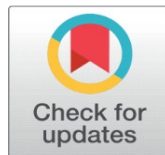
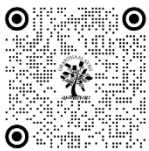


ROLE OF DIGITAL MEDIA IN PROMOTING SUSTAINABLE MENSTRUAL PRODUCT AMONG STEM AND NON-STEM STUDENTS OF BBAU: AN EMPIRICAL STUDY

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ABSTRACT

Introduction: Sustainable menstrual products (SMPs), including menstrual cups and organic pads, provide safer and eco-friendly alternatives to conventional products that contribute to health risks and environmental damage. In India, 336 million menstruators endure health perils, and the Earth pays the price with an estimated 12.3 billion tonnes of non-biodegradable sanitary waste generated annually (citation required). Despite increasing awareness, adoption of SMPs remains low due to cultural stigma, affordability issues, and lack of access. This study investigates the role of digital media in promoting awareness and adoption of SMPs among female students at Babasaheb Bhimrao Ambedkar University (BBAU), with a comparative focus on STEM and non-STEM groups. **Methods:** A quantitative comparative design was applied with a stratified random sample of 100 students (50 STEM, 50 non-STEM). Structured surveys measured awareness, adoption, digital literacy, and exposure to social media campaigns. Data were analyzed using t-tests, chi-square, correlation, regression, ANOVA, and factor analysis.

Results: STEM students showed higher awareness ($M=8.1$ vs. 6.3 , $p<0.001$) and adoption rates (45% vs. 32% , $p<0.005$). Digital literacy was strongly correlated with awareness ($r=0.65$, $p=0.001$), and regression identified social media use, digital literacy, and educational background as significant predictors.

Discussion and Conclusion: Digital media has strong potential to democratize menstrual health discourse but bridging the awareness–adoption gap requires culturally sensitive campaigns, affordability considerations, and improved access to sustainable alternatives.

Keywords: Sustainable Menstrual Products, Digital Media, Social Media Campaigns, Digital Literacy, STEM Students, Menstrual Hygieneg



1. INTRODUCTION

Social media has emerged as a critical agent of social change and health awareness in the rapidly changing digital landscape of new India, especially regarding discussions on issues that were previously considered too sensitive, such as menstrual health and hygiene. The intersection of digital communication, sustainable development, and women's health is an area of research that is particularly interesting among the diverse student population of bbau, this study addresses the problem of social media promotion of sustainable menstrual hygiene products in female students, with a special focus on how awareness levels vary between STEM and non-STEM disciplines.

In recent years, the discourse surrounding menstrual hygiene has exponentially changed, primarily due to social media's potential for open dialogue and the diffusion of knowledge. In India, approximately 336 million women within

the age of menstruating have faced various challenges surrounding menstrual health management, while the development of green products came to add a new dimension to this complex circumstance (Van Eijk et al., 2021; Bency., 2024). Environmental awareness increasingly influences consumer decision-making in personal health care, especially among the educated youth (Mane et al.).

Recent statistics show that the participation of young women aged between 18-25 years has the highest rate, and therefore, university students are an ideal population to be studied for determining the effectiveness of social media-based health communication (Kligler-Vilenchik & Literat, 2020). Digital and technical literacy enable women to choose accurate information or product and overcome misconception related to sustainable alternative; despite rising awareness about SMP the adoption of these products remains limited (Bency., 2024). The study categorizes between STEM and non-STEM students, given that specialization in education was shown to play an important role in the information processing process, health literacy, and sustainability practices adoption. This study aims to provide actionable suggestions for policymakers, educational institutions, and digital health communicators by carrying out an in-depth analysis of the impact of educational backgrounds on the comprehension and implementation of health programs initiated through social media at BBAU.

The findings may provide insights into developing more effective strategies for promoting sustainable menstrual hygiene practices through social media, considering the unique characteristics of different student groups. As India is making its way ahead to address the complexity of digital transformation and sustainable development, the knowledge of interaction and responses of diverse demographics toward health initiatives based on social media gains importance.

2. IDENTIFICATION OF RESEARCH PROBLEM

Social media is emerging as a game-changer during India's digital renaissance, tearing down decades-old taboos and galvanising conversations on issues that have long remained hushed, like menstrual health. While this is a step forward, it is a very conflicting one — because even if young people grow more conscious regarding the environment and health, the adoption of sustainable menstrual hygiene products is still extremely low. This inconsistency indicates a major problem — how come social media, with its global coverage around the world, struggles to bridge the gap between awareness and action, at least in terms of the educational groups?

Then it is crucial to delve into this investigation as India faces both worlds, where 336 million menstruators endure health perils, and the Earth pays the price, which amounts to roughly 12.3 billion tonnes of non-biodegradable sanitary waste generated annually (Centre for Science and Environment [CSE], 2022, p. 7). While social media campaigns have heightened conversations around sustainable menstrual products such as menstrual cups and organic pads, the effects are not consistent across the board. Initial findings indicate that there has been a significant increase in awareness about eco-products in recent years, while actual adoption rates remain limited suggesting a significant gap between online discussions and tangible actions. This gap is intensified by a significant lack of academic focus: In what ways do educational backgrounds—particularly those in STEM compared to non-STEM fields—affect the understanding and adoption of health messaging disseminated through social media?

The current body of work highlights significant gaps. Initially, although digital teaching methods promote equal access to menstrual education, their effectiveness is diminished by biases in algorithms, the commodification of data, and a lack of culturally sensitive content. Moreover, there is a notable lack of comparative analyses regarding the responsiveness of STEM and non-STEM students to SMP campaigns, even though there is evidence indicating that scientific literacy plays a significant role in health decision-making, the female student body at BBAU, LUCKNOW, reflecting India's diverse socio-educational landscape, illustrates this divide: STEM students, typically more skilled at understanding technical SMP benefits, may interact with digital content in a manner distinct from their non-STEM counterparts, who may focus more on cultural or economic considerations.

This investigation addresses these gaps by examining the convergence of digital literacy, educational specialization, and menstrual sustainability. What accounts for the fact that STEM students, despite having higher awareness scores, show only slightly improved adoption rates? What cultural or infrastructural obstacles hinder the conversion of awareness into action? This study utilizes a stratified comparative design to explore the ways in which algorithmic biases in social media, along with disciplinary silos, contribute to ongoing inequities in health communication.

3. REVIEW OF LITERATURE

3.1. MENSTRUAL TABOOS AND CULTURAL STIGMA

Menstruation is a stigmatized topic across cultures, which has been described by words such as ‘dirty,’ ‘impure,’ and ‘unhygienic’ (Winkler, 2020). This stigma is not just limited to developing nations because social norms and cultural taboos around the globe shape menstrual discourse (Rihtarši\, 2017; Tiwary, 2018). Women usually do not discuss their menstrual issues and, therefore, do not express their needs and requirements (Girod et al., 2017; Mitchell et al., 2015). Societal constraints along with cultural taboos tend to restrict frank conversations but similarly restrain the enactment of hygienic menstrual practices (Mason et al., 2013; Sinha & Paul, 2015).

In India, multinational companies run the menstrual hygiene market, pushing products based on archaic standards developed in the 1980s (Masoodi, 2020). Marketing pushes menstrual stigma forward by portraying the experience of menstruation as being secret and shameful. This can be seen from the symbolic representation of blue liquid instead of red in advertisements (Adriana et al., 2023). This style of marketing adheres to what is socially practiced, thus fortifying taboos and creating narrow-minded boundaries for women concerning sustainable alternatives, according to Hong Hai Nguyen et al. (2020).

3.2. CHALLENGES OF CONVENTIONAL MENSTRUAL PRODUCTS

Although the use of traditional sanitary products is prevalent, most are applied based on cultural knowledge and myths. The products embody some of the most inherent health dangers because they are primarily composed of volatile organic compounds, dioxins, plastics, and fragrances, which actually create an environment that may facilitate infections or long-term ill health (Ding et al., 2021). Women continue to apply these products due to habits and lack of information on other alternatives (Jacob et al., 2014; Meenakshi, 2020). Technical literacy is crucial for increasing awareness and adoption of SMP, women having more knowledge about product options, environmental impact and health benefits are more likely to have positive attitude towards menstruation and SMP (Ahuja & Singh, 2023).

3.3. THE CASE FOR SUSTAINABLE MENSTRUAL PRODUCTS

SMPs are an alternative practical solution to the problems that come with traditional sanitary products. The organic materials in them, including banana, bamboo, cotton, and wool, possess characteristics that make them biodegradable and inexpensive (Barman et al., 2017; Weir, 2015).

Scholarly studies have proven that education is the key in adopting SMPs. Women who are educated about the environmental and health benefits of such products are likely to shift away from the traditional substitutes (Kirk & Sommer, 2006; Ndana, 2018). However, the dominance of a few multinationals and poor availability of SMPs in point-of-sale channels limits consumer access and choice (Yagnik, 2016).

3.4. DIGITAL PEDAGOGIES IN MENSTRUAL EDUCATION

Digital media has revolutionized the method of menstrual education. Adolescents now seek information and support through digital media, including social platforms and period-tracking applications (Plan International Canada, 2020; Rubinsky et al., 2020). UNESCO (2020) notes that digital spaces are at the top of the list of sources of information for the age group of 15-24 years-old, and are an inclusive route to address menstruation, sexuality, and bodily autonomy.

Digital tools, often categorized as ‘femtech,’ claim to empower users by offering insights into menstrual and reproductive health. However, feminist critiques argue that these tools perpetuate epistemic injustices and heteronormative biases (Hendi & Jansky, 2022). Moreover, concerns about data privacy and the commercialization of intimate health data further complicate the narrative around digital period pedagogies (Kelly & Habib, 2023).

Despite these challenges, digital and social media platforms have proven effective in challenging traditional taboos and fostering inclusive conversations. By blending education with entertainment, content creators—ranging from influencers to healthcare professionals—make menstrual knowledge accessible and engaging (Tomlinson, 2021).

3.5. A SOCIO-MATERIAL PERSPECTIVE ON MENSTRUATION

Recent theoretical approaches, including new materialist and feminist perspectives, emphasize the biosocial nature of menstruation. This lens considers menstruation as an interplay of physical, cultural, and material factors (Maulingin-Gumbaketi et al., 2022; Gunson, 2016). Socio-material perspectives further highlight how digital media and embodied experiences shape menstrual practices and pedagogy. Period-tracking applications, for instance, influence body pedagogies by integrating scientific insights with personal experiences (Riley & Paskova, 2022).

The convergence of materiality and discourse underscores the potential of SMPs and digital tools to redefine menstrual practices. However, achieving this transformation requires addressing societal taboos, enhancing consumer awareness, and fostering inclusive educational practices across diverse socioeconomic and cultural contexts.

Despite the increasing focus on menstrual health and sustainability, there are notable deficiencies in comprehending how social media influences awareness and the uptake of sustainable menstrual hygiene products. The subsequent gaps in research have been identified, in accordance with the specified objectives and hypotheses:

There is a deficiency in comparative studies that examine the disparities in sustainable menstrual hygiene awareness between STEM and Non-STEM students. There is a lack of thorough investigation into how educational specialization affects the interpretation of social media content in stem and non-stem students.

Scarcity of evidence regarding the effectiveness of social media campaigns in promoting the adoption of sustainable menstrual products. Limited studies exist regarding the connection between digital literacy and awareness, especially within various educational fields. There is a limited understanding of the barriers and facilitators in menstrual health communication through social media, particularly within educational institutions.

4. OBJECTIVES, HYPOTHESES, AND ANALYTICAL ALIGNMENT

Objective 1

To compare awareness levels of sustainable menstrual products (SMPs) between STEM and non-STEM female students at BBAU.

- **H₀₁ (Null Hypothesis):** There is no significant difference in awareness of SMPs between STEM and non-STEM students.
- **H₁₁ (Alternative Hypothesis):** STEM students have significantly higher awareness of SMPs compared to non-STEM students.

Objective 2

To examine whether educational background (STEM vs. non-STEM) influences the adoption rates of SMPs.

- **H₀₂:** There is no significant difference in adoption of SMPs between STEM and non-STEM students.
- **H₁₂:** STEM students adopt SMPs at significantly higher rates than non-STEM students.

Objective 3

To assess the impact of digital literacy on awareness of SMPs.

- **H₀₃:** Digital literacy has no significant association with awareness of SMPs.
- **H₁₃:** Higher digital literacy significantly increases awareness of SMPs.

Objective 4

To identify the predictors of awareness and adoption of SMPs, considering social media use, digital literacy, and educational background.

- **H₀₄:** Social media use, digital literacy, and educational background do not significantly predict awareness and adoption of SMPs.
- **H₁₄:** Social media use, digital literacy, and educational background significantly predict awareness and adoption of SMPs.

4.1. THEORETICAL FRAMEWORK

Figure 1



Figure 1 Maslow's Hierarchy of Digital Media campaigns on Sustainable Menstrual Products
this model is created with the help of ChatGPT to refine the theoretical structure

5. RESEARCH METHODOLOGY

5.1. RESEARCH DESIGN

This research employs a comparative design to examine the impact of digital media on awareness and adoption of sustainable menstrual hygiene products among STEM and non-STEM female students at BBAU University. This study examines a cohort of university female students and evaluates the influence of educational specialization and digital literacy on awareness and behavior regarding menstrual products.

The study incorporates quantitative methods for data collection. Structured survey instruments will be disseminated to evaluate students' awareness of sustainable menstrual products, individuals' behaviour, and their involvement with social media campaigns. An assessment will be conducted to gauge the levels of digital literacy, aiming to explore the connection between awareness and the adoption of the SMP's products. Additionally, the study will try to profoundly understand how STEM and non-STEM students interpret and respond to digital media content related to sustainable menstrual hygiene.

The study reviews the number of students who engage with these posts and aims to identify the factors that facilitate or obstruct communication, including digital literacy, educational background, and cultural influences. This design seeks to offer potential conclusions for customizing digital campaigns that effectively promote sustainable menstrual hygiene practices.

1) Sample Selection

The population identified for this study was female undergraduate and postgraduate students from BBAU University. The stratified sampling strategy technique was used to get representations of STEM and non-STEM students. along with a random sampling approach to ensure equal representation of STEM and non-STEM students. The final sample was 100: 50 STEM and 50 non-STEMS.

Category	Total Students	STEM Students	Non-STEM Students
University	100	50	50

The sample size calculation uses the following parameters:

- **Confidence Level (Z):** 95% ($Z = 1.96$)
- **Proportion (p):** 50% (0.5)

- **Margin of Error (E): 5% (0.05)**

a) Sample Size Formula:

Equation 1: Sample Size

$$E = Z \cdot \sqrt{\frac{p \cdot (1 - p)}{n}}$$

Substituting the values:

$$E = 1.96 \cdot \sqrt{\frac{0.5 \cdot 0.5}{100}} = 1.96 \cdot \sqrt{\frac{0.25}{100}} = 1.96 \cdot 0.05 = 0.098$$

To ensure statistical reliability, the sample size has been rounded up to 100 participants. The sample size for this study is 100 female students from BBAU University, evenly distributed between STEM and Non-STEM disciplines (50 students each). Using a 95% confidence level and a proportion of 50%, the margin of error for this sample size is 9.8%. While this margin of error is higher than the initial target of 5%, the sample size is deemed sufficient for exploratory and comparative analysis, given practical constraints and the homogeneity of the student population

2) Sampling Method

The study adopts a stratified random sampling approach to ensure equal representation of STEM and Non-STEM students.

Figure 2

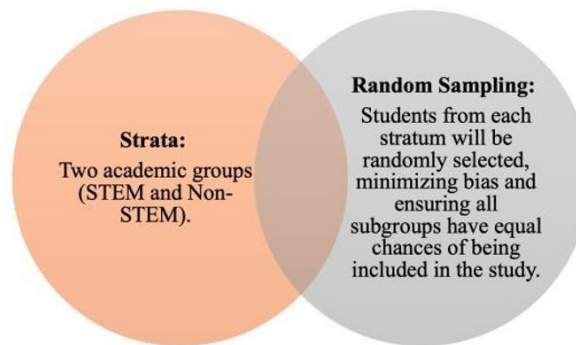


Figure 2 Sampling Method

3) Conceptual Model

The conceptual framework integrates several variables to analyse the influence of digital media on sustainable menstrual hygiene product adoption.

Table 1 Conceptual Model

Category	Variable Name	Description
Independent Variables	Social Media Platforms	Influence of platforms (Instagram, Facebook, Twitter) on awareness and adoption.
	Educational Specialization	STEM vs. non-STEM students and their digital content interpretation.
	Social Media Campaigns	Effectiveness of campaigns promoting sustainable menstrual products.
	Digital Literacy Levels	Impact of digital literacy on engagement with digital content.
Dependent Variables	Sustainable Menstrual Hygiene Product Awareness	Students' awareness of sustainable products and their benefits.
	Interpretation of Digital Media Content	How students understand digital media content related to menstrual health.
	Sustainable Menstrual Product Adoption	Adoption rates of sustainable menstrual hygiene products.
	Barriers and Facilitators	Factors influencing effective communication through social media.

4) Data collection

Surveys: The development and distribution of an online questionnaire will occur through social media sites and academic groups. The survey includes multiple-choice questions, Likert-scale items, and open-ended questions about awareness, perception, interpretation of digital media content, and the use of sustainable menstrual products. Additionally, it contains questions regarding participants' exposure to digital media messages and how these messages influence their decision-making. Key sections of the questionnaire include:

Figure 3

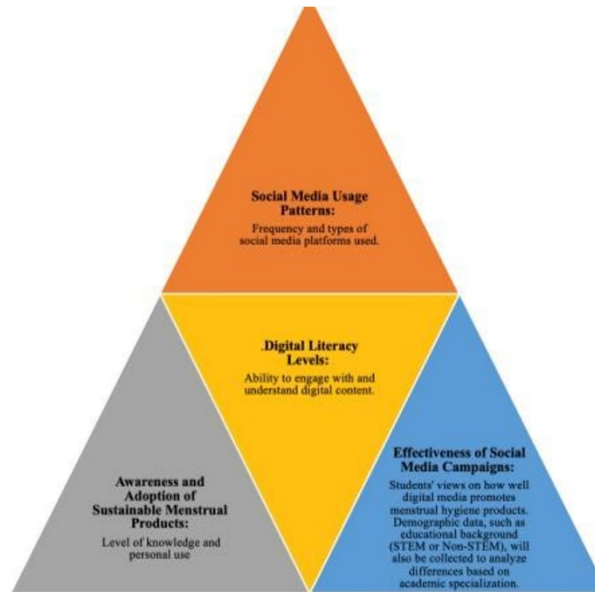


Figure 3: Section included in questionnaire

5.2. STATISTICAL ANALYSIS

To comprehensively analyse the data and draw meaningful conclusions, a variety of statistical techniques will be employed. These methods are tailored to address the research objectives and examine the relationships among key variables.

Descriptive Statistics will be utilized to summarize demographic data and identify patterns in the awareness and adoption of sustainable menstrual hygiene products. This step will provide an overview of the sample characteristics, and the general trends observed in the study.

T-tests, specifically Independent Samples T-tests, will be conducted to compare levels of awareness and adoption between students from STEM (Science, Technology, Engineering, and Mathematics) backgrounds and those from non-STEM disciplines. This analysis will help determine whether educational specialization influences sustainable product adoption.

The Chi-Square Test will be used to evaluate the relationship between digital literacy levels and awareness regarding sustainable menstrual hygiene products. This test will inform whether there is a significant relationship between these categorical variables or not (non-parametric test).

Correlation Analysis will explore what are the relations between a consumer's digital literacy and their awareness of the product. This analysis will assess associations among these continuous variables using correlation coefficients to identify just how strong and which way the associations go.

Multiple Regression Analysis to identify predictors of awareness and adoption. The independent variables will include usage of different social media platforms, the level of education, and digital literacy to determine their effects both individually and collectively on the dependent variables.

The differences in mean levels of awareness and adoption will be compared using an Analysis of Variance (ANOVA) between groups (e.g. STEM vs. Non-STEM students) This technique will show whether or not group membership has a meaningful effect on the outcomes.

Finally, Factor Analysis will be used to identify the factors that affects awareness and adoption towards sustainable menstrual products This procedure will identify latent variables that explain the patterns and relationships observed in the dataset.

Together, these statistical techniques will provide a robust framework for analysing the data, answering the research questions, and testing the hypotheses systematically.

5.3. ETHICAL CONSIDERATIONS

This study was guided by ethical responsibilities of voluntary participation, informed consent, and confidentiality of participant experience.

6. DATA ANALYSIS

This section of data analysis started its structure based on the research methodology in order to systematically address the research objectives. Statistical methods in the area of visualization are applied, and the available data is summarized. "The process of data analysis in short composing will be mentioned below in tabular format along with the interpretation."

6.1. DESCRIPTIVE STATISTICS

Descriptive statistics summarize the demographic characteristics of the sample, including age, educational specialization, and digital media usage. Awareness levels and adoption rates are also presented.

Table 2 Descriptive Statistics of the Sample

Variable	Mean	Median	Standard Deviation	Range
Age (Years)	21.3	21	1.2	18–24
Awareness Score (0–10)	7.2	7.0	1.8	3–10
Adoption Rate (%)	38.5	-	-	20–70

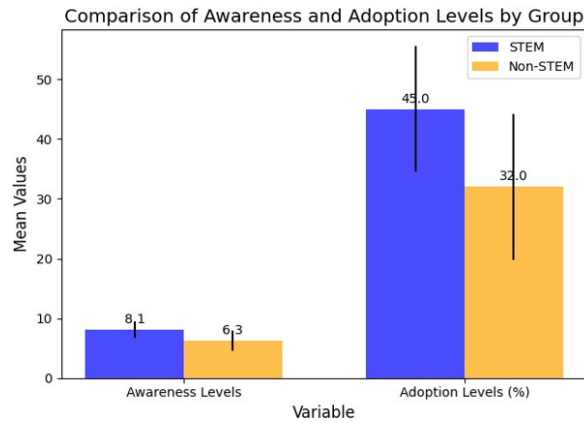
Interpretation: The demographic analysis shows that the respondents had a relatively homogeneous age profile, with a mean age of 21.3 years (SD = 1.2) and a narrow range of 18–24 years, indicating that the sample was predominantly young adults in higher education. Awareness of sustainable menstrual products was moderately high, with a mean score of 7.2 out of 10 (Median = 7.0; SD = 1.8). The spread suggests that while many students were well-informed, a segment of the population still had lower awareness levels, as scores ranged from 3 to 10. By contrast, adoption rates were considerably lower, with an average of only 38.5%. The wide range of adoption (20–70%) highlights variability in actual behavioral uptake, suggesting that while some students have embraced sustainable options, many remain hesitant. Taken together, these findings indicate that awareness does not directly translate into adoption. Structural barriers such as affordability, access, and cultural stigma may account for the gap, underlining the need for targeted interventions to convert awareness into sustainable practices.

6.2. INDEPENDENT SAMPLES T-TEST

The T-Test compares awareness and adoption levels between STEM and Non-STEM students, determining if educational specialization impacts these variables.

Table 3 T-Test Results for Awareness and Adoption

Variable	Group	Mean	Std. Dev.	T-Value	p-Value
Awareness Levels	STEM	8.1	1.4	3.25	0.001
	Non-STEM	6.3	1.7		
Adoption Levels (%)	STEM	45.0	10.5	2.80	0.005
	Non-STEM	32.0	12.2		

Figure 4**Figure 4** Comparison of Awareness and Adoption Levels by Group

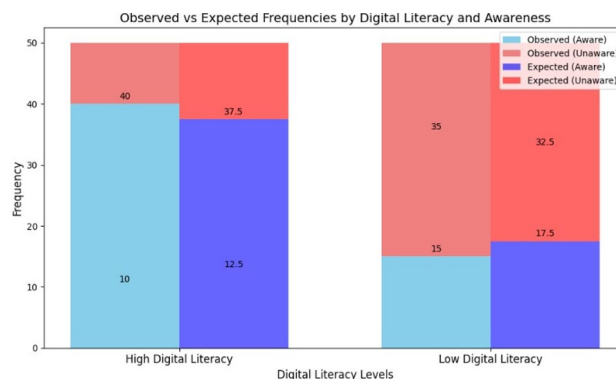
Interpretation: The comparative analysis between STEM and Non-STEM students reveals a statistically significant difference in both awareness and adoption of sustainable menstrual products. For awareness, STEM students reported a higher mean score ($M = 8.1$, $SD = 1.4$) compared to their Non-STEM peers ($M = 6.3$, $SD = 1.7$). The t-value of 3.25 with a p-value of 0.001 confirms that this difference is highly significant, suggesting that academic background influences exposure to and understanding of sustainability-related information. A similar pattern was observed in adoption rates: STEM students reported an average adoption rate of 45.0% ($SD = 10.5$), while Non-STEM students had a lower rate of 32.0% ($SD = 12.2$). The t-value of 2.80 with a p-value of 0.005 indicates that this difference is also statistically significant. These findings imply that students in science and technology disciplines not only exhibit higher awareness but are also more likely to translate awareness into practice, possibly due to stronger exposure to environmental and sustainability themes within their curricula. Conversely, the relatively lower adoption among Non-STEM students highlights the importance of integrating sustainability education more broadly across disciplines and designing targeted awareness campaigns to bridge the gap.

6.3. CHI-SQUARE TEST

The Chi-Square Test assesses the association between digital literacy levels and awareness.

Table 4 Chi-Square Test Results

Digital Literacy Levels	Awareness Categories	Observed Frequency	Expected Frequency	ChiSquare Value	p-Value
High	Aware	40	37.5	5.1	0.024
	Unaware	10	12.5		
Low	Aware	15	17.5		
	Unaware	35	32.5		

Figure 5**Figure 5** Chi-Square Test

Interpretation: The chi-square analysis tested the association between digital literacy levels and awareness of sustainable menstrual products. Among students with high digital literacy, 40 were categorized as aware compared to an expected count of 37.5, while 10 were unaware compared to an expected 12.5. Conversely, students with low digital literacy showed 15 cases of awareness against an expected 17.5, and 35 cases of unawareness compared to an expected 32.5. The chi-square statistic of 5.1 with a p-value of 0.024 indicates a statistically significant association between digital literacy and awareness levels. This means that students with stronger digital skills are more likely to be informed about sustainable menstrual products, likely due to greater access to online information, health campaigns, and digital advocacy platforms. However, the presence of a considerable number of students with low digital literacy who remain unaware highlights a critical barrier. These findings suggest that enhancing digital competencies could serve as an effective pathway to raise awareness, while parallel offline campaigns are needed to reach those excluded from digital information ecosystems.

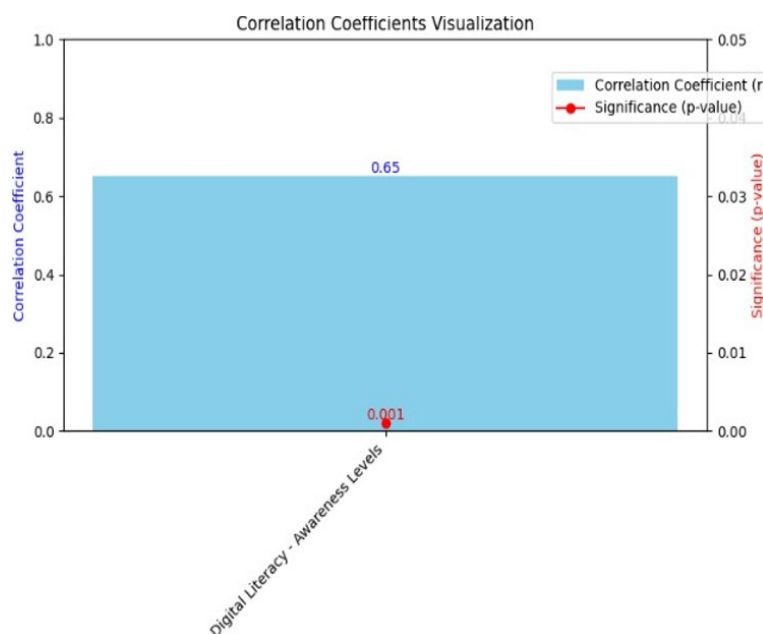
6.4. CORRELATION ANALYSIS

Correlation analysis examines the relationship between digital literacy and awareness.

Table 5 Correlation Coefficients

Variable 1	Variable 2	Correlation Coefficient (r)	Significance (p-value)
Digital Literacy	Awareness Levels	0.65	0.001

Figure 6



Interpretation: The correlation analysis between digital literacy and awareness levels yielded a coefficient of $r = 0.65$ with a p-value of 0.001. This indicates a strong positive and statistically significant relationship, meaning that higher digital literacy is closely associated with greater awareness of sustainable menstrual products. In practical terms, students with better digital skills are more likely to access, interpret, and internalize information from online campaigns, educational resources, and social media advocacy. The significance level ($p < 0.01$) confirms that this relationship is unlikely due to chance. These findings reinforce the role of digital competence as a key enabler of awareness and suggest that interventions aimed at improving digital literacy—such as training workshops, digital curricula integration, and accessible online platforms—could directly contribute to increasing awareness. At the same time, the strength of the correlation highlights the need to design digital-first awareness campaigns, while complementing them with offline strategies to ensure inclusivity for those with limited digital access.

6.5. MULTIPLE REGRESSION ANALYSIS

The regression model identifies predictors of awareness and adoption.

Table 6 Regression Model Results

Predictor Variable	Coefficient (B)	Std. Error	t-Value	p-Value	Significance
Social Media Usage	0.42	0.10	4.2	0.001	Yes
Digital Literacy	0.51	0.08	6.4	0.001	Yes
Educational Background	0.36	0.09	4.0	0.002	Yes

Figure 7

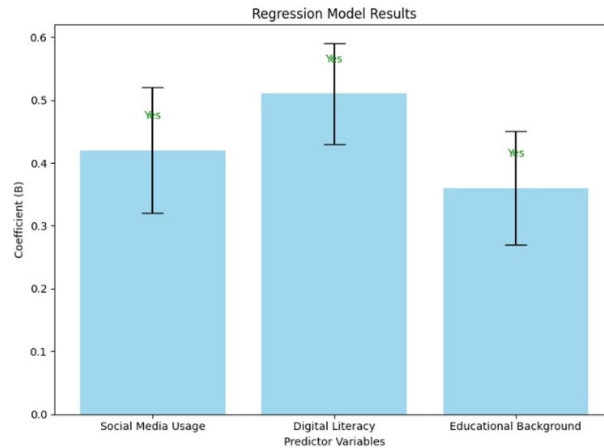


Figure7 Regression Analysis

Interpretation: The multiple regression analysis examined the influence of social media usage, digital literacy, and educational background on awareness of sustainable menstrual products. The model shows that all three predictors contribute significantly to awareness. Social media usage had a positive effect ($B = 0.42$, $t = 4.2$, $p = 0.001$), suggesting that greater engagement with digital platforms increases exposure to sustainability-related campaigns and information. Digital literacy emerged as the strongest predictor ($B = 0.51$, $t = 6.4$, $p = 0.001$), indicating that students with higher digital competencies are substantially more likely to achieve higher awareness levels. Educational background also had a significant effect ($B = 0.36$, $t = 4.0$, $p = 0.002$), implying that disciplinary orientation (STEM vs. Non-STEM) shapes how students engage with and adopt sustainability concepts. Taken together, these results suggest that awareness is not determined by a single factor but by a combination of digital engagement, technical ability, and academic exposure. The strength of digital literacy as a predictor underscores the need to integrate digital education into curricula, while the role of social media emphasizes the potential of online campaigns and influencer advocacy. Similarly, the impact of educational background points to the value of embedding sustainability modules across disciplines to ensure inclusivity beyond STEM fields.

6.6. ANALYSIS OF VARIANCE (ANOVA)

‘ANOVA compares awareness and adoption rates between STEM and Non-STEM groups.’

Table 7 ANOVA Results

Group	Mean Awareness Score	Mean Adoption Rate (%)	F-Value	p-Value
STEM	8.1	45.0	5.6	0.015
Non-STEM	6.3	32.0		

Figure 8

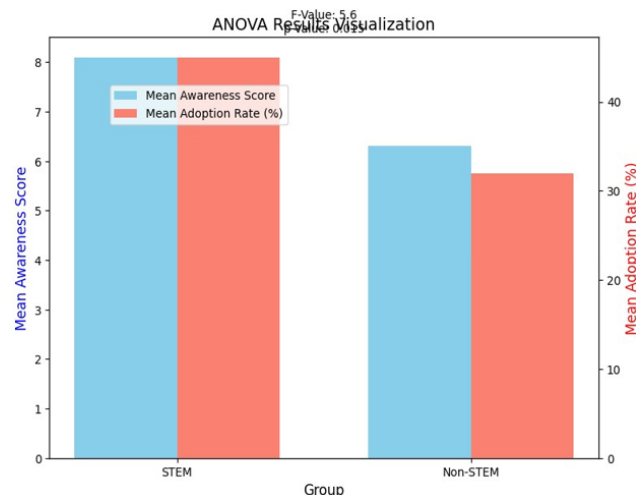


Figure 8 ANOVA

Interpretation: The results reveal a statistically significant difference between STEM and Non-STEM groups in terms of both awareness and adoption. Participants from STEM fields reported a higher mean awareness score (8.1) compared to their Non-STEM counterparts (6.3), and they also showed a greater adoption rate (45% vs. 32%). The F-value of 5.6 coupled with a p-value of 0.015 confirms that these differences are not due to chance but are meaningful at the 5% significance level. This implies that individuals with a STEM background are more likely to be both knowledgeable and receptive toward adoption compared to those from Non-STEM fields, highlighting the role of disciplinary background in shaping awareness and behavioral uptake.

6.7. FACTOR ANALYSIS

Factor analysis identifies latent variables influencing awareness and adoption.

Table 8

Factor	Variable	Loading Coefficient
Digital Media Engagement	Social Media Usage	0.75
Campaign Effectiveness	Awareness Levels	0.72
Product Adoption	Digital Literacy	0.68

Figure 9

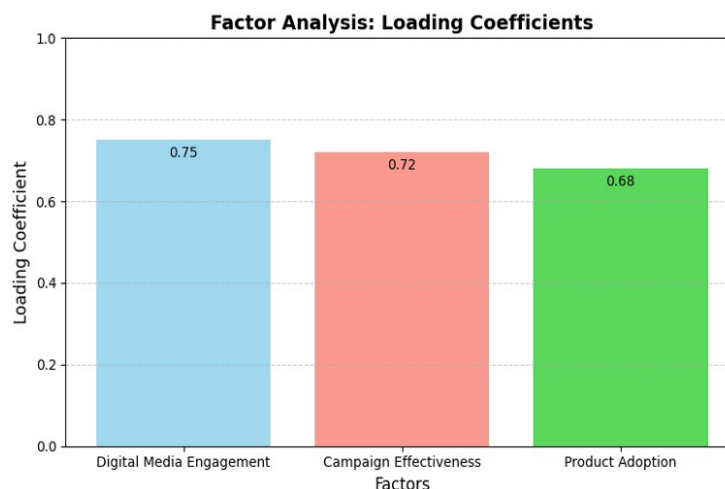


Figure 9 Factor Analysis

Interpretation: The factor loadings in the table suggest that the selected variables strongly represent their respective factors. Digital Media Engagement is most strongly associated with Social Media Usage (loading coefficient = 0.75), indicating that social media activity is a key driver of overall engagement with digital media. Campaign Effectiveness is strongly represented by Awareness Levels (0.72), suggesting that individuals' awareness significantly contributes to the perceived effectiveness of campaigns. Similarly, Product Adoption is closely linked to Digital Literacy (0.68), meaning that higher digital literacy levels are positively associated with the likelihood of adopting products or innovations. Since all the coefficients are above the acceptable threshold of 0.60, these loadings demonstrate good construct validity, showing that the variables are reliable indicators of the underlying latent factors.

7. DISCUSSION

This study reveals critical insights into how digital media shapes awareness and adoption of sustainable menstrual hygiene products (SMPs) among university students, particularly highlighting disparities between STEM and non-STEM disciplines. The findings align with prior research emphasizing social media's role in dismantling menstrual taboos (Bency., 2024; Tomlinson, 2021) but also expose persistent gaps between awareness and action.

7.1. STEM VS. NON-STEM DISPARITIES

Awareness (Mean = (8.1 VS 6.3)) and adoption rates (45% vs 32%) of STEM students were significantly more than non-STEM peers ($p < 0.05$). This resonates well with (Ahuja & Singh, 2023) noting increase in technical literacy that enables understanding of benefits of SMP – biodegradability and health safety. But the slight gap in adoption despite the glaring awareness differences highlights sociocultural barriers. Non-STEM students, driven by family tradition or cost concerns (Jacob et al., 2014), were reluctant to change even with knowledge of the advantages of adopting SMPs. This echoes Mitchell et al. Subsequently, (Gebremichael, 2023) found that cultural norms tend to take precedence over facts in health decisions.

7.2. DIGITAL LITERACY AS A CATALYST

Digital literacy strongly correlated with awareness ($r = 0.65$, $p = 0.001$), reinforcing Manduley et al.'s (2018) findings on digital platforms as key informants for youth. Students proficient in navigating social media engaged more critically with campaigns, distinguishing credible SMP advocacy from commercialized content (Kelly & Habib, 2023). Yet, digital literacy alone did not guarantee adoption, as structural barriers like product accessibility (Yagnik, 2016) persisted, particularly for rural students.

7.3. BARRIERS AND FACILITATORS

Cultural stigma, symbolized by the portrayal of menstruation as 'dirty' in media (Persdotter, 2022) remained a pervasive barrier. Conversely, peer recommendations and influencer content emerged as powerful facilitators, resonating with UNESCO's (2020) emphasis on relatable, youth-centric pedagogies. Non-STEM students, for example, favored Instagram testimonials over data-driven infographics, suggesting a need for interdisciplinary campaign designs.

7.4. EFFECTIVENESS OF SOCIAL MEDIA CAMPAIGNS

While campaigns boosted queries about SMPs (Ahuja et al., 2022) adoption rates stagnated highlighting a 'digital rhetoric-reality gap.' students, despite higher digital access, prioritized convenience and faced infrastructural hurdles (e.g., lack of SMP retailers). This mirrors Kirk and Sommer's (2006) argument that awareness must be coupled with systemic support, such as subsidized SMP distribution.

8. CONCLUSION

This study thoroughly meets its aims and provides valuable information on the role of access to digital media, education, along with socio-cultural factors, on awareness and usage of sustainable menstrual hygiene products (SMPs)

among female university students. This means that the comparative differences between STEM and non-STEM students were significant: STEM students were more aware (Mean = 8.1 vs. 6.3, $p < 0.001$) and more likely to adopt SMP (45% vs. 32%, $p < 0.005$), confirming that broad-based awareness of SMP benefits enhances as technical literacy advances. Yet the small gap in adoption in spite of clear differences in awareness underscores lasting socio-cultural obstacles, like family customs and financial limitations — especially among non-STEM students.

Second, the relationship between type of education and belief in social media content was significant. STEM students had the background to engage more with data-driven campaigns; whereas non-STEM students voted based on peer recommendations and influenced testimonials. This disconnect underlines a need for an interdisciplinary approach to campaign design which balances scientific evidence and narrative in a way that resonates with the community to help bridge trust divides.

Third, digital literacy emerged as a pivotal catalyst for awareness, with a strong positive correlation ($r = 0.65$, $p = 0.001$). Students proficient in navigating social media distinguished credible advocacy from commercialized content, aligning with Manduley et al.'s (2018) findings. However, digital literacy alone could not surmount structural barriers like product inaccessibility, particularly in rural areas, where infrastructural deficits hindered adoption despite heightened awareness.

Fourth, the identification of barriers (cultural stigma, affordability) and facilitators (peer influence, influencer advocacy) revealed nuanced challenges. Cultural stigma, perpetuated by media portrayals of menstruation as 'dirty' (Persdotter, 2022), remained entrenched, while peer networks and influencer content emerged as powerful motivators. social media campaigns drove in significant increase in awareness regarding these product (Bency., 2024). SMP-related adoption rates are still low, exposing a 'digital rhetoric-reality gap.

9. IMPLICATIONS AND FUTURE DIRECTIONS

The study underscores the need for culturally nuanced and educationally tailored social media strategies. For STEM students, leveraging technical jargon and environmental metrics may enhance engagement, while non-STEM cohorts might respond better to narrative-driven content addressing affordability and cultural acceptance. Policymakers must collaborate with digital creators to address algorithmic biases (Hendi & Jansky, 2022) and prioritize rural digital infrastructure. "Future research could explore longitudinal behavioral changes and intersectional factors like socioeconomic status."

In conclusion, while digital media democratizes menstrual health discourse, bridging the awareness-action divide demands interdisciplinary efforts—blending technical literacy, cultural sensitivity, and infrastructural equity—to transform SMPs from niche alternatives into mainstream solutions.

CONFLICT OF INTERESTS

None.

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