity in study designs, knowledge measurement instruments, follow-up periods, and intervention components. Overall, educational media represent potentially useful complements to school- and community-based reproductive health education, but the available evidence does not establish the superiority of a single format. Further comparative studies using validated knowledge measures and longer follow-up periods are needed to determine the sustainability of knowledge gains and their relationship with subsequent health behaviors.'

Keywords: Adolescent Reproductive Health; Reproductive Health Knowledge; Educational Media; Digital Education; Health Education.

1. INTRODUCTION

Adolescence is a critical developmental period characterized by physical, psychological, and social changes, including puberty and reproductive maturation. During this stage, adequate reproductive health knowledge is essential for understanding bodily changes, making informed decisions, and developing healthy behaviors. Knowledge of puberty, menstruation, contraception, sexually transmitted infections (STIs), and sexual and reproductive health rights is particularly important for enabling adolescents to access reliable information and make informed health-related decisions. Comprehensive, age-appropriate, and evidence-informed sexuality education therefore represents an important component of adolescent health promotion [1]. However, access to accurate and adolescent-friendly educational information remains an important consideration when designing effective reproductive health education programs.

Conventional reproductive health education, including classroom lectures and printed educational materials, continues to provide a foundation for school- and community-based health promotion. Nevertheless, educational delivery methods differ in their opportunities for interaction, repeated exposure, accessibility, and learner engagement. Advances in digital technology have expanded the range of educational media available to adolescents, including mobile applications, messaging

platforms, websites, social media, animated videos, interactive electronic modules, and other multimedia resources. Previous reviews have examined digital applications, web-based interventions, and other educational media for sexual and reproductive health education among adolescents [6]–[10]. These approaches offer alternative ways to present health information, although their educational value needs to be assessed through measured learning outcomes rather than technological features or user engagement alone.

Primary intervention studies have evaluated different educational media and reported varying knowledge-related outcomes. Messaging platforms such as LINE and WhatsApp have been investigated for reproductive health education [11], while animated videos, mobile applications, and interactive electronic modules have been examined in relation to reproductive health and menstrual hygiene knowledge [12]–[17]. Other studies have evaluated short-message service (SMS), web-based programs, social media, and on-demand mobile health services [18]–[26]. Although several studies have reported improvements in knowledge following educational interventions, the comparative advantages of different media are not consistent across studies. Some interventions have demonstrated favorable outcomes relative to their comparators, whereas others have not established statistically significant superiority over printed educational materials or alternative educational approaches. These differences indicate the need to examine both the knowledge outcomes reported by individual studies and the conditions under which the interventions were implemented.

Despite the expanding evidence base, several issues require further synthesis. First, existing studies differ in educational media, intervention duration, participant characteristics, study design, and knowledge assessment instruments. Such heterogeneity complicates direct comparisons of reported outcomes. Second, knowledge is frequently discussed alongside related outcomes, including attitudes, engagement, usability, accessibility, and health-related behaviors. Although these outcomes provide useful information about educational interventions, they are conceptually distinct from measured reproductive health knowledge [2]. Third, the evidence remains insufficiently consolidated regarding the educational approaches evaluated, their comparative knowledge outcomes, and the contextual factors that influence their implementation. Evidence on sustained knowledge retention is also limited in comparison with short-term post-intervention assessment. A focused synthesis of primary intervention studies is therefore needed to distinguish direct knowledge outcomes from related educational outcomes and to identify limitations in the available evidence.

The potential contribution of innovative educational media can be examined through multimedia learning principles, which explain how learners process verbal and visual information during learning [3], [4]. These principles provide a theoretical basis for examining the presentation and organization of educational content, but they do not independently establish the effectiveness of a particular reproductive health intervention. Features such as interactivity, feedback, repeated access, and age-appropriate presentation may offer educational benefits, while their practical value depends on content accuracy, cultural relevance, digital accessibility, and the needs of the target population. Accordingly, evaluating educational media requires attention to measured knowledge outcomes, intervention characteristics, comparison conditions, and implementation context rather than assuming that digital delivery is inherently more effective than conventional education.

This literature review aimed to synthesize evidence from primary intervention studies on educational media used to improve reproductive health knowledge among adolescents. Specifically, the review examined the types of educational media evaluated, the knowledge outcomes reported, differences in findings across interventions and comparators, and the methodological and contextual factors relevant to interpreting their effectiveness. By distinguishing knowledge outcomes from related educational and behavioral measures, this review seeks to provide an evidence-informed comparison of available approaches and identify priorities for future research and the implementation of adolescent-friendly reproductive health education in school and community settings.

2. METHODOLOGY

2.1 Study Design

This study employed a structured literature review with a narrative thematic synthesis to examine educational media used to improve reproductive health knowledge among adolescents. The review focused on the types and characteristics of educational media, reported changes in knowledge outcomes, comparative findings across interventions, and contextual factors relevant to

implementation. A structured approach was used to organize literature identification, eligibility assessment, data extraction, and evidence synthesis. The findings were interpreted descriptively because the included studies differed in intervention characteristics, study designs, knowledge measurement instruments, and follow-up periods.

2.2 Literature Search Strategy

The literature search was conducted during September 15–October 19, 2026, covering publications dated January 1, 2020, through October 19, 2026. PubMed, ScienceDirect, and Google Scholar were searched to identify studies on adolescent reproductive health education and educational media. The search yielded 86 records in total: 44 from PubMed, 36 from ScienceDirect, and 6 from Google Scholar.

The search strategy covered four concepts: adolescent populations, sexual or reproductive health, educational media, and knowledge outcomes. Search terms were combined and adapted to the search functions of PubMed, ScienceDirect, and Google Scholar. The following search strings present the terms and combinations used to identify potentially relevant studies.

Conceptual search string recorded in the original notes: (adolescent* OR teenager* OR teen* OR youth) AND ("reproductive health" OR "sexual health" OR "menstrual health" OR "menstrual hygiene") AND ("educational media" OR "health education" OR "digital education" OR "mobile application" OR "web-based education" OR animation OR "educational video" OR "interactive e-module" OR SMS OR "social media") AND (knowledge OR awareness OR understanding).

Search strings were organized according to each platform's search functionality. PubMed supports MeSH and title/abstract terms, while ScienceDirect and Google Scholar use platform-specific query functions and may process long Boolean expressions differently. PubMed search string: (("Adolescent"[Mesh] OR adolescent*[tiab] OR teenager*[tiab] OR teen*[tiab] OR youth[tiab]) AND ("Reproductive Health"[Mesh] OR "Sexual Health"[Mesh] OR "reproductive health"[tiab] OR "sexual health"[tiab] OR "menstrual health"[tiab] OR "menstrual hygiene"[tiab]) AND ("Health Education"[Mesh] OR "educational media"[tiab] OR "health education"[tiab] OR "digital education"[tiab] OR "mobile application"[tiab] OR "mobile applications"[tiab] OR "web-based education"[tiab] OR animation[tiab] OR "educational video"[tiab] OR "interactive e-module"[tiab] OR SMS[tiab] OR "social media"[tiab]) AND (knowledge[tiab] OR awareness[tiab] OR understanding[tiab])) AND ("2020/01/01"[Date - Publication] : "2026/10/19"[Date - Publication]).

ScienceDirect search string: (adolescent OR adolescents OR teenager OR teenagers OR youth) AND ("reproductive health" OR "sexual health" OR "menstrual health" OR "menstrual hygiene") AND ("educational media" OR "health education" OR "digital education" OR "mobile application" OR "web-based education" OR animation OR "educational video" OR "interactive e-module" OR SMS OR "social media") AND (knowledge OR awareness OR understanding). Apply the publication-year/date limits for January 1, 2020, through October 19, 2026, where the platform interface supports them.

Google Scholar search string: adolescent OR teenager OR youth combined with reproductive health OR sexual health OR menstrual health and education OR mobile application OR educational video OR e-module and knowledge. Search phrase: (adolescent OR teenager OR youth) ("reproductive health" OR "sexual health" OR "menstrual health") (education OR "mobile application" OR video OR "e-module" OR SMS OR "social media") knowledge. Apply the custom date range 2020–October 19, 2026, where supported. Because Google Scholar does not consistently process long Boolean strings, use the documented query in manageable keyword combinations and record each query separately.

Publication date limits were set from January 1, 2020, through October 19, 2026. The search returned 86 records: 44 from PubMed, 36 from ScienceDirect, and 6 from Google Scholar.

2.3 Inclusion and Exclusion Criteria

Studies were eligible for the primary evidence synthesis when they met the following criteria:

1. Published between January 1, 2020, and October 19, 2026.
2. Involved adolescents aged 10–19 years or provided separately extractable findings for this population.
3. Evaluated an educational intervention addressing sexual or reproductive health, including menstrual health and hygiene.
4. Measured reproductive health knowledge as an outcome.
5. Provided sufficient information about the study population, intervention, research design, and knowledge-related findings for interpretation.

Primary intervention studies, including randomized, quasi-experimental, and other experimental or non-randomized intervention designs, were considered for inclusion when relevant knowledge outcomes were reported. Studies involving mixed-age populations were eligible only when adolescent-specific findings were available.

Studies were excluded when they focused on populations outside the review scope, addressed topics unrelated to adolescent sexual or reproductive health, did not measure a relevant knowledge outcome, or lacked sufficient methodological information for meaningful interpretation. Studies reporting only usability, satisfaction, engagement, accessibility, or behavioral intentions without a relevant knowledge outcome were not included in the primary synthesis.

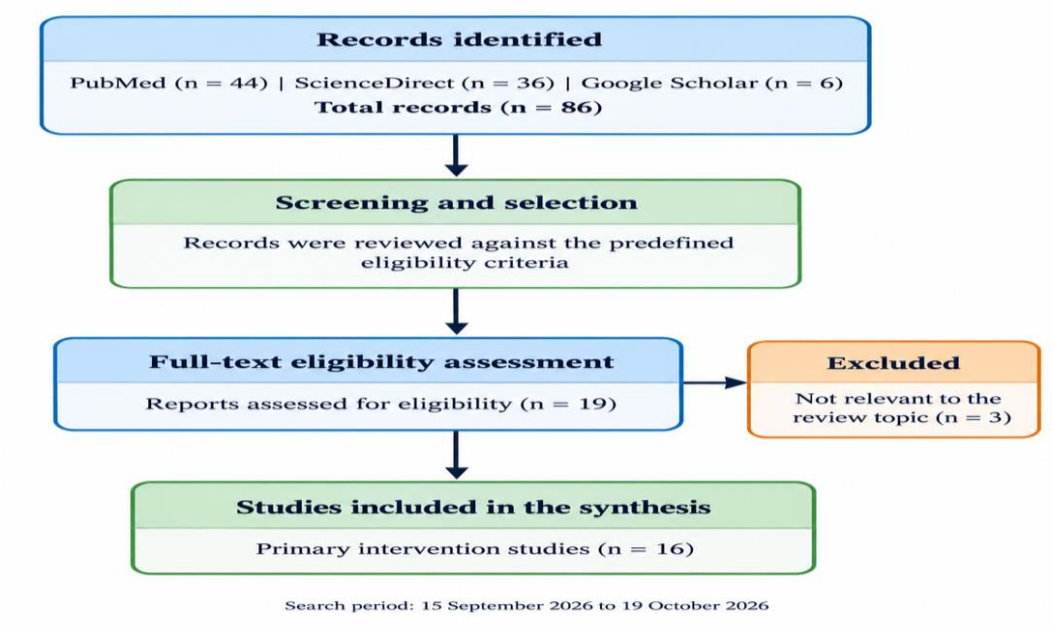
The screening decisions and reasons for exclusion were documented in the Excel selection sheet. Systematic reviews, scoping reviews, and other secondary research were used as contextual sources where relevant but were not counted among the primary studies included in the synthesis.

2.4 Study Selection Process

The study selection process was documented in an Excel worksheet. A total of 86 records were identified from three sources: PubMed (n = 44), ScienceDirect (n = 36), and Google Scholar (n = 6). Of these, 19 reports proceeded to full-text eligibility assessment. Three reports were excluded because they did not meet the review topic criteria, resulting in 16 primary intervention studies being included in the final synthesis.

Full-text eligibility was assessed based on three main criteria: relevance to the target adolescent population, evaluation of an educational intervention related to sexual or reproductive health, and measurement of reproductive health knowledge as an outcome. Studies meeting these criteria were retained for synthesis. The study selection process is illustrated in Figure 1, following the PRISMA 2020 reporting framework [5].

Figure 1. Study Selection Flow Diagram



Following the study selection process presented in Figure 1, 16 primary intervention studies were included in the final synthesis. Data were extracted from each study, including the authors and year of publication, country and participant characteristics, study design and sample size, type of educational media, knowledge assessment instruments, principal knowledge-related findings, and reported limitations. The extracted data were organized and compared to identify patterns in the reported effectiveness of educational media, differences in knowledge outcomes, and methodological limitations across the included studies.

2.5 Data Extraction

A structured data-extraction framework was used to organize information from the 16 included primary studies. The extracted variables comprised author and publication year, study country, participant characteristics, sample size, study design, intervention and comparison conditions, educational media, intervention duration, knowledge measurement instruments, reported knowledge outcomes, and study limitations.

Educational media were categorized according to their principal delivery format, including mobile applications, messaging platforms, SMS-based interventions, social media, animated videos, interactive electronic modules, web-based education, and blended educational approaches integrating digital technology with other instructional activities.

Reproductive health knowledge was treated as the primary outcome. Knowledge outcomes were distinguished from attitudes, motivation, engagement, satisfaction, usability, health literacy, and self-reported reproductive health practices. These related outcomes were considered where relevant but were not interpreted as direct measures of knowledge improvement.

Reported pre-intervention and post-intervention scores, between-group differences, effect estimates, confidence intervals, and statistical significance were extracted when available in the accessible study reports. Information not reported in the source material was identified as unavailable rather than inferred. Bibliographic details and quantitative findings were checked against available article texts and publication records.

2.6 Data Synthesis and Analysis

A narrative thematic synthesis was conducted to compare educational media and their reported reproductive health knowledge outcomes. The synthesis was organized around four themes:

1. Characteristics and delivery formats of educational media.
2. Reported changes in reproductive health knowledge and comparative intervention findings.
3. Educational features potentially relevant to knowledge acquisition.
4. Contextual factors and methodological limitations affecting interpretation and implementation.

Where data were available, findings were compared using pre-intervention and post-intervention knowledge scores, between-group differences, effect estimates, confidence intervals, and reported statistical significance. Interpretation considered study design, participant characteristics, comparison conditions, intervention duration, and the specific knowledge domains measured.

Within-group improvements were distinguished from evidence of superiority over a comparison group. A statistically significant pre-intervention to post-intervention change within an intervention group was not treated as sufficient evidence that the intervention was more effective than an alternative educational approach. Studies without an appropriate comparison group were interpreted cautiously.

A quantitative meta-analysis was not conducted. The included studies differed in educational content, delivery formats, research designs, knowledge assessment instruments, and outcome reporting. A narrative synthesis was therefore used to describe the available findings without combining results that were not sufficiently comparable.

2.7 Methodological Considerations

Several methodological considerations informed the interpretation of the findings. These included differences in study design, sample characteristics, educational content, delivery methods, knowledge measurement instruments, comparison conditions, and follow-up duration. Potential sources of bias, including selection bias, self-reported outcome measurement, and incomplete follow-up, were considered when such limitations were reported by the original studies.

A formal risk-of-bias assessment using a standardized appraisal tool was not conducted. Consequently, the review does not assign an overall certainty rating to the included evidence. The findings should be interpreted as a structured narrative synthesis of the available primary intervention studies rather than a pooled quantitative estimate of educational effectiveness.

Search results, study-selection decisions, and reasons for exclusion were organized in the Excel screening file. The final selection comprised 19 reports assessed at full text, three reports excluded as outside the review topic, and 16 primary intervention studies included in the synthesis.

3. RESULTS

3.1 Study Selection and Characteristics

The search identified 86 records: 44 from PubMed, 36 from ScienceDirect, and 6 from Google Scholar. The Excel selection sheet records 19 reports assessed at full text, three reports excluded because they did not match the review topic, and 16 primary intervention studies included in the synthesis.

The 16 included studies were conducted in Indonesia, Bangladesh, Kenya, and the United States. They examined school-based or service-linked adolescent populations and evaluated mobile health applications, messaging platforms, SMS, animated videos, interactive digital booklets and e-modules, social media, web-based programs, on-demand mobile services, and blended educational approaches. Study designs included quasi-experimental pretest–posttest studies, individual randomized controlled trials, and a cluster randomized trial. Table 1 summarizes the characteristics, educational media, principal knowledge findings, and limitations of all 16 studies.

Table 1. Summary of Included Primary Intervention Studies

Author and year	Country and sample	Study design	Educational media	Main knowledge findings	Limitations
Kosasih et al. (2024) [11]	Indonesia; n = 154 (LINE n = 78; WhatsApp n = 76)	Quasi-experimental, two groups	LINE and WhatsApp	Mean knowledge scores increased from 15.68 to 20.21 in the LINE group and from 15.16 to 19.67 in the WhatsApp group (both within-group p = 0.001). The difference in knowledge gain between groups was not significant (p = 0.973).	Two schools; one-month follow-up.
Linsqy et al. (2025) [12]	Indonesia; n = 50 female Grade XI students (25 per group)	Quasi-experimental with control group	Animated video on vulva hygiene	Mean score increased from 5.20 to 6.92 in the intervention group (p < 0.001); the control score changed from 4.80 to 4.64 (p = 0.54). The between-group comparison was significant (reported p = 0.00).	Small sample; single-school setting.
Nurhaeni et al. (2025) [13]	Indonesia; n = 120 adolescents (60 per group)	Quasi-experimental pretest–posttest with control group	Digital application with family nursing support	The intervention group's knowledge score increased by 12.4 points (p < 0.001; Cohen's d = 1.45). The adjusted between-group difference was significant (p < 0.001).	The independent effect of the application cannot be separated from family support.
Sari et al. (2026) [14]	Indonesia; n = 140 adolescents (70 per group)	Quasi-experimental controlled study, three-month follow-up	Teen Health application	Knowledge-score gain was 4.36 points in the intervention group versus 0.86 in the control group (p < 0.001).	Non-randomized design; follow-up was three months.
Agustini et al. (2026) [15]	Indonesia; n = 156 adolescents (HEROIC n = 85; booklet n = 71)	Quasi-experimental pretest–posttest	HEROIC application and printed booklet	Knowledge improved in both groups (within-group p < 0.001), but the difference in knowledge improvement between groups was not significant.	Non-randomized allocation; short-term outcome assessment.
Fuadah et al. (2026) [16]	Indonesia, Bandung Regency; n = 180 female students (90 per condition)	Quasi-experimental with control group	Animated video plus interactive digital booklet	The difference-in-differences estimate was 12.5 points (95% CI: 10.2–14.7; p < 0.001).	Combined intervention prevents isolation of each medium's effect.
Noviani et al. (2026) [17]	Indonesia; n = 70 female students (35 per group)	Quasi-experimental pretest–posttest, two groups	Interactive e-module versus educational video	Median knowledge score increased from 50 to 95 in the e-module group and from 50 to 90 in the video group; both within-group changes and the between-group difference were significant (p < 0.001).	Purposive sampling; single-district setting; short follow-up.

Author and year	Country and sample	Study design	Educational media	Main knowledge findings	Limitations
Ahmed (2020) [18]	Bangladesh; n = 400 adolescent girls aged 14–19 years at baseline	Uncontrolled before-and-after quasi-experimental study; eight-week intervention	SMS-based reproductive health education	Mean knowledge score increased from 44.71% (SD 9.13) at baseline to 70.8% (SD 9.7) post-intervention ($p < 0.001$; Cohen's $d = 3.6$). Post-intervention data were available for 381 participants.	No control group; one geographic area; 4.8% missing at post-test.
Martínez-García et al. (2023) [19]	United States; n = 1,210 females aged 14–18 years in the final analytic sample	Randomized controlled trial; three- and six-month follow-up	Crush mobile application versus wellness app	At three months, the adjusted effect estimate for contraceptive knowledge was 0.03 (SE 0.007; $p < 0.001$; marginal effect 0.029). The study also assessed outcomes at six months.	Female-only sample; recruitment through social media; outcomes included self-reported measures.
Sumarmi et al. (2026) [20]	Indonesia, Takalar; n = 100 female high-school students (50 per group)	Quasi-experimental pretest–posttest with control group	Android-based reproductive health education	Mean score increased from 11.52 (SD 3.04) to 17.54 (SD 2.29) in the intervention group, compared with 12.86 (SD 3.74) to 13.24 (SD 4.22) in the control group.	Single-school setting; non-random allocation.
McCrimmon et al. (2024) [21]	United States; n = 457 high-school students (HEART n = 233; control n = 224)	Randomized controlled trial; immediate post-test	HEART web-based sexual health program	At post-test, HIV/STI knowledge was higher in the HEART group than in control (means 7.03 vs. 4.61; adjusted B = 2.42, SE 0.16; $p < 0.001$; Cohen's $d = 1.17$).	Immediate post-test; long-term knowledge retention was not assessed.
Yarger et al. (2024) [22]	United States; n = 1,263 adolescents across 95 cohorts	Cluster randomized trial; three-month follow-up	In-person sexual health education integrating digital technologies	At three months, 57.6% of sexual-health knowledge items were answered correctly in the intervention group versus 50.7% in control ($p = 0.001$).	The independent effect of digital technology cannot be isolated from the in-person program.
Macharia et al. (2022) [23]	Kenya; n = 300 randomized (USSD n = 146; control n = 154)	Randomized controlled trial; three-month follow-up	USSD-based on-demand mobile information service	Among the analyzed knowledge scores, the intervention mean was 10.77 (SD 2.01) versus 10.17 (SD 2.41) in control ($t = 2.197$; $p = 0.03$). The paper reports 54.9% (62/109) used the app at least once.	App uptake was limited; knowledge analysis had fewer observations than the 300 randomized participants.

Author and year	Country and sample	Study design	Educational media	Main knowledge findings	Limitations
Haninuna et al. (2023) [24]	Indonesia, Semau Island; n = 78 junior-high-school students (39 per group)	Quasi-experimental pretest–posttest, two groups	TikTok versus leaflet	Knowledge scores increased from 11.15 to 17.20 in the TikTok group (gain 6.05) and from 10.20 to 15.90 in the leaflet group (gain 5.70); both within-group tests reported p = 0.0001.	Small sample; single-location setting.
Parimayuna et al. (2023) [25]	Indonesia, Bali; n = 50 students aged 12–17 years	Quasi-experimental, two-group pretest–posttest	Local-language versus national-language education	Knowledge improved in both groups (local language p < 0.001; national language p = 0.004); the between-group difference favored local-language delivery (p = 0.005).	Small purposive sample from one village.
Jenner et al. (2023) [26]	United States; n = 1,770 Black and Hispanic females aged 18–19 years (Plan A n = 886; control n = 884)	Individual randomized controlled trial; three-month follow-up	Plan A sexual health video versus control video	At three months, contraceptive knowledge was significantly higher in the Plan A group (adjusted effect estimate 0.03, SE 0.007; p < 0.001; marginal effect 0.029).	Population restricted to Black and Hispanic females aged 18–19 years; self-reported outcomes.

Note: CI = confidence interval; HIV = human immunodeficiency virus; STI = sexually transmitted infection; SMS = short message service; USSD = unstructured supplementary service data.

3.2 Knowledge-Related Outcomes

The findings indicated that several educational interventions were associated with short-term improvements in adolescent reproductive health knowledge. However, the magnitude of change and evidence of superiority over comparison conditions varied.

Mobile applications showed mixed comparative outcomes. Teen Health reported a greater knowledge gain in the intervention group than in the control group, whereas the HEROIC application did not demonstrate statistically significant superiority over a printed booklet [14], [15]. Nurhaeni et al. also reported a significant knowledge improvement following an application intervention combined with family nursing support, although the independent contribution of the application could not be isolated [13].

Visual and interactive media showed favorable outcomes in studies of vulva hygiene and menstrual hygiene. The combined animated-video and digital-booklet intervention reported a difference-in-differences estimate of 12.5 points (95% CI: 10.2–14.7; p < 0.001). A separate study reported a greater median knowledge gain with an interactive e-module than with an educational video [12], [16], [17]. Because the interventions and measurement instruments differed, these findings should not be treated as direct comparisons across studies. Messaging and social-media interventions were also associated with knowledge improvement, although comparative advantages were inconsistent. LINE and WhatsApp did not differ significantly in knowledge gain, while both TikTok and leaflet groups improved [11], [24]. Studies examining SMS, USSD-based services, web-based education, and blended programs extended the evidence to other settings, but used different outcomes and knowledge instruments [18], [21]–[23].

Overall, the evidence suggests that several educational media may support short-term gains in adolescent reproductive health knowledge. However, improvement within an intervention group does

not establish superiority over an alternative approach. Differences in study design, knowledge instruments, comparator conditions, and intervention components limit conclusions about the relative effectiveness of individual media formats.

3.3 Educational Media Characteristics and Potential Learning Mechanisms

Mobile applications and on-demand mobile services provided structured or on-demand access to educational content, while messaging platforms distributed information through familiar communication channels [11], [13]–[15], [18], [19], [23]. Animated videos and interactive e-modules presented information through visual content and structured learning sequences [12], [16], [17].

Blended programs integrated face-to-face instruction with digital technologies, although the independent contribution of the digital components cannot be isolated in such designs [22]. These features offer plausible ways to support learning, but the available findings do not establish that any single feature independently caused the observed improvements.

3.4 Contextual Factors and Limitations of the Evidence

Implementation may depend on access to digital devices and internet connectivity, content accuracy, cultural relevance, age appropriateness, language, privacy, and support from teachers, families, or healthcare professionals. These are practical considerations and were not necessarily measured as outcomes in every included study.

Methodological limitations included non-randomized designs, purposive sampling, small or context-specific samples, and variation in knowledge assessment instruments. Several interventions combined more than one educational component, making it difficult to isolate the effect of a single medium. Most studies assessed immediate or short-term outcomes, and evidence on sustained knowledge retention and subsequent reproductive health behaviors remained limited.

The results should therefore be interpreted as a synthesis of heterogeneous studies rather than evidence that one educational format is universally superior. Further comparative studies using robust designs, clearly described knowledge measures, and longer follow-up periods are needed.

4. DISCUSSION

This literature review synthesized 16 primary intervention studies examining educational media and adolescent knowledge of sexual, reproductive, or menstrual health. The studies evaluated messaging platforms, mobile applications, SMS, animated videos, interactive e-modules, social media, web-based programs, USSD-based information services, and blended education. Overall, several interventions were associated with short-term improvements in knowledge, but comparative results varied. The findings do not establish that digital media are consistently superior to printed materials or other educational approaches [11]–[26].

4.1 Educational Mechanisms and Knowledge Acquisition

The reviewed interventions delivered information through different formats and levels of interaction. Mobile applications and digital services offered structured or on-demand access to content, while messaging platforms distributed information through familiar communication channels. Animated videos and interactive e-modules presented information through visual and structured learning sequences [11]–[18], [20], [23], [24]. These characteristics provide plausible explanations for how educational media might support learning, but the included studies generally evaluated complete interventions rather than isolating the effects of individual features.

The possible value of combining verbal and visual information is consistent with multimedia learning principles, which emphasize the organization and integration of relevant words and images during learning [3], [4]. Interactive quizzes, feedback, and repeated access might also encourage learners to revisit educational material. Nevertheless, these mechanisms should be treated as explanatory interpretations rather than demonstrated causal effects, because the available studies did not consistently compare individual design components under controlled conditions.

4.2 Comparative Effectiveness of Educational Media

The comparative findings for mobile applications were mixed. Teen Health was associated with a larger reported knowledge gain than routine education, while the HEROIC application did not significantly outperform a printed booklet [14], [15]. Nurhaeni et al. reported favorable knowledge outcomes after an application intervention integrated with family nursing support, but the contribution of the application cannot be separated from the accompanying support [13]. These results indicate that the effectiveness of an application depends on the intervention and comparator, and should not be inferred from the digital format alone.

Messaging and social-media studies also showed varied comparative results. Knowledge scores increased in both the LINE and WhatsApp groups, but the difference in knowledge gain was not statistically significant ($p = 0.973$). The TikTok and leaflet groups both improved in the study by Haninuna et al. [11], [24]. The evidence therefore does not establish a consistent advantage for one messaging or social-media platform.

Visual and interactive interventions reported promising findings for specific knowledge domains. Linsqy et al. reported an increase in vulva-hygiene knowledge following animated-video education. Fuadah et al. reported a difference-in-differences estimate of 12.5 points (95% CI: 10.2–14.7; $p < 0.001$) for a combined animated-video and interactive digital-booklet intervention. Noviani et al. reported greater median knowledge gain in the interactive e-module group than in the video group [12], [16], [17]. The Fuadah findings reflect the combined intervention and do not identify the separate effect of either medium.

Evidence from SMS, USSD-based services, web-based education, and blended programs broadens the range of delivery models represented in the review [18], [21]–[23]. However, outcomes were measured using different instruments and scoring systems. Numerical results should therefore be interpreted within each study rather than ranked directly across studies. In addition, improvement within an intervention group does not by itself demonstrate superiority over a comparator.

4.3 Implementation Conditions and Target Populations

The practical suitability of educational media may depend on access to devices and internet connectivity, language, privacy, content accuracy, cultural relevance, and the availability of educational or healthcare support. These considerations are relevant when selecting an intervention for a particular setting, but they were not measured consistently across the 16 studies and should not be interpreted as comparative findings from the review.

Developmental appropriateness is also important when presenting information about puberty, menstruation, contraception, and sexually transmitted infections. Short, clearly structured materials may be suitable for some learning contexts, while other contexts may require more detailed information or opportunities to ask questions. The included evidence does not establish a universal age-specific advantage for any medium, so these choices should be guided by the target population and the educational objective.

Blended approaches may be useful where digital resources are combined with face-to-face education. However, the Yarger et al. study evaluated an in-person program integrating digital technologies, so the independent contribution of the digital component cannot be determined from that comparison alone [22]. Similarly, the ReproCare intervention included family nursing support, which limits attribution of its findings to the application alone [13].

4.4 Methodological Limitations and Interpretation of Evidence

The evidence base was heterogeneous in study design, sample characteristics, intervention duration, comparator conditions, and knowledge measurement. Eleven studies used quasi-experimental designs, including one uncontrolled before-and-after study, while four used individual randomized controlled trials and one used a cluster randomized trial, accounting for all 16 included studies [11]–[26]. Non-random allocation and purposive sampling in several studies may increase the risk of selection bias and confounding.

Knowledge outcomes were measured with different questionnaires, item sets, and score ranges. Source-text checks confirmed the baseline and post-intervention scores reported by Ahmed, the adjusted contraceptive-knowledge estimate reported by Martínez-García et al., and the three-month contraceptive-knowledge effect reported by Jenner et al. These estimates should be interpreted within each study because the outcome scales and statistical models differ.

Several interventions included more than one component, including family support, counseling, videos, or face-to-face instruction. This makes it difficult to attribute observed outcomes to one medium. Follow-up periods also varied, and many studies focused on immediate or short-term knowledge outcomes. The evidence is therefore insufficient to conclude that observed knowledge gains persist over time or lead to changes in reproductive health behavior.

The review used a structured search and predefined eligibility criteria, followed by narrative synthesis rather than quantitative meta-analysis. The results should be interpreted as a synthesis of the included studies, not as a pooled estimate of intervention effectiveness.

4.5 Implications for Future Research and Practice

Future studies should compare educational media using clearly defined knowledge outcomes, validated and reliable instruments, and transparent reporting of baseline scores, post-intervention results, between-group differences, confidence intervals, and effect estimates. Comparative designs should, where feasible, control for content, intervention duration, and accompanying support so that the contribution of the medium can be assessed more clearly.

Longer follow-up is needed to examine knowledge retention and to determine whether knowledge gains are associated with subsequent decision-making or health behaviors. Researchers should also report intervention content, frequency, duration, participant engagement, and implementation context in sufficient detail to support replication and comparison.

In practice, educational media should be selected according to the learning objective, content quality, accessibility, developmental suitability, privacy requirements, and available support. Digital approaches may complement school- and community-based reproductive health education, while printed and blended formats may remain appropriate in settings with limited digital access. Based on the current evidence, no single educational format can be considered universally superior.

5. CONCLUSIONS

This literature review identified mobile applications, animated videos, and interactive e-modules as promising educational media for improving adolescent reproductive health knowledge. However, no single format demonstrated consistent superiority across studies. Interactive e-modules showed greater knowledge gains than educational videos in one direct comparison, while the HEROIC application did not significantly outperform a printed booklet. A combined animated-video and interactive digital-booklet intervention also reported a significant improvement in menstrual hygiene knowledge. These findings suggest that educational design and intervention content are important considerations when selecting educational media.

Short-term improvement in reproductive health knowledge was the most consistently reported outcome across the included studies. Nevertheless, the evidence was limited by heterogeneous study designs and knowledge assessment instruments, non-randomized allocation in several studies, and interventions combining multiple educational components. Evidence regarding long-term knowledge retention and subsequent reproductive health behaviors remained insufficient.

In practice, mobile and multimedia educational media should complement school- and community-based reproductive health education. Selection should consider content accuracy, developmental appropriateness, cultural relevance, digital accessibility, and available educational support. Future research should prioritize rigorous comparative trials, validated knowledge assessment instruments, and longitudinal follow-up to establish whether knowledge gains are sustained and which approaches are most effective for different adolescent populations and implementation settings.

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REFERENCES

[1] United Nations Educational, Scientific and Cultural Organization (UNESCO), International Technical Guidance on Sexuality Education: An Evidence-Informed Approach, revised ed. Paris, France: UNESCO, 2018. ISBN: 978-92-3-100259-5.

[2] D. Nutbeam and J. E. Lloyd, “Understanding and responding to health literacy as a social determinant of health,” Annual Review of Public Health, vol. 42, pp. 159–173, 2021, doi: 10.1146/annurev-publhealth-090419-102529.

[3] R. E. Mayer, Multimedia Learning, 3rd ed. Cambridge, UK: Cambridge University Press, 2020, doi: 10.1017/9781316941355.

[4] R. C. Clark and R. E. Mayer, e-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning, 5th ed. Hoboken, NJ, USA: John Wiley & Sons, 2023. ISBN: 978-1-394-17737-0.

[5] M. J. Page et al., “The PRISMA 2020 statement: An updated guideline for reporting systematic reviews,” BMJ, vol. 372, art. no. n71, 2021, doi: 10.1136/bmj.n71.

[6] C. D. Darmayani, Kumboyono, F. A. Nugroho, and L. Supriati, “The educational media to improve reproductive health knowledge among adolescents: A systematic review,” Jurnal Ilmiah STIKES Yarsi Mataram, vol. 15, no. 2, pp. 203–213, 2025, doi: 10.57267/jisym.v15i2.494.

[7] H. P. Angesti, D. R. Oktavia, and D. A. N. Utami, “Systematic review: Efektivitas aplikasi mobile dalam edukasi kesehatan reproduksi remaja,” Journal of Noncommunicable Diseases, vol. 5, no. 1, pp. 63–80, 2025, doi: 10.52365/jond.v5i1.1416.

[8] M. Muehlmann and S. Tomczyk, “Mobile apps for sexual and reproductive health education: A systematic review and quality assessment,” Current Sexual Health Reports, vol. 15, pp. 77–99, 2023, doi: 10.1007/s11930-023-00359-w.

[9] R. Guo, H. Xie, W. Zhao, and J. Wang, “Web-based sexual and reproductive health education for adolescents aged 10–17 years: A systematic review and meta-analysis,” BMJ Paediatrics Open, vol. 9, no. 1, art. no. e003714, 2025, doi: 10.1136/bmjpo-2025-003714.

[10] R. Oktaria and E. Martha, “Analisis penggunaan media belajar pendidikan kesehatan reproduksi berbasis aplikasi Android dan website: Sistematic review,” Media Publikasi Promosi Kesehatan Indonesia, vol. 6, no. 12, pp. 2397–2404, 2023, doi: 10.56338/mppki.v6i12.4140.

[11] C. E. Kosasih, T. Solehati, and I. Maryati, “Comparing the effect of LINE-based and WhatsApp-based educational interventions on reproductive health knowledge, attitudes, and behaviors among Triad adolescents: A quasi-experimental study,” Belitung Nursing Journal, vol. 10, no. 1, pp. 87–95, 2024, doi: 10.33546/bnj.3033.

[12] L. A. D. Linsqy, D. T. Lestari, and A. M. Rahmawati, “Improving adolescents’ reproductive health knowledge through animated video education on vulva hygiene,” Indonesian Journal of Nursing Research, vol. 8, no. 2, pp. 80–87, 2025, doi: 10.35473/ijnr.v8i2.4288.

[13] A. Nurhaeni, R. Rahayu, T. Oktiany, E. S. Purbaningsih, L. Wahyuni, and D. E. Marisa, “Utilizing digital applications as educational media for adolescent reproductive health within the family nursing approach,” Jurnal Bidan Cerdas, vol. 7, no. 1, pp. 140–153, 2025, doi: 10.33860/jbc.v7i1.4193.

[14] D. N. Sari, D. K. Sunjaya, P. Sari, and D. Hilmanto, “The Teen Health application as a digital intervention medium for adolescent reproductive health: Development, validation, and effectiveness within integrated primary care in Garut Regency Indonesia,” Journal of Intelligent Decision Making and Information Science, vol. 3, no. 2, pp. 2246–2255, 2026. [Online]. Available: https://www.jidmis.org/index.php/jidmis/article/view/4072.

[15] N. K. T. Agustini, N. W. M. Parwati, A. S. Sari, and I. K. Swarjana, “The effect of HEROIC application on increasing knowledge and attitudes of health reproductive among adolescent students in Indonesia,” Public Health of Indonesia, vol. 12, no. 1, pp. 167–179, 2026, doi: 10.36685/phi.v12i1.1546.

[16] F. Fuadah, G. Yogisutanti, and B. D. Saragih, “The effectiveness of digital media in improving menstrual hygiene knowledge among adolescent girls: A study in junior high schools in Bandung Regency,” BMC Public Health, vol. 26, art. no. 65, 2026, doi: 10.1186/s12889-025-24967-4.

[17] J. Noviani, D. Prasetyo, D. Pusianawati, Q. E. S. Adnani, D. D. L. Hakim, S. Irianti, and I. Garti, “Educational videos versus interactive e-modules: Adolescents’ menstrual hygiene knowledge, attitudes, and practices,” AJOG Global Reports, art. no. 100699, 2026, doi: 10.1016/j.xagr.2026.100699.

[18] T. Ahmed, “Effect of mHealth tool on knowledge regarding reproductive health of school going adolescent girls: A before-after quasi-experimental study,” BMJ Open, vol. 10, no. 10, art. no. e036656, 2020, doi: 10.1136/bmjopen-2019-036656.

[19] G. Martínez-García, A. C. Ewing, Y. Olugbade, R. J. DiClemente, and A. P. Kourtis, “Crush: A randomized trial to evaluate the impact of a mobile health app on adolescent sexual health,” Journal of Adolescent Health, vol. 72, no. 2, pp. 287–294, 2023, doi: 10.1016/j.jadohealth.2022.09.019.

[20] S. Sumarmi, W. Hidayati, E. Ernawati, S. Arafah, A. Alwi, and R. R. Mulyoto, “Impact of Android-based reproductive health education on knowledge improvement among adolescent girls in Takalar, Indonesia: A quasi-experimental study in a senior high school,” Jurnal Keperawatan Komprehensif, vol. 12, no. 2, pp. 242–249, 2026, doi: 10.33755/jkk.v12i2.1011.

[21] J. McCrimmon, L. Widman, H. Javidi, J. Brasileiro, and J. Hurst, “Evaluation of a brief online sexual health program for adolescents: A randomized controlled trial,” Health Promotion Practice, vol. 25, no. 4, pp. 689–697, 2024, doi: 10.1177/15248399231162379.

[22] J. Yarger et al., “In the Know: A cluster randomized trial of an in-person sexual health education program integrating digital technologies for adolescents,” Journal of Adolescent Health, vol. 74, no. 5, pp. 1019–1025, 2024, doi: 10.1016/j.jadohealth.2023.12.012.

[23] P. Macharia, A. Pérez-Navarro, B. Sambai, I. Inwani, J. Kinuthia, R. Nduati, and C. Carrion, “An unstructured supplementary service data-based mHealth app providing on-demand sexual reproductive health information for adolescents in Kibra, Kenya: Randomized controlled trial,” JMIR mHealth and uHealth, vol. 10, no. 4, art. no. e31233, 2022, doi: 10.2196/31233.

[24] G. Y. Haninuna, C. R. Nayoan, and E. Z. Haba Bunga, “Effect of Tik-Tok and leaflet media in increasing adolescents’ knowledge and attitude about reproductive health,” Journal of Public Health for Tropical and Coastal Region, vol. 6, no. 1, pp. 30–36, 2023, doi: 10.14710/jphtcr.v6i1.17709.

[25] I. G. A. A. B. A. Parimayuna, N. M. P. Batiari, and N. W. C. Aswari, “The effectiveness of health education and media using local language in improving reproductive health knowledge among adolescents,” Proceedings of the International Conference on Public Health, vol. 8, no. 2, pp. 47–58, 2023, doi: 10.17501/24246735.2023.8206.

[26] E. Jenner et al., “Randomized trial of a sexual health video intervention for Black and Hispanic adolescent females,” Prevention Science, vol. 24, suppl. 2, pp. 262–271, 2023, doi: 10.1007/s11121-023-01499-0.