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Effectiveness of tiktok and instagram based education in improving adolescent reproductive health literacy in bone regency: An explanatory sequential mixed-methods study

Syahridayanti Syahridayanti[1]✉, Leli Leli[1], Rahmiyani Saad[1], Liska Alfaaizin[2], Jumiyati Jumiyati[3]

[1] Diploma III Program in Midwifery, Faculty of Health Sciences, Universitas Cokroaminoto Makassar, Makassar, South Sulawesi, Indonesia
[2] Diploma III Program in Nutrition, Akademi Ilmu Gizi YPAG Makassar, Makassar, South Sulawesi, Indonesia.
[3] Diploma III Program in Midwifery, Faculty of Health Sciences, Institut Kesehatan dan Teknologi Bisnis Menara Bunda Kolaka, Kolaka, Southeast Sulawesi, Indonesia

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ABSTRACT

Introduction: Social and cultural barriers may limit adolescents' access to reproductive health information. This study examined changes in reproductive health literacy following social media-based education and explored adolescents' experiences in Bone Regency, Indonesia.

Research Methodology: An explanatory sequential mixed-methods study was conducted in four schools. Two schools were allocated to the intervention and two to the control condition. The analysis included 114 adolescents (57 per group). The intervention lasted four weeks. Qualitative findings were obtained through focus group discussions (12 participants) and in-depth interviews (6 participants). Quantitative comparisons used nonparametric tests, and qualitative data were analyzed thematically. Cluster-adjusted estimates were not reported and require reanalysis.

Results: Mean literacy scores increased from 52.4 to 78.6 in the intervention group (a 26.2-point change) and from 51.8 to 55.2 in the control group (a 3.4-point change). The unadjusted difference in changes was 22.8 points. Exploratory platform subgroups showed mean changes of 27.8 points for TikTok (n = 38), 23.4 for Instagram (n = 13), and 29.6 for multiplatform use (n = 6). Qualitative themes concerned privacy, contextual relevance, cultural norms, peer dissemination, and culturally sensitive content. Statistical significance and effect sizes must be reassessed with clustering accounted for.

Conclusion: Social media-based reproductive health education was associated with improved measured literacy in the participating schools. Platform comparisons are exploratory, and the proposed Digital Contextual Education Model (DiCEM) requires independent validation. The design does not establish changes in actual reproductive health behavior.

Keywords: reproductive health literacy; social media; tiktok; instagram; generation Z.

✉Corresponding author. email: antyaudiyah@gmail.com
Diploma III Program in Midwifery, Faculty of Health Sciences, Universitas Cokroaminoto Makassar, Makassar, South Sulawesi, Indonesia

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INTRODUCTION

Adolescent reproductive health is a strategic component in achieving Sustainable Development Goals (SDGs), in particular target 3.7 related to access to sexual and reproductive health services by 2030 (WHO, 2024). On a national scale, the 2023 Indonesian Health Survey (SKI) reported that the prevalence of pregnancy in the 15–19-year age group was 26 per 1,000 live births, with school dropouts due to unwanted pregnancies still a problem, especially in areas outside Java (Dewi et al., 2024). Bone Regency is one of the districts with a large youth population in South Sulawesi, with around 178,432 residents aged 10–24 years, based on the 2020 Population Census (South, 2023).

Bone Regency faces serious challenges related to adolescent reproductive health, with data showing an increase in pregnancy cases among adolescents under 19 years of age and low reproductive health literacy (Bone, 2023). The lack of knowledge and understanding of reproductive health contributes to risky sexual behaviors, which can result in unwanted pregnancies and sexually transmitted infections (Sawidi et al., 2025). Therefore, the integration of digital technologies and interactive learning methods, such as mobile apps and simulations, can increase adolescents' engagement and understanding of health information. Reproductive health literacy is an important factor in adolescent health decision-making and behavior, especially in the context of Generation Z, who are more connected to digital technology. The proposed health literacy framework could emphasize the ability to access, understand, assess, and use health information as a key component (Feijó da Silva et al., 2025).

The use of TikTok and Instagram as reproductive health education media shows significant potential to improve adolescent health literacy. TikTok, with its short video format and interactive elements, has been shown to be effective in increasing adolescents' knowledge about reproductive health through the @animasi. pintar6 account. Meanwhile, Instagram, through features such as Reels and Stories, also plays an important role in conveying interesting and easy-to-understand health information, as shown by the @wanita_edu account that has succeeded in improving reproductive health literacy in adolescents. The Cognitive Theory of Multimedia Learning (CTML) and Bandura's Social Learning Theory support each other's effectivity by emphasizing the importance of visual information processing and learning through observation. CTML, which emphasizes the management of essential processing and the reduction of unnecessary processing, shows that the proper use of visual elements in multimedia can improve information comprehension and retention (Cavanagh & Kiersch, 2023)

A number of studies show that social media has the potential to be a means of reproductive health education. Findings report a 42.3% increase in knowledge after an Instagram-based intervention in adolescents in Surabaya (Rahman et al., 2023), while Fadillah & Mulyati, (2024) found significant changes in attitudes after a TikTok intervention in adolescents in Makassar City. Evidence on the comparison of TikTok and Instagram in one study design is also limited, especially in the context of the Bugis community in Bone Regency. Thus, there are several research gaps, namely the lack of research using mixed methods regarding digital reproductive health education in Bone Regency, limited studies on the influence of local socio-cultural contexts such as the value of *siri' na pacce*, the lack of systematic comparisons between TikTok and Instagram, and the lack of intervention models that integrate aspects of technology, content, social dynamics, and local cultural contexts.

This research was carried out through the development of the *Digital Contextual Education Model* (DiCEM), which is a conceptual model of digital reproductive health education that integrates the perspectives of health literacy, social learning, and technology acceptance in the

local socio-cultural context. The DiCEM model explains that adolescents' ability to access, understand, assess, and apply reproductive health information is influenced by the process of observation, interaction, social modeling, and perception of the benefits and convenience of digital media. Studies show that 91% of adolescents use social media to find reproductive health information, with Instagram and TikTok as the main platforms (Syam et al., 2021). Although adolescents' familiarity with reproductive health is considered the good, there are still challenges in understanding accurate information, especially due to the influence of complex digital cultures. The distinctiveness of DiCEM lies in the integration of social media effectivity with adolescents' characteristics and learning experiences, as well as their sociocultural environment, which helps identify factors that support or hinder the effectivity of media in conveying health information (Aswar et al., 2025).

This study aims to analyze the effectivity of TikTok and Instagram-based educational media in improving the reproductive health literacy of Generation Z adolescents in Bone Regency, and to explore the factors that affect its effectivity from the perspective of adolescents. *A* mixed-methods approach was used to obtain a more comprehensive understanding of literacy changes as well as social and cultural mechanisms. The use of the DiCEM model was expected to be empirically tested and provide contextual recommendations for digital reproductive health education and support the strengthening of the Youth Care Health Service (PKPR) program in South Sulawesi.

RESEARCH METHODOLOGY

Research design

This study used a mixed-methods approach with a sequential explanatory design by combining quantitative and qualitative methods. The integration of the two methods was carried out at the final interpretation stage through the Joint Display (Guetterman et al., 2015). The research was conducted in Bone Regency, South Sulawesi, covering four schools, namely SMAN 1 Watampone, SMAN 2 Watampone, SMAN 1 Tanete Riattang Timur, and SMAN 1 Palakka, which were selected by purposive sampling. The data collection lasted for four months (December 2025–March 2026) in a target population of 1,240 students in grades X and XI aged 15–18 years who actively used social media for at least one hour per day.

The allocation of research groups (intervention and control) was carried out at the school level (cluster randomization), not at the individual student level, considering the high potential for social interaction and information exchange between students in the same school environment, which had the potential to cause intervention contamination if the allocation was carried out individually. Cluster randomization of the four SMANs that met the eligibility criteria was carried out by members of the research team who were not involved in the participant recruitment process or the measurement of results using digital-based programs. Based on the results of the randomization, SMAN 1 Watampone and SMAN 1 Tanete Riattang Timur were designated as intervention groups, while SMAN 2 Watampone and SMAN 1 Palakka were designated as control groups.

The quantitative component compared pretest and posttest outcomes between school-level intervention and control groups. Four schools were allocated at the cluster level (two per arm), while participants were recruited purposively within schools. A total of 120 adolescents were recruited and 114 were included in the reported complete-case analysis (57 per group; 5.0% overall attrition). The original analyses used SPSS version 26, Wilcoxon signed-rank and Mann–Whitney U tests, and exploratory Kruskal–Walli's comparisons. These individual-level tests do

not account for within-school correlation; with only four clusters, conventional cluster-adjusted inference may be unreliable. The allocation process, sample-size assumptions, intracluster correlation, cluster-specific outcomes, and an appropriately qualified reanalysis must be reported before confirmatory claims can be made. Qualitative interviews (n = 6) and focus groups (n = 12) were analyzed thematically with NVivo 12. Integration occurred through a joint display.

To anticipate the contamination of intervention between groups, this study applied several strategies. Firstly, school cluster-based allocation was the main defense because students in the intervention and control groups came from different schools, so face-to-face interactions rarely occurred. Secondly, the research team conducted periodic monitoring of social media groups and students' online forums to detect indications of the spread of intervention content to the control group. Thirdly, participants in the intervention group were given an explanation about the importance of maintaining the confidentiality of the research material and were asked not to disseminate links or screenshots of the content to students from other schools. Fourthly, at the end of the intervention period, the control group was confirmed through a brief question about exposure to the intervention material.

Reproductive health literacy was assessed using a 40-item questionnaire described as adapted from the Reproductive Health Literacy Scale (Mohammadi et al., 2022), covering knowledge (15 items), attitudes (15 items), and self-reported preventive-behavior-related items (10 items) on four-point response scales. Forward–backward translation and expert review were reported. However, the item-to-domain mapping, scoring transformation, thresholds, missing-data rules, content-validity indices, and reliability coefficients for this sample are not provided. These must be documented from the study records before measurement validity can be established; self-reported behavioral-domain scores should not be interpreted as observed behavior.

RESULT

Of 120 recruited respondents, six were excluded from the final analysis, yielding an overall attrition rate of 5.0% (6/120) and a complete-case sample of 114 (57 in each arm). The source manuscript reports reasons for missingness but does not clearly reconcile them by study arm. A participant-flow diagram with school-level and individual-level counts, exclusions, reasons, and analysis populations is required.

Table 1. Demographic characteristics of respondents and initial condition equivalency test (n = 114)

Characteristics	Intervention (n=57)	Control (n=57)	Total (n=114)	p-value
Age (years)				0,847
15	18 (31,6%)	16 (28,1%)	34 (29,8%)	
16	22 (38,6%)	24 (42,1%)	46 (40,4%)	
17	12 (21,1%)	13 (22,8%)	25 (21,9%)	
18	5 (8,8%)	4 (7,0%)	9 (7,9%)	
Gender				0,712
Female	32 (56,1%)	34 (59,6%)	66 (57,9%)	
Male	25 (43,9%)	23 (40,4%)	48 (42,1%)	
Class Level				0,863
Class X	30 (52,6%)	29 (50,9%)	59 (51,8%)	
Class XI	27 (47,4%)	28 (49,1%)	55 (48,2%)	
Duration of Social Media Use				0,793
1–2 hours/day	14 (24,6%)	16 (28,1%)	30 (26,3%)	
3–4 hours/day	26 (45,6%)	24 (42,1%)	50 (43,9%)	

>4 hours/day	17 (29,8%)	17 (29,8%)	34 (29,8%)	
Major Social Media Platforms				0,911
TikTok	38 (66,7%)	36 (63,2%)	74 (64,9%)	
Posted on Instagram	13 (22,8%)	15 (26,3%)	28 (24,6%)	
Both (multi-platform)	6 (10,5%)	6 (10,5%)	12 (10,5%)	
Pre-test Literacy Score (Average ± Elementary School)	52.4 ± 8.7	51.8 ± 9.1	52.1 ± 8.9	0,721

Reported tests: chi-square and Mann–Whitney U. A nonsignificant p-value does not establish baseline equivalence. These tests did not account for school-level clustering.

Table 1 presents the distribution of respondents' demographic characteristics and the results of the initial condition equivalency test. Most of the respondents were in the age group of 16 years (40.4%) and female (57.9%). The majority of respondents used social media for 3–4 hours per day (43.9%), with TikTok being the most accessed social media platform (64.9%). The results of the Chi-Square differential test showed that there were no significant differences in any demographic variables between the two groups ($p > 0.05$). In addition, the Mann-Whitney U test on the average literacy score before the intervention (pre-test) confirmed that there were no significant differences between the intervention group (52.4 ± 8.7) and the control group (51.8 ± 9.1), with a $p = 0.721$. This proves that both groups were in equal and standardized initial conditions before the intervention was given.

The Effectivity of Digital Education Interventions on Reproductive Health Literacy

A four-week social media-based reproductive health education intervention resulted in a significant increase in literacy scores in the intervention group compared to the control group.

Table 2. Comparison of pre-test and post-test reproductive health literacy scores (n = 114)

Literacy Groups/Domains	Pre-test (Average ± SD)	Post-test (Average ± SD)	Average	%	p-value
Intervention Group (n=57)					
Knowledge	51.2 ± 9.3	80.4 ± 7.1	29,2	57,0%	<0.001
Attitude	53.7 ± 8.2	77.8 ± 6.9	24,1	44,9%	<0.001
Preventive Behavior	52.3 ± 9.1	77.6 ± 7.8	25,3	48,4%	<0.001
Total Literacy Score	52.4 ± 8.7	78.6 ± 7.3	26,2	50,0%	<0.001
Control Group (n=57)					
Knowledge	51.4 ± 8.9	54.7 ± 8.2	3,3	6,4%	0,124
Attitude	52.1 ± 9.4	55.6 ± 9.1	3,5	6,7%	0,098
Preventive Behavior	52.0 ± 9.3	55.3 ± 8.7	3,3	6,3%	0,113
Total Literacy Score	51.8 ± 9.1	55.2 ± 8.4	3,4	6,6%	0,087
Difference of Improvement (Δ Intervention – Δ Control)			22,8		<0.001
Magnitude of Effect (Cohen's d)			3,14		

Wilcoxon Signed-Rank Test; Mann-Whitney U Test; α = Score Change Difference.

Table 2 reports a mean increase in total literacy scores of 26.2 points (52.4 to 78.6) in the intervention arm and 3.4 points (51.8 to 55.2) in the control arm; the unadjusted difference in change was 22.8 points. The originally reported p-values and Cohen's $d = 3.14$ are retained in the table as author-reported results pending verification, but should not be treated as confirmatory because the analysis does not account for allocation by school. The effect-size denominator and uncertainty intervals require independent recalculation from the participant-level dataset.

Table 3. Transformation of reproductive health literacy level category (n = 114)

Literacy Category (Score)	Pre-test Intervention Group	Post-test Intervention Group	Pre-test Control Group	Post-test Control Group
Low (< 60)	39 (68,4%)	2 (3,5%)	41 (71,9%)	37 (64,9%)
Medium (60–79)	16 (28,1%)	25 (43,9%)	15 (26,3%)	18 (31,6%)
High (≥ 80)	2 (3,5%)	30 (52,6%)	1 (1,8%)	2 (3,5%)

Table 3. Before the intervention, the majority of respondents in the intervention (68.4%) and control (71.9%) groups were in the low literacy category (< 60). After the intervention, the proportion of highly literate respondents (≥ 80) in the intervention group experienced a sharp jump from 3.5% (n = 2) to 52.6% (n = 30).

Comparative Analysis of Platform Effectiveness: TikTok VS Instagram

Subgroup analysis in the intervention group (n = 57) showed differences in effectivity based on social media platforms used.

Table 4. Comparative analysis of effectivity indicators based on social media platforms in the intervention group (n = 57)

Performance Indicators	TikTok (n=38)	Instagram (n=13)	Multi-Platform (n=6)	p-value
Knowledge Score	30.1 ± 6.4	25.2 ± 7.8	33.6 ± 5.2	0,019
Attitude Score	24.9 ± 5.8	21.3 ± 7.2	28.4 ± 4.9	0,034
Behavior Score	26.4 ± 6.1	22.8 ± 7.4	29.1 ± 5.3	0,041
Total Literacy Score	**27.8 ± 6.2**	**23.4 ± 7.1**	**29.6 ± 5.8**	**0,028**
Information Retention (%)	87.3 ± 5.4	72.6 ± 8.2	91.2 ± 4.1	<0.001
Engagement Rate (%)	89.5 ± 4.8	78.3 ± 7.6	93.1 ± 3.7	<0.001
Media Satisfaction (Scale 1-5)	4.6 ± 0.4	4.2 ± 0.6	4.8 ± 0.3	0,003
Magnitude of Effect (Cohen's d)	3,24	2,71	3,48	-

Kruskal-Walli's test; Δ = the difference between the increase in post-test score and the pre-test score.

Based on the analysis of the Kruskal-Walli's test in Table 4, the use of the TikTok platform (n = 38) resulted in a significantly higher increase in total literacy scores compared to Instagram (n = 13) (Δ = 27.8 ± 6.2 vs Δ = 23.4 ± 7.1, p = 0.028). The highest performance was achieved by the multiplatform subgroup (n = 6), with an increase in the average score of 29.6 ± 5.8. Descriptively, the TikTok subgroup had higher reported retention (87.3% versus 72.6%) and engagement (89.5% versus 78.3%) than the Instagram subgroup. However, platform exposure was not independently randomized, subgroup sizes were unequal (38 versus 13; multiplatform n = 6), and the omnibus Kruskal–Wallis p-values do not establish a statistically significant TikTok–Instagram pairwise difference. These findings should be interpreted as exploratory associations pending prespecified pairwise testing and confounder adjustment.

Qualitative Findings: Phenomenological Exploration

The qualitative thematic analysis identified five main themes and 14 sub-themes reflecting adolescents' experiences with social media-based reproductive health education. These themes highlight digital accessibility and privacy, contextual relevance of educational content, sociocultural barriers, peer influence, and cultural-religious adaptation. The findings provide insights into factors influencing adolescents' acceptance and engagement with digital reproductive health education, as summarized in Table 5.

Table 5. Matrix of main themes and sub-themes results of qualitative thematic analysis

Yes	Main Themes	Outline Description	Key Sub-Themes
1	Digital Accessibility and Privacy	Digital private spaces facilitate the search for information without embarrassment (*stigma-free*).	Digital safe spaces; privacy as a facilitator; flexibility of access.
2	Contextual Relevance of Content	Local reality-based content and popular narratives are easier to understand and remember.	Local contextualization; the use of popular language; contextual case studies.
3	Cultural Barriers and Social Norms	The concept of seri' restricts open communication in the domestic and school spheres.	Taboo of reproductive communication; the absence of family discussions; alternative private spaces.
4	The Role of Peer-Influencers in Diffusion	Peer educators have higher interactional credibility compared to authority figures.	Credibility of peer educators; targeted dissemination; peer group referrals.
5	The Need for Cultural-Religious Adaptation	The integration of local and Islamic values increases social acceptance of material.	Cultural sensitivity and religious values; framing moral/religious values; dignity-based approach.

Accessibility and Privacy of Digital Information

All participants emphasized that freedom from social *judgment* is the main factor in consuming reproductive information through social media. Secrecy in the digital space provides a sense of security that is not obtained in face-to-face communication with adults.

"If you ask your mother or teacher directly at school, you are afraid of being thought to have done something wrong. If you go through TikTok, we can learn on our own without embarrassment."

(Participant 04, Male, 16 years old, FGD Session 2)

Contextual Relevance of Content

Participants reported that the use of colloquial language and illustrations of local scenarios significantly improved material comprehension compared to formally structured scientific explanations.

"The video that I remember the most is the one that talks about the consequences of early marriage in our area. The language used is the same as our everyday language, so it feels real and not just a theory."

(Participant 02, Female, 17 years old, In-Depth Interview)

Barriers to Domestic Culture and Communication

The local cultural construct *of siri' na pacce* is found to be the main limiting factor in the discussion of reproductive problems in the family environment, thus creating limited access to formal information at home.

"At home, it is rare to discuss reproductive problems because my parents also lack knowledge, so usually when I open TikTok, I often see information related to reproductive health."

(Participant 09, Female, 15 years old, FGD Session 1)

The Role of Peer-Influencers in Information Diffusion

The format of delivery by peer educators triggers a faster diffusion of information through private communication channels between adolescents. On average, participants disseminate the received content to their peers via text messages.

"If there is content about health that is interesting and easy to understand, I immediately send it to my friends' WhatsApp groups or Instagram DMs."
(Participant 06, Male, 16 years old, FGD Session 3)

The Need for Cultural Adaptation and Religious Values

Participants emphasized the need to align reproductive health materials with religious norms and local cultural values to be fully accepted in their social environment.

"I am more comfortable if reproductive health material is associated with the value of maintaining self-honor in Islam. So it feels like learning religion as well as learning health."
(Participant 01, Female, 17 years old, In-Depth Interview)

Joint Display Integration

The integration of quantitative and qualitative data through *joint display techniques* is presented in Table 6. Qualitative data clarifies the mechanism behind the significant increase in statistical scores, where the superiority of audiovisual features and emotional engagement are the main drivers of information retention.

Table 6. *Joint display*: integration of quantitative and qualitative findings

Integration Dimensions	Quantitative Findings	Qualitative Elaboration	Integration Status
Effectivity of Interventions	$\Delta = \pm 26.2$ points ($p < 0.001$; *Cohen's d* = 3.14).	Peer-educator-based audiovisual delivery improves adolescents' memory and confidence.	Convergence (*Mutually Reinforcing*)
Platform Superiority	TikTok retention was 87.3% vs Instagram 72.6% ($p < 0.001$).	The combination of motion effects, animated text, and short narration facilitates better memory processing compared to static images.	Convergence (*Mutually Reinforcing*)
Low Early Literacy	68.4% of the sample was in the low category before the intervention.	Cultural barriers (*siri'*) and limitations in the school curriculum limit access to early information.	Explanatory (*Explaining Cause*)
Information Diffusion Pattern	Engagement 89.5%; spread to 4.7 friends on average.	Peer figures increase credibility; the dissemination of content is driven by the suitability of local languages and norms.	Expansion

The synthesis of both data resulted in a Digital Contextual Education Model *(DiCEM*). This model confirms that the success of digital education interventions is determined by the integration of four main pillars: the functional characteristics of the platform, the relevance of contextual content, the dynamics of peer diffusion, and the alignment of local sociocultural-religious norms.

DISCUSSION

The results show that social media-based reproductive health education interventions provide a meaningful increase in reproductive health literacy in Generation Z adolescents. In the intervention group, literacy scores increased from 52.4 ± 8.7 to 78.6 ± 7.3, with an increase of 26.2 points or about 50% ($p<0.001$), while the control group only increased by 3.4 points and was not statistically significant ($p=0.087$). The difference in the increase between groups of 22.8 points showed that the changes that occurred in the intervention group were more likely to be related to exposure to digital education compared to natural changes during the study period. These findings reinforce international evidence that social media can be used as a channel for

health interventions in adolescent and young adult groups, especially because the characteristics of social media allow information to be conveyed repeatedly, interactively, visually, and integrated with users' social networks.

This systematic review shows that social media influencers can be trusted health communicators, but they also have the potential to spread misinformation. It is important to improve digital literacy and implement transparent platform design to accurately assess health information (Lawal & Stvilia, 2025). Thus, the contribution of this study not only shows that adolescents use social media to obtain health information, but also provides experimental evidence that reproductive health content designed in a structured manner and delivered through platforms has been used by adolescents in substantially improving reproductive health literacy scores (Ula et al., 2026).

The research instrument showed an increase in three domains, namely knowledge, attitudes, and preventive behaviors, but behavioral domain scores in this context remain part of literacy measurement and are not identical to actual behavioral observations in daily life. In the intervention group, the knowledge domain increased by 29.2 points (57.0%), attitude by 24.1 points (44.9%), and preventive behavior by 25.3 points (48.4%). Thus, the increase in the score of preventive behavior is more accurately understood as an increase in reported capacity, readiness, or behavioral tendencies, rather than as confirmation that respondents have actually implemented reproductive health prevention practices.

Based on Bandura's theory, social media creates a learning environment that allows adolescents to observe, receive behavioral models, gain social reinforcement, and repeat information independently. In this context, audiovisual formats and delivery by peer educators can provide social modeling that is closer to the participants' life characteristics. By implementing attention, retention, reproduction, and motivation measures, educators can increase the effectivity of learning and behavior changes among adolescents (Mintasih et al., 2024). However, the findings also show that changes in the domain of knowledge should not automatically be seen as evidence of changes in health behavior (Suprapto, Yuriatson, et al., 2026). This is important because the research instrument measures literacy in the domain of preventive behavior through self-reports, rather than observing actual reproductive behavior practices (Kayalkar & Dmello, 2024). Thus, an increase in behavioral domain scores indicates an increase in knowledge, perception, or preparation related to prevention, but has not proven changes in practices such as contraceptive use, health service search, or pregnancy prevention (Gelgelo et al., 2023). Theoretically, the relationship between literacy and behavior is also influenced by ability factors, social norms, self-efficacy, access to services, and opportunities to act (Okumu et al., 2025).

The results of the study also show the importance of the interaction between individual characteristics and the digital environment. Participants not only receive information passively, but also find that the material delivered by peer educators is easier to accept and then to share with friends. This is in line with the concept of observational learning and Social Modeling; that is, individuals learn more easily when the observed model is perceived as relevant, credible, and having characteristics that are close to them. The results of this study provide a theoretical explanation of the quantitative results regarding height Commitment. However, qualitative results on content sharing cannot be used to conclude that the diffusion process has resulted in behavioral changes in peers (Mohammadi et al., 2022). Thus, the contribution of peer aspects in this study is stronger as a potential mechanism for increasing exposure and information acceptance, while its impact on behavior change is still a hypothesis that needs to be tested longitudinally (Orben et al., 2024).

The difference in platform effectivity provides more specific findings. TikTok resulted in an increase in literacy scores of 27.8 ± 6.2, higher than Instagram's of 23.4 ± 7.1 (p = 0.028), accompanied by higher information retention and commitment. In the context of this study, the characteristics of TikTok that are based on short videos can make the delivery of information more in line with the participants' media consumption patterns compared to the Instagram format used in the intervention. The findings are also consistent with international studies showing that TikTok has evolved into an important channel for health communication, particularly among young users, although the quality of health information on it is not always guaranteed (Cilubai & & Maheswari, 2024). However, the results of this study are not enough to state that TikTok is universally more effective than Instagram. The differences are the result of platform configuration, content design, participant characteristics, and exposure patterns in this study. In addition, the group size of Instagram (n = 13) is smaller compared to TikTok (n = 38), so TikTok's superiority needs to be confirmed through research with a more balanced distribution of samples and randomization at the platform level.

The results in the multiplatform group showed the highest literacy increase, at 29.6 ± 5.8 points, accompanied by the highest level of satisfaction. The findings may indicate that the use of more than one platform allows participants to gain exposure to information through different media characteristics, thereby expanding the chances of repetition and reinforcement of messages. Thus, these findings may seem unexpected because multi-platform is more appropriately positioned as an exploratory finding that can generate hypotheses for subsequent research, rather than as sufficient evidence to conclude that multi-platform strategies are more causally effective.

Qualitative findings provide additional dimensions that cannot be obtained through quantitative analysis alone. There are five themes: digital accessibility and privacy, contextual relevance, cultural barriers and social norms, the role of peer influencers, as well as the need for cultural and religious adaptations that suggest that the reception of reproductive health information takes place in complex social environments (Grulich et al., 2025). Respondents described digital media as a relatively private space to seek information about reproductive issues that are difficult to discuss directly with parents or teachers. These findings are in line with international literature that shows that adolescents use digital media as a source of information for sensitive health issues because they are relatively easy to access and allow for a certain level of anonymity or privacy (Suprapto, Rakhman, et al., 2026). However, international research also reminds us that ease of access is not always synonymous with good health literacy because social media can be a source of inaccurate or misleading information (Mukhalalati et al., 2022). In this context, the increase in literacy scores after the intervention can be understood not only as a result of the existence of social media, but also of the curation and structure of educational content that is deliberately designed to provide relevant reproductive health information (Shiba et al., 2025); (Takeda et al., 2025).

Social and cultural aspects are also important components in explaining the participants' responses to reproductive health education (Angraeni et al., 2025). The concept of Siri' na pacce: Emerging qualitative data suggest that norms regarding shame, honor, and suitability can limit open communication about reproductive health. In such situations, digital media can provide an alternative space for adolescents to obtain information without having to directly express personal questions or concerns to others. However, digital media does not eliminate the influence of social norms because the reception of information is still influenced by family, religion, and social environment values. This shows that the effectivity of digital education is not only determined by

the technology used, but also by the suitability of the content of the message to the social context in which adolescents live (Harini et al., 2026; Zimmermann & Tomczyk, 2025).

The role of peers and peer influencers is another finding that helps explain the process of disseminating information. The participants consider that information shared or conveyed by their peers is easier to accept because there is social closeness and trust. In Bandura's social learning perspective, observation of models that are considered close and relevant can increase attention, acceptance, and the possibility of reproduction of certain information or actions. In this study, the activity of sharing and discussing content can be understood as a form of information diffusion and communication engagement. These activities should not be interpreted as evidence of changes in reproductive health behaviors, but as a potential mechanism that can expand the reach of messages and strengthen the social learning process. Thus, peer credibility can be an important component in the development of digital interventions aimed at adolescents.

DiCEM can be seen as an effort to integrate technological, cognitive, social, and cultural mechanisms within a single digital reproductive health education framework. Quantitative data provide support for the overall effectivity of the intervention and show differences by platform, while qualitative data provide an explanation of the participants' experiences of privacy, content relevance, peer influence, and culture. Therefore, the research findings provide initial support for the conceptual structure of DiCEM as a conceptual model resulting from the integration of findings, rather than as a model that already has construct validity and external validity. Further validation needs to be carried out through several stages, including the development of indicators that explicitly represent each DiCEM construct, testing the content validity and validity of the construct, confirmatory factor analysis or structural equation modeling testing, and replication in different populations and geographic contexts. Thus, DiCEM has the potential to evolve from a contextual framework to an empirically testable model, but the process is beyond the scope of current research.

Overall, this study makes three contributions. Firstly, empirically, the study shows that reproductive health education through social media can substantially increase measurable reproductive health literacy in adolescents. Secondly, the study shows that the characteristics of the platform, particularly in the configuration of the interventions used, can be related to the level of engagement and increased literacy, with TikTok showing higher results than Instagram. Thirdly, through a sequential explanatory mixed-methods approach, the study identified that the effectivity of digital education was understood by the participants through a combination of private access, content relevance, peer interaction, and cultural appropriateness. The integration of these three findings became the basis for the development of DiCEM. However, DiCEM's contribution at this stage is a conceptual and exploratory contribution, not a final model validation. The limitation of these claims makes the interpretation of the results more consistent with the strength of the data while opening up the next research agenda to test the validity, generalization, and predictive ability of DiCEM.

CONCLUSION

In the participating schools, four weeks of social media-based education was associated with a larger unadjusted improvement in measured reproductive health literacy than the comparison condition (26.2 versus 3.4 points; difference in change 22.8 points). Interpretation of statistical significance and the reported effect size require a cluster-aware reanalysis. Exploratory platform results suggested variation in literacy change, retention, and engagement, but do not demonstrate the causal superiority of TikTok. Interviews and focus groups highlighted privacy,

contextual relevance, peer influence, and cultural sensitivity. DiCEM is a preliminary conceptual synthesis rather than a validated model. Future research should use more clusters, rigorous platform comparisons, longitudinal outcomes, and independent model validation.

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Conflict of Interest
The authors declare that there are no financial, professional, or personal conflicts of interest related to this research. The authors are solely responsible for the content and writing of this manuscript.

Authors' Contributions
Sy: Conceptualization, methodology, data collection, and preparation of manuscript drafts. Ll: Quantitative data analysis, interpretation of results, and manuscript revision. RS: Qualitative data collection, provision of resources, and manuscript review. LA & JM: Data collection, coordination of participants, literature review, manuscript editing, and final approval of manuscripts. All authors have reviewed and approved the final version of the manuscript and are responsible for aspects of their respective work and the integrity of the overall research.

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Declaration of Generative AI Use
During the preparation of this manuscript, the authors used generative artificial intelligence tools to assist in language refinement, grammar improvement, and structuring academic writing. The authors critically reviewed and fully verified the scientific interpretation, data analysis, conclusions, and final content of the manuscript. The authors are solely responsible for the accuracy and integrity of the manuscript.

Ethical Approval
The manuscript states that data were collected from December 2025 to March 2026, whereas the cited ethics reference (932/B.6/KEP-UMI/IX/2026) appears to be dated September 2026. The authors must provide the original approval letter and reconcile the timeline. Retrospective approval must not be represented as prospective approval. Participant assent, parental/guardian permission where applicable, and safeguards for minors must also be documented accurately from source records.

Data Availability
The data on which the findings of this study are based can be obtained from the authors of the correspondence through reasonable requests. The data are not publicly published because the authors consider the ethical aspects of the research and the protection of participants' privacy.

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