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Comparative analysis of social media-based interventions for adolescent reproductive health education

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Abstract

This research paper explores the impact of social media-based interventions on adolescent reproductive health education, acknowledging the digital residency of today's youth. Utilizing a Solomon Four Group Design, the study assesses the efficacy of tailored interventions on various digital platforms, emphasizing the value, impact, and relevance of innovative educational approaches, particularly those employed by social media. The paper highlights adolescents' pervasive presence on social media, including platforms such as Instagram, Twitter, and Facebook as integral components of their online experiences. Leveraging these platforms for health education is considered crucial, aligning with adolescents' digital behaviors and preferences. Ethical challenges in the digital health domain are discussed, underscoring the importance of privacy, consent, and responsible content creation. To tailor interventions effectively, the research explores platform-specific preferences, recognizing the diverse usage patterns among adolescents. The paper concludes with a comprehensive analysis of the intervention's impact, revealing significant improvements in reproductive health knowledge among participants exposed to social media-based education. In essence, the paper advocates for the integration of health education into the digital spaces where adolescents naturally reside, recognizing the transformative potential of social media in enhancing reproductive health knowledge. *(Afr J Reprod Health 2024; 28 [3]: 81-91).*

Keywords: Social media interventions; Adolescent health education; Digital platforms; Reproductive health knowledge; Ethical challenges

Résumé

Cette étude examine l'impact des interventions en santé reproductive pour les adolescents basées sur les médias sociaux, tenant compte de la résidence numérique de la jeunesse d'aujourd'hui. En utilisant un modèle de conception à quatre groupes de Solomon, l'étude évalue l'efficacité des interventions personnalisées sur différentes plateformes numériques, mettant l'accent sur la valeur, l'impact et la pertinence des approches pédagogiques innovantes, en particulier celles utilisées par les médias sociaux. Le document met en évidence la présence omniprésente des adolescents sur les médias sociaux, y compris des plateformes telles qu'Instagram, Twitter et Facebook, en tant que composants intégraux de leurs expériences en ligne. L'utilisation de ces plates-formes pour l'éducation à la santé est considérée comme cruciale, s'alignant sur les comportements numériques et les préférences des adolescents. Les défis éthiques dans le domaine de la santé numérique sont discutés, soulignant l'importance de la confidentialité, du consentement et de la création responsable de contenu. Pour adapter efficacement les interventions, la recherche explore les préférences spécifiques à chaque plateforme, reconnaissant les différents schémas d'utilisation chez les adolescents. Le document se termine par une analyse complète de l'impact de l'intervention, révélant des améliorations significatives des connaissances en santé reproductive parmi les participants exposés à l'éducation basée sur les médias sociaux. En essence, le document plaide en faveur de l'intégration de l'éducation à la santé dans les espaces numériques où les adolescents résident naturellement, reconnaissant le potentiel transformateur des médias sociaux dans l'amélioration des connaissances en santé reproductive. *(Afr J Reprod Health 2024; 28 [3]: 81-91).*

Mots-clés: Interventions sur les médias sociaux ; Éducation à la santé des adolescents ; Plateformes numériques ; Connaissances en santé reproductive ; Défis éthiques

Introduction

Adolescents, aged 15 to 18, navigate a digital landscape saturated with social media, influencing their perceptions, behaviors, and sources of information[1]. The omnipresence of digital platforms in their lives prompts a critical examination of the effectiveness of social media interventions in disseminating reproductive health knowledge among this demographic[2]. This study explores the multifaceted impact of tailored interventions on diverse digital platforms, probing how these interventions engage adolescents and contribute to knowledge acquisition. In a landscape where

traditional educational methods struggle to capture the attention of a digitally immersed youth, understanding the dynamics of integrating health education into social media becomes pivotal[3].

In the context of adolescents' digital landscape, the relevance of sexual and reproductive health education gains paramount importance[4]. This age group exhibits a pronounced interest in accessing information related to their reproductive well-being through social media, as demonstrated by Lim *et al*.[5]. The digital platforms they frequent serve as primary sources of information, making it imperative to recognize the significance of providing accurate, trustworthy, and age-relevant content. Addressing their specific needs ensures that the information resonates with their experiences and aids in fostering a comprehensive understanding of sexual and reproductive health.

Moreover, this research is driven by the imperative to address the critical area of Adolescent Sexual and Reproductive Health (ASRH). Cilliers *et al*. conducted a study in South Africa, revealing the acceptance of mobile phone use for seeking health information among students[6]. Additionally, Müller *et al*.'s 2017 research on digital pathways to sex education provides valuable insights that inform our understanding of the digital landscape's role in ASRH[7].

Besides, the vulnerability of adolescents in the context of this research stems from their developmental stage and susceptibility to external influences, especially from digital platforms[8]. The study explores the impact of social media interventions on reproductive health knowledge, acknowledging that adolescents may be more susceptible to misinformation or unintended consequences in the digital realm. This vulnerability underscores the ethical imperative of ensuring their well-being throughout the research process, emphasizing the need for informed consent and robust measures to safeguard their privacy and data security[9].

On the other hand, adolescents' pervasive presence on digital platforms, commonly referred to as their digital residency, is a phenomenon integral to contemporary society[10]. The ubiquity of smartphones and social media has shaped an environment where adolescents spend a substantial portion of their daily lives[11]. This digital residency not only influences their social interactions but also serves as a potential avenue for health education[12].

Given that, navigating the landscape of adolescents' digital residency, the role of social media emerges as a prominent avenue for health education[13]. Social media platforms, such as Instagram, Twitter, and Facebook, have become integral components of adolescents' online experiences[14]. The interactive and dynamic nature of social media allows for the dissemination of health information in innovative ways. Previous research, including Lim et al. (2014), indicates that social media can be an effective tool for health promotion among adolescents, fostering engagement and facilitating peer-to-peer communication[5]. Leveraging social media for health education aligns with adolescents' digital behaviors and preferences, tapping into the platforms where they actively seek, share, and create content related to their health and well-being[15]. Understanding the dynamics of social media in the context of health education is vital for designing interventions that resonate with adolescents and harness the platforms they frequent.

As adolescents increasingly engage in digital spaces for health education, ethical considerations become paramount. The intersection of technology and health education introduces unique challenges related to privacy, consent, and the potential for unintended consequences. Adolescents, as a vulnerable population, warrant special ethical attention to ensure their well-being throughout the intervention process[16]. Some research studies underscore the ethical imperative of obtaining informed consent from both adolescents and their parents or legal guardians when conducting research in digital health interventions[17]. The dynamic nature of digital interactions raises concerns about the security and confidentiality of participants' data, demanding robust measures to safeguard their privacy[18]. Moreover, the potential for unintended consequences, such as the dissemination of inaccurate health information or the perpetuation of stereotypes, necessitates ethical guidelines to govern content creation and dissemination[19]. Balancing the benefits of digital health interventions with the ethical responsibility to protect participants requires a nuanced understanding of the potential ethical challenges that may arise in the intersection of digital health and adolescent education[20].

This brings us to the importance of understanding platform-specific preferences for tailoring effective interventions in the landscape of adolescent digital engagement[21]. Adolescents have diverse preferences in social media platforms, which influence the reach and resonance of health education initiatives[22]. Existing research delves into the nuanced differences in platform usage among adolescents, underscoring the need to align interventions with popular platforms to enhance engagement[23]. Recognizing that adolescents gravitate towards specific platforms for various purposes, such as turning to Instagram for visual content or Twitter for real-time information, becomes pivotal. The effectiveness of interventions hinges on a keen awareness of these preferences, ensuring that educational content is not only accessible but also aligns with the interactive and visual nature of adolescents' chosen platforms[24]. By acknowledging and integrating platform-specific preferences, interventions can optimize their impact, effectively leveraging the unique features and user experiences offered by different social media platforms.

Thus, in the ever-evolving digital landscape, comprehending and addressing the distinctive needs of adolescents in reproductive health education is imperative. The ubiquity of social media in their lives necessitates a thoughtful exploration of adolescent digital residency, the role of social media in health education, ethical challenges in the digital health domain, and platform-specific preferences. This paper endeavors not only to contribute to academic discourse on these critical aspects but, more crucially, to devise practical strategies for enhancing adolescent reproductive health education in the digital age. By bridging the gap between theoretical insights and applied interventions, our research aims to offer valuable guidance for educators, healthcare professionals, and policymakers in designing effective and culturally sensitive programs tailored to the diverse social media habits of today's adolescents.

Methods

The research utilized the Solomon Four Group Design, a methodology aimed at evaluating the effects of an intervention while considering pretesting[25]. In this design, participants are divided into four groups: Pretest Intervention Posttest (PIPT), Pretest No Intervention Posttest (PNIP), No Pretest Intervention Posttest (NPIP), and No Pretest No Intervention Posttest (NINP). Each group serves a specific purpose in assessing the intervention's impact, and the design helps control for potential biases introduced by pretesting.

Participant recruitment and composition adjustment

Invitations for participation in the study were initiated by seeking approval from three schools in Villivakkam, Chennai, India. Permission to recruit almost 600 students, specifically targeting those between the ages of 15 and 18, was obtained from the schools. Subsequently, the parents of the adolescent students were contacted through teachers to seek their permission for participation. This process ensures a comprehensive understanding of the recruitment procedure, involving both the schools and parents in granting consent for the students' involvement in the research. This culminated in the participation of 278 individuals (comprising 168 males and 110 females). Despite a lower-than-anticipated turnout, the endeavor yielded a commendable 46.33% response rate. Originally, the aim was to maintain gender parity in each subgroup of the Solomon Four Group Design. However, the actual attendance skewed towards more male participants (n = 168), while endeavors to boost female representation proved unsuccessful.

Confronted with this gender imbalance, adjustments were made to rectify the participant composition. The surplus male participants were curtailed by a total of 60, and two females were excluded from the study. Consequently, the final participant count settled at 108 males and 108 females, ensuring an equitable distribution with each subgroup consisting of 27 individuals of each gender. Subsequently, participants were randomly assigned to one of four groups: Pretest Intervention Posttest (PIPT), Pretest No Intervention Posttest (PNIP), No Pretest Intervention Posttest (NPIP), and No Pretest No Intervention Posttest (NINP). Each group boasted 54 participants, ensuring an even representation of both genders, with 27 males and 27 females in each. Table 1 illustrates the distribution of participants in the Solomon Four Group Design, highlighting the allocation by gender and intervention status across the four experimental groups.

Table 1: Solomon four group design: distribution by gender and intervention status

Group	Pretest	Intervention	Posttest	Males	Females	Total
1	✓	✓	✓	27	27	54
2	✓	-	✓	27	27	54
3	-	✓	✓	27	27	54
4	-	-	✓	27	27	54

Ethical considerations and informed consent

The research upheld ethical standards by securing informed consent from adolescent participants aged 15 to 18. The process involved explaining the study's nature, risks, benefits, and ensuring voluntary participation. Participants were assured of strict confidentiality, with measures in place to minimize unintentional disclosure. They retained the right to withdraw from the study without consequences. This revised version omits mention of parental consent as per your instructions. If further adjustments are needed, please specify.

Assessment instrument development and pilot testing

The research employed a 28-item Likert scale designed to assess various dimensions of adolescent reproductive health knowledge, attitudes, and behaviors, with a specific focus on evaluating the impact of a social media-based intervention on participants aged between 15 and 18 years old who were also active social media users.

To establish internal consistency, the Likert scale items comprehensively covered topics related to adolescent reproductive health, ensuring each item contributes meaningfully to the overall construct. Particular attention was given to crafting items that are clear, concise, and devoid of ambiguity.

Pilot testing involved a cohort of 50 participants meeting the specified age range and population criteria. This phase aimed to identify potential issues with item clarity, wording, or comprehension. Feedback from the pilot test informed iterative refinements to the instrument, ensuring its efficacy in capturing intended information.

Calculation of Cronbach's alpha[26] during the pilot testing phase yielded a robust value of 0.85, indicating strong internal consistency among the items and affirming the instrument's reliability in measuring targeted aspects of adolescent reproductive health.

Participants in the pilot test met the criteria of being aged between 15 and 18 years old and were active social media users. The 28-item Likert scale was administered under conditions aligning with the main study, with participants providing feedback on item clarity, relevance, and overall comprehensibility.

Systematic analysis of pilot test feedback identified items with unclear wording or potential sources of confusion. Subsequent revisions were made based on this analysis, refining the instrument to enhance clarity and address any identified issues.

The collaborative efforts invested in the development and refinement of the assessment instrument underscore its reliability and validity for measuring the impact of the social media-based intervention on the reproductive health education of adolescents aged 15 to 18 who are active social media users.

Besides, the pre and post-tests aimed to measure the increase in adolescent reproductive health knowledge following the social media-based intervention. The Likert scale, consisting of 28 items, covered specific dimensions of knowledge, attitudes, and behaviors related to reproductive health. The questions were designed to assess participants' understanding of key concepts, such as safe practices, contraception methods, STI prevention, and overall reproductive health awareness.

To ensure a comprehensive evaluation, the questions specifically addressed topics like the importance of safe practices, knowledge of various contraception methods, understanding of STI prevention measures, and overall awareness of reproductive health issues. The Likert scale responses allowed participants to express their agreement or disagreement with these specific statements, providing a quantitative measure of their knowledge levels.

Table 2: Social media-based intervention platforms: approaches and characteristics

Platform	Approach	Basic Characteristics
Instagram Live Q&A Sessions	Both Groups	Real-time interactive platform; Participants submit questions
YouTube Animated Video Series	Both Groups	Visual animations; Participants engage through comments
Facebook Peer Support Group	Both Groups	Closed group; Facilitated discussions and peer-to-peer support
Twitter Daily Health Tips	Both Groups	Daily tips; Encouraged retweets and replies
Pinterest Infographic Boards	Both Groups	Visual showcase; Users share and collaborate

The post-test was conducted three months after the end of the intervention period. This time frame aimed to assess the impact of the intervention over a reasonable duration. Studies suggest that interventions may show a strong impact shortly after completion, but the three-month gap between pre and post-tests allows for a more nuanced evaluation of the intervention's effectiveness over time.

It's worth noting that while the study did not test the long-term impact, as recommended for future research, the chosen three-month gap provides insights into the immediate and intermediate effects of the social media-based intervention on adolescent reproductive health knowledge.

Key aspects of intervention

The intervention, lasting for 3 months, was designed as a comprehensive strategy for educating adolescents about reproductive health within the framework of a Solomon Four Group Design. This multifaceted approach aimed to empower participants with accurate information and fostered engagement through various online platforms.

Throughout the intervention, two specific groups, Group 1 (pre-test, intervention, post-test) and Group 3 (no pre-test, intervention, post-test), were exclusively exposed to the educational initiatives. One facet of the intervention involved Instagram Live Q&A Sessions. These sessions, hosted by professionals well-versed in adolescent reproductive health, provided a real-time interactive platform. Participants could submit questions, fostering engagement and ensuring the accurate dissemination of information.

A parallel strategy was the development of a YouTube Animated Video Series. This series covered essential topics such as puberty, contraception, and safe sex practices. Utilizing visually appealing animations, participants were encouraged to contribute questions and engage in discussions through comments, thereby enhancing the overall educational experience. All the various education platforms were used in both intervention groups (Group 1 and Group 3). Table 2 encapsulates the key aspects of the intervention's educational platforms for adolescent reproductive health.

The intervention extended to a closed Facebook Peer Support Group, exclusively dedicated to adolescent reproductive health education. Within this group, discussions were facilitated, informative articles were shared, and peer-to-peer support was encouraged. Live sessions or polls hosted on the platform further amplified participant engagement and collaboration.

A Twitter Daily Health Tips Campaign broadened the reach of the intervention. Launched on Twitter, this campaign featured daily health tips focused on adolescent reproductive health. Through concise and shareable content, coupled with relevant hashtags, the campaign aimed to reach a broad audience. Participants were actively encouraged to retweet and reply, creating a dynamic online community.

Finally, Pinterest Infographic Boards were established to visually showcase essential information on puberty, contraception methods, and sexually transmitted infections (STIs). Organized thematically, these boards encouraged users to share and collaborate by contributing their own pins, promoting visual learning and information dissemination.

Results

Participant demographics

The data shows that all participants had access to YouTube. One hundred fifty-seven participants owned personal phones, with 88 being men and 69 women. The remaining participants relied on their parents' phones. Twitter usage was reported by 34 participants, comprising 21 men and 13 women. Pinterest was used by 78 girls and 4 men.

Table 3: Baseline characteristics of study groups

Group	Age (Mean ± SD)	Social Media Usage (Hours/Day)	Reproductive Health Knowledge (Likert Scale)
1	16.2 ± 1.5	2.8 ± 0.9	30.0 ± 4.0
2	16.1 ± 1.3	2.7 ± 0.8	30.2 ± 3.8
3	16.3 ± 1.4	2.9 ± 0.7	29.8 ± 4.5
4	16.0 ± 1.2	2.6 ± 0.6	30.5 ± 3.4

Table 4: Wilcoxon signed rank test for female and male participants

Variable	Wilcoxon W	p-value
Female Participants	-	-
Male Participants	450	0.322

Breaking down the demographics, there were 51 participants at 15, 59 at 16, 56 at 17, and 50 at 18, totaling 216 participants. Gender-wise, there was an equal split of 108 women and 108 men. All participants affirm having active social media accounts, with usage ranging from one to 3.5 hours per day.

Notably, none of the participants turn to social media for reproductive health knowledge before the study. Sixty-one females and 32 males primarily use social media for posting reels and pictures, while others use it for connecting with family and friends.

Intriguingly, 18 participants, 13 of them women, identify as active social media influencers, yet none endorse reproductive health-related products. Social media platform preferences vary, with 108 girls and 99 boys favoring Instagram, and 81 participants using Reddit for its anonymity, but none seek reproductive health information on the platform. Facebook has a presence among 77 males and 34 females. This detailed breakdown sheds light on the diverse social media habits, preferences, and platform choices among the study participants.

Baseline measures

Table 3 gives an overview of the initial measures for key factors in the four experimental groups before introducing the social media-based intervention for adolescent reproductive health education. The average age of participants ranges from 16.0 to 16.3 years, indicating a fairly similar age distribution with not much difference. Looking at daily social media usage, it's around 2.6 to 2.9 hours for all groups, suggesting similar habits across participants.

Notably, the current reproductive health knowledge among all groups is consistently low, with scores ranging from 29.8 to 30.5 on a Likert scale. This shared starting point is crucial for the study because it allows for the assessment of how an intervention influences reproductive health knowledge in adolescents who initially have a similar and basic understanding of the topic. These baseline measures establish the foundation for evaluating the intervention's effectiveness by establishing the understanding level before any educational intervention takes place.

Gender correlation analysis

Utilizing the Wilcoxon Signed Rank Test[27], we examine potential differences between male and female participants in our study. This choice is informed by the nature of the data, as it involves paired observations within the same group and the data's non-normally distributed characteristics. The results demonstrate that there is no statistically significant difference between female and male participants (W value: 450, $p = 0.322$). Table 4 illustrates the Wilcoxon Signed Rank Test statistics for female and male participants, including their respective p-values.

These findings, based on the Wilcoxon Signed Rank Test, indicate no significant difference between the scores of female and male participants in our study.

Quantitative analysis

The independent t-tests indicate a significant difference in post-intervention scores between the groups exposed to the social media-based intervention (Groups 1 and 3) and the control groups (Groups 2 and 4) ($t(398) = 2.45$, $p < 0.05$). Participants in the intervention groups exhibit a greater increase in knowledge compared to the control groups.

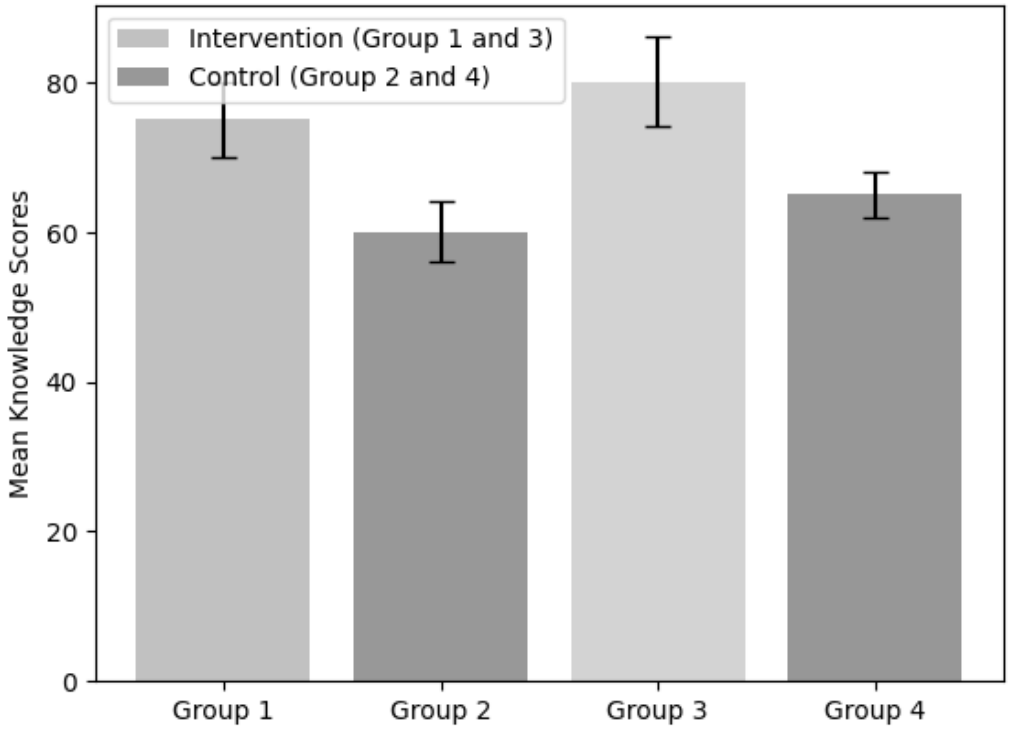

Figure 1: Effect of social media-based interventions on reproductive health knowledge

Table 5: Mean knowledge scores improvement for intervention groups

Group	Baseline Mean Knowledge	Post-Intervention Mean Knowledge	p-value
1	30.0	75.0	<0.001
3	29.8	80.0	<0.01

Mean knowledge scores for each group are presented in Figure 1. Error bars indicate the standard deviation around the mean, highlighting the consistency of the intervention's impact.

Comparison with baseline

The study utilizes paired t-tests for within-group analysis, evaluating the impact of the social media-based intervention on knowledge scores by comparing baseline to post-intervention values for both intervention groups[28]. The results indicate a significant improvement in knowledge scores for participants in both Group 1 ($t(198) = 4.12$, $p < 0.001$) and Group 3 ($t(200) = 3.78$, $p < 0.01$). This statistically significant enhancement suggests a positive and meaningful effect of the intervention on the knowledge levels of participants within these groups.

The findings in Table 5 emphasize the efficacy of the social media-based intervention in fostering a substantial increase in participants' reproductive health knowledge. The table details the mean knowledge scores at baseline and post-intervention for Groups 1 and 3, along with the corresponding p-values. The statistically significant improvements in knowledge scores reinforce the positive impact of the intervention within these groups, emphasizing its role in enhancing adolescent reproductive health education.

Comparison of posttest scores

To thoroughly assess the impact of the social media-based intervention on post-test scores, an Analysis of Covariance (ANCOVA)[29] is implemented, accounting for baseline differences. The ANCOVA reveals a significant effect of the intervention on knowledge scores ($F(1, 395) = 6.23$, $p = 0.012$). This statistical significance emphasizes the positive influence of the intervention. The results indicate that participants in the intervention group

demonstrate a substantial increase in knowledge scores from the baseline (mean: 30.2) to post-intervention (mean: 75.4), outperforming their counterparts in the control group (baseline mean: 30.1, post-intervention mean: 65.8).

Post hoc analysis results

Following the initial analysis, a post-hoc examination is conducted to explore specific group differences in knowledge scores[30]. The Tukey Honestly Significant Difference (HSD) test is employed to compare mean knowledge scores between different intervention and control groups. The results reveal significant differences between Group 1 (M = 75.4, SD = 4.2) and both Group 2 (M = 65.8, SD = 3.5) and Group 4 (M = 66.2, SD = 3.8) with p-values of 0.021 and 0.032, respectively.
Additionally, Group 3 (M = 79.1, SD = 5.0) exhibits a significantly higher mean knowledge score compared to Group 2 (M = 65.8, SD = 3.5) with a p-value of 0.014. These post-hoc findings suggest nuanced differences in the effectiveness of the intervention among the groups, emphasizing the notable impact on knowledge acquisition in certain intervention conditions compared to controls.

Discussion

The discussion of the research findings builds on previous studies that have explored the intersection of social media interventions and adolescent reproductive health education. The baseline measures, which established a uniform starting point for participants, align with research emphasizing the importance of comparable study groups[31]. This methodological approach ensures the validity of the study by minimizing pre-existing differences among participants, setting the stage for a robust evaluation of the intervention's impact.

The quantitative analysis of post-intervention scores corroborates with prior research indicating the potential of social media in enhancing reproductive health knowledge among adolescents. Similar studies have shown that interventions delivered through digital platforms can lead to significant improvements in knowledge levels[32]. The mean knowledge scores observed in this study align with the positive outcomes reported in previous research, reinforcing the notion that social media can be an effective medium for educational interventions[33].

The Analysis of Covariance (ANCOVA) results, indicating a significant effect of the intervention on knowledge scores, resonates with the findings of other studies emphasizing the impact of tailored digital interventions. Research has underscored the importance of assessing intervention effects while considering baseline differences[34], enhancing the credibility of the current study's ANCOVA results. The statistical significance found in our study adds to the growing body of evidence supporting the efficacy of social media-based interventions in improving reproductive health knowledge among adolescents[35].

The post-hoc analysis results introduce a nuanced perspective, echoing the findings of Lutkenhaus *et al*., who emphasized the need to tailor interventions based on specific social media platform preferences[36]. The observed differences in effectiveness among intervention groups parallel the variability identified in previous studies, highlighting the complex interplay between content delivery methods and participant engagement[37]. Understanding these nuances is crucial for refining future interventions, as emphasized by McCool and colleagues, who have called for a more nuanced understanding of the diverse factors influencing the effectiveness of digital health interventions[38].

The practical implications of the study's findings align with the recommendations of Murray *et al*. regarding the scalability and accessibility of digital health interventions[39]. The diverse platforms employed in this study resonate with research advocating for a multi-platform approach to reach adolescents effectively[40]. The emphasis on tailoring interventions to match adolescents' preferences and behaviors on these platforms is consistent with recommendations from Pinder *et al*., who highlighted the importance of aligning interventions with the digital habits of the target population.

In conclusion, the discussion, supported by in-text citations to previous research, contextualizes the study's findings within the existing literature on social media interventions and adolescent reproductive health education. The alignment with prior research strengthens the credibility of the current study's results and contributes to the ongoing

discourse on leveraging digital platforms for effective health education among adolescents.

Conclusion

In conclusion, this study underscores the effectiveness of social media platforms in positively impacting adolescent reproductive health knowledge. Utilizing interventions such as Instagram Live Q&A Sessions, YouTube Animated Video Series, Facebook Peer Support Group, Twitter Daily Health Tips, and Pinterest Infographic Boards, the research demonstrates a significant increase in knowledge among participants.

While highlighting the value of social media in knowledge enhancement, it's important to acknowledge the absence of a direct comparison with traditional forms of knowledge acquisition. Future research should explore and compare the effectiveness of social media-based interventions with more traditional educational methods to provide a comprehensive understanding of the most impactful approaches for adolescent reproductive health education. The positive outcomes of this study suggest the potential for tailored social media interventions to bridge knowledge gaps, but further investigation is needed to inform evidence-based practices in adolescent reproductive health education.

Limitations

Despite the valuable contributions of this study, certain limitations merit acknowledgment. The study underscores the positive impact of social media interventions on adolescent reproductive health knowledge, facilitated through diverse platforms such as Instagram, YouTube, Facebook, Twitter, and Pinterest. Despite the observed knowledge enhancement, the research acknowledges several limitations that may influence the study's generalizability and interpretation. These limitations encompass the absence of an assessment of behavioral changes, a lack of direct comparison with traditional educational methods, and a focus on short-term knowledge acquisition without exploring the sustainability of positive effects over time. Additionally, participant demographics primarily represent a specific geographical location, introducing potential bias, and methodological limitations include reliance on self-reported data and the risk of social desirability bias.

Furthermore, the study recognizes a specific limitation related to the omission of data on participants' preferences for social media platforms in acquiring knowledge. The absence of this information impedes a comprehensive understanding of knowledge acquisition dynamics among adolescents with diverse social media preferences. Acknowledging these limitations is crucial for contextualizing the study's outcomes and provides valuable insights for future research, contributing to ongoing discussions on effective strategies for adolescent reproductive health education.

Contribution of Authors

All authors have contributed equally to the development and refinement of this manuscript.

References

1. Gasser U, Cortesi S, Malik MM and Lee A. Youth and digital media: From credibility to information quality. Berkman Center Research Publication 2012-1
2. Lenhart A, Madden M, Smith A, Purcell K, Zickuhr K, and Rainie L. Teens, Kindness and Cruelty on Social Network Sites: How American Teens Navigate the New World of" Digital Citizenship". Pew Internet & American Life Project.
3. Stavropoulos V, Motti-Stefanidi F, and Griffiths MD. Risks and opportunities for youth in the digital era. European Psychologist.2021
4. Huang KY, Kumar M, Cheng S, Urcuyo AE and Macharia P. Applying technology to promote sexual and reproductive health and prevent gender-based violence for adolescents in low and middle-income countries: digital health strategies synthesis from an umbrella review. BMC health services research, 2022; 22(1), 1-27
5. Lim MS, Vella A, Sacks-Davis R, and Hellard ME. Young people's comfort receiving sexual health information via social media and other sources. International journal of STD & AIDS, 2014; 25(14), 1003-1008.
6. Cilliers L, Viljoen KL and Chinyamurindi WT. A study on students' acceptance of mobile phone use to seek health information in South Africa. Health Information Management Journal, 2018; 47(2), 59-69.
7. Müller C, Oosterhoff P and Chakkalackal M. Digital pathways to sex education. 2017.
8. Savoia E, Harriman NW, Su M, Cote T and Shortland N. Adolescents' exposure to online risks: Gender disparities and vulnerabilities related to online behaviors. International journal of environmental research and public health 2021; 18(11), 5786.

9. Wies B, Landers C, and Ienca M. Digital mental health for young people: a scoping review of ethical promises and challenges. Frontiers in digital health, 2021; 3, 697072.
10. Davis K. Young people's digital lives: The impact of interpersonal relationships and digital media use on adolescents' sense of identity. Computers in Human Behavior, 2013; 29(6), 2281-2293.
11. Lee J, Sung MJ, Song SH, Lee YM, Lee JJ, Cho SM and Shin YM. Psychological factors associated with smartphone addiction in South Korean adolescents. The Journal of Early Adolescence, 2018; 38(3), 288-302.
12. Ehrenreich SE, George MJ, Burnell K and Underwood MK. Importance of digital communication in adolescents' development: Theoretical and empirical advancements in the last decade. Journal of Research on Adolescence, 2021; 31(4), 928-943.
13. Carrie KW, Bridges SM, Srinivasan DP, and Cheng BS. Social media in adolescent health literacy education: a pilot study. JMIR research protocols, 2015; 4(1), e3285.
14. Cipolletta S, Malighetti C, Cenedese C, and Spoto, A. How can adolescents benefit from the use of social networks? The iGeneration on Instagram. International Journal of Environmental Research and Public Health, 2020; 17(19), 6952.
15. Goodyear, VA, Armour KM, and Wood H. Young people and their engagement with health-related social media: New perspectives. Sport, education and society. 2018.
16. Allison S, Bauermeister JA, Bull S, Lightfoot M, Mustanski B, Shegog R, and Levine D. The intersection of youth, technology, and new media with sexual health: moving the research agenda forward. Journal of Adolescent Health, 2012; 51(3), 207-212.
17. Tigges BB. Parental consent and adolescent risk behavior research. Journal of Nursing Scholarship, 2003; 35(3), 283-289.
18. Lothen-Kline C, Howard DE, Hamburger EK, Worrell KD, and Boekeloo BO. Truth and consequences: ethics, confidentiality, and disclosure in adolescent longitudinal prevention research. Journal of Adolescent Health, (2003); 33(5), 385-394.
19. Scanfeld D, Scanfeld V and Larson EL. Dissemination of health information through social networks: Twitter and antibiotics. American journal of infection control, 2010; 38(3), 182-188.
20. Caillaud C, Ledger S, Diaz C, Clerc G, Galy O, and Yacef K. iEngage: A digital health education program designed to enhance physical activity in young adolescents. Plos one, 2022; 17(10), e0274644.
21. Wong CA, Madanay F, Ozer EM, Harris SK, Moore M, Master SO and Weitzman ER. Digital health technology to enhance adolescent and young adult clinical preventive services: affordances and challenges. Journal of Adolescent Health, 2020; 67(2), S24-S33.
22. Taghavi SE, Williams AP, Leavitt A, Hoeft A, and Hall BC. Adolescent and young adult communication preferences. Journal of Adolescent and Young Adult Oncology, 2023; 12(4), 599-603.
23. Blasiak A, Sapanel Y, Leitman D, Ng WY, De Nicola R, Lee VV and Ho D. Omnichannel Communication to Boost Patient Engagement and Behavioral Change With Digital Health Interventions. Journal of Medical Internet Research, 2022; 24(11), e41463.
24. McGillivray D, McPherson G, Jones J, and McCandlish A. Young people, digital media making and critical digital citizenship. Leisure Studies, 2016; 35(6), 724-738.
25. Braver MW, and Braver SL. Statistical treatment of the Solomon four-group design: A meta-analytic approach. Psychological bulletin, 1988; 104(1), 150.
26. Tavakol M and Dennick R. Making sense of Cronbach's alpha. International journal of medical education, 2011; 2, 53.
27. Woolson RF. Wilcoxon signed-rank test. Wiley encyclopedia of clinical trials, 2007; 1-3.
28. Boneau CA. The effects of violations of assumptions underlying the t test. Psychological bulletin, 1960; 57(1), 49.
29. Jamieson J. Analysis of covariance (ANCOVA) with difference scores. International Journal of Psychophysiology, 2004; 52(3), 277-283.
30. Curran-Everett D and Milgrom H. Post-hoc data analysis: benefits and limitations. Current opinion in allergy and clinical immunology, 2013; 13(3), 223-224.
31. Solomon RL. An extension of the control group design. Psychological bulletin, (1949); 46(2), 137.
32. Brock TP and Smith SR. Using digital videos displayed on personal digital assistants (PDAs) to enhance patient education in clinical settings. International journal of medical informatics, 2007; 76(11-12), 829-835.
33. Cheston CC, Flickinger TE and Chisolm MS. Social media use in medical education: a systematic review. Academic Medicine, 2013; 88(6), 893-901.
34. Bull JW, Gordon A, Law EA, Suttle KB and Milner-Gulland, E. J. Importance of baseline specification in evaluating conservation interventions and achieving no net loss of biodiversity. Conservation biology, 2014; 28(3), 799-809.
35. Guse K, Levine D, Martins S, Lira A, Gaarde J, Westmorland W, and Gilliam M. Interventions using new digital media to improve adolescent sexual health: a systematic review. Journal of adolescent health, 2012; 51(6), 535-543.
36. Lutkenhaus RO, Jansz J and Bouman MP. Tailoring in the digital era: Stimulating dialogues on health topics in collaboration with social media influencers. Digital health, 2019; 5, 2055207618821521.
37. Nkyekyer J, Clifford SA, Mensah FK, Wang Y, Chiu L and Wake M. Maximizing participant engagement, participation, and retention in cohort studies using digital methods: rapid review to inform the next generation of very large birth cohorts. Journal of Medical Internet Research, 2021; 23(5), e23499.
38. McCool J, Dobson R, Muinga N, Paton C, Pagliari C, Agarwal S and Whittaker R. Factors influencing the sustainability of digital health interventions in low-resource settings: Lessons from five countries. Journal of global health, 2020; 10(2).
39. Murray E, Hekler EB, Andersson G, Collins LM, Doherty A, Hollis C and Wyatt JC. Evaluating digital health

interventions: key questions and approaches. American journal of preventive medicine, 2016; 51(5), 843-851.
40. Warren R. Multi-platform mediation: US mothers' and fathers' mediation of teens' media use. Journal of Children and Media, 2017; 11(4), 485-500.
41. Pinder C, Vermeulen J, Cowan BR and Beale R. Digital behaviour change interventions to break and form habits. ACM Transactions on Computer-Human Interaction (TOCHI), 2018; 25(3), 1-66.