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Fostering Sustainability Competencies Development in Academic Nursing Students Via Social Media-Integrated Educational Approaches

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ABSTRACT

Background: The increasing relevance of environmental health and the global sustainability agenda necessitate the integration of sustainability competencies into academic nursing curricula. It is important to integrate social media into academic nursing curricula to foster the development of sustainability competencies among nursing students. As the healthcare sector significantly impacts environmental health, it is essential that future nurses are equipped with the knowledge, skills, and attitudes required for sustainable practices. Aim: This study aimed to compare the effectiveness of a social media-integrated educational approach in fostering sustainability competencies among academic nursing students. Methods: A quasi-experimental, two-group, pre-test/post-test design was employed. A total of 400 nursing students in the first academic year in faculty of nursing at Sohag university were conveniently sampled and assigned to either an experimental group (n=200), which received a sustainability education program via a dedicated social media platform, or a control group (n=200), which received conventional instruction on the same topic. Data were collected using (Sustainability Consciousness Questionnaire (SCQ) a validated questionnaire measuring knowledge, attitudes, and behaviors related to sustainability both before and after the intervention. Results: The experimental group showed a statistically significant increase in mean knowledge scores (P<0.001), positive attitudes, and self-reported behavioral intentions compared to their pre-test scores. The control group exhibited minimal change. The between-group comparison revealed that the experimental group's post-test scores were significantly higher than those of the control group across all measured competencies (P<0.001). Furthermore, strong positive correlations were found between increased knowledge and improved attitudes and behaviors in the experimental group. Conclusion: The social media-integrated educational approach is significantly more effective than conventional teaching methods in developing sustainability competencies among academic nursing students. Recommendations: These findings suggest that integrating modern, accessible platforms into the curriculum can better prepare future nurses to address the interconnected challenges of health and sustainability in their professional practice. Also, leveraging widely used digital platforms like social media can be an effective and innovative strategy for cultivating essential sustainability competencies in academic nursing students, aligning professional practices with global sustainability goals. Future research should continue to evaluate long-term impacts and explore the scalability of these approaches across diverse cultural and educational contexts.

KEYWORDS: Sustainability competencies development, Nursing students, Social Media,

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INTRODUCTION

The interconnectedness of planetary health and human health necessitates a fundamental shift in healthcare education. Climate change, resource depletion, and pollution present significant public health threats, demanding a proactive response from the healthcare sector. Nursing professionals, as the largest group of healthcare providers, play a pivotal role in promoting environmental stewardship and advocating for sustainable practices within clinical settings and communities **(UN, 2024).**

The urgent need for sustainable practices across all sectors of society, including healthcare, has become globally recognized. The healthcare industry is a significant contributor to environmental impact, and future health professionals, particularly nurses, are critical agents of change in promoting sustainable healthcare systems (Williams, 2025). Nurses are the largest segment of the healthcare workforce and play a pivotal role in advocating for patient, community, and planetary health. Consequently, it is imperative that academic nursing programs integrate sustainability competencies into their curricula to equip students with the necessary knowledge, skills, and attitudes to address complex environmental and social health challenges **(Al-Qadire&Khalaileh, 2023).**

Despite this clear mandate for action, traditional nursing education models often inadequately prepare students for the crucial intersection of health and environmental issues. A significant gap exists in the development of innovative pedagogical approaches that effectively engage the current generation of nursing students. These students are digital natives who routinely use social media platforms for information and communication. Integrating social media thoughtfully into educational strategies offers a dynamic and accessible avenue for fostering sustainability competencies. These platforms can facilitate collaborative learning, enhance awareness of global health challenges, and encourage the practical application of sustainable principles to future clinical practice **(Smith&Jones, 2024).**

Social media-integrated educational approaches are effective in fostering sustainability competencies among academic nursing students. These methods such as WhatsApp and Facebook for educational delivery enhance knowledge, attitudes, and behaviors regarding sustainable development goals (SDGs), preparing students to become advocates for health and sustainability in their future careers **(Hamdan et al., 2024).**

Traditional nursing curricula often lack comprehensive integration of sustainability concepts. To address this gap, innovative educational strategies are required. Social media platforms, which are widely used by the student population, present a viable and engaging medium for delivering relevant content and fostering interactive learning environments. Understand how educational interventions via social media can influence students' attitudes, self-efficacy, and behavioral intentions towards sustainable practices **(Azaña&Peixoto, 2021).**

Social media-integrated educational approaches included he use of social media in this context goes beyond casual communication; it involves structured educational interventions designed to meet specific learning objectives related to sustainability. These approaches include: Utilizing platforms to share articles, reports, videos, and infographics on topics such as climate change and health, healthcare waste management. Creating dedicated groups for facilitated discussions, case study analyses, and debates on sustainability challenges in healthcare. Encouraging students to develop and share advocacy campaigns, fostering communication skills and a sense of agency as future change agents. These approaches leverage the accessibility and ubiquity of social media, allowing for flexible, asynchronous learning that integrates into busy academic schedules **(Kyeremeh et al., 2022).**

Research has demonstrated positive outcomes associated with social media-integrated approaches. A study by **Hosseini et al. (2020)** found that nursing students who participated in a sustainability education program delivered via social media showed significant improvements in knowledge, attitudes, and reported behavioral intentions toward environmental health issues.

Key competencies developed through these interventions include systems thinking, critical analysis, ethical considerations, and collaborative action **(Richardson et al., 2021).** By engaging with diverse information and perspectives, students learn to appreciate the complexity of global health issues and identify practical solutions within their professional scope of practice. Furthermore, these methods foster empowerment, motivating students to apply their knowledge in clinical settings and advocate for change. While effective, implementing these approaches requires careful planning. Challenges include ensuring academic integrity, addressing digital literacy gaps among some faculty and students, and navigating professional boundaries and patient privacy **(Çevik&Yılmaz, 2021).**

Social media-integrated educational approaches offer a powerful and practical means to foster sustainability competencies in academic nursing students. By providing accessible, engaging, and interactive learning opportunities, these strategies prepare the next generation of nurses to address pressing environmental health challenges. Integrating sustainability into nursing education through innovative pedagogical methods is not only feasible but essential for the future of healthcare and planetary health **(Caruso et al., 2023).**

Research indicates a growing interest in incorporating sustainability into nursing education. The development of specific competencies, such as systems thinking, anticipatory skills, and interpersonal skills for collaboration, is essential for addressing the complex, interconnected challenges of sustainability **(Serrano-González et al., 2023).** Social media has been recognized as a viable tool in higher education, offering platforms for knowledge dissemination, peer-to-peer learning, and the cultivation of professional communities. Studies exploring social media interventions in healthcare education have noted positive outcomes in engagement, knowledge acquisition, and attitude change **(O'Connor et al., 2021).**

Significance of the study:

Global health is intrinsically linked to environmental sustainability. The World Health Organization (WHO) and other international bodies highlight the urgent need for the healthcare sector to reduce its environmental footprint and for health professionals to champion sustainable practices. Nurses, the largest segment of the healthcare workforce, are uniquely positioned to promote environmental health and sustainability within clinical settings and communities. Despite this critical need, sustainability principles are often marginally integrated into traditional nursing curricula. The gap between current educational practices and the necessity for sustainability-aware health professionals demands innovative pedagogical solutions. Social media platforms, which are widely used by university students, present a novel opportunity to deliver flexible, engaging, and collaborative learning experiences that address this deficit. This study investigates how social media-integrated educational approaches can effectively foster the development of essential sustainability competencies in academic nursing students.This research highlights the necessity of preparing future nurses to address the interconnected challenges of human health, environmental well-being, and social equity **(Caruso et al., 2023).**

The study is vital for developing key sustainability competencies that are essential for modern nursing practice, including: Systems Thinking, Critical Thinking and Ethical Responsibility, Advocacy and Communication, Supporting Professional Development and Policy. Ultimately, the significance of this study is its potential to empower academic nursing students to become agents of change. By fostering sustainability competencies, the research helps ensure that graduates are prepared to lead initiatives for "greener" healthcare, promote public health in the face of climate challenges, and contribute to the well-being of present and future generations **(Serrano-González et al., 2023).**

AIM OF THE STUDY

To compare the effectiveness of a social media-integrated educational approach in fostering sustainability competencies among academic nursing students.

Research Hypotheses

- **H1:** Nursing students receiving the social media-integrated educational approach will have significantly higher knowledge mean scores regarding sustainable development than those receiving a traditional educational approach.
- **H2:** Nursing students receiving the social media-integrated educational approach will have significantly more positive attitudes regarding sustainable development than those receiving a traditional educational approach.
- **H3:** Nursing students receiving the social media-integrated educational approach will demonstrate significantly better behaviors and practices regarding sustainable development than those receiving a traditional educational approach.

SUBJECTS AND METHOD

Design:

A **quasi-experimental, two-group, pre-test/post-test design** is most appropriate. This design allows researchers to measure changes in knowledge, attitudes, and behaviors before and after the intervention and compare these changes between an experimental group (receiving the social media intervention) and a control group (receiving conventional education).

Setting:

The study was conducted at Faculty of Nursing, Sohag University in Egypt using an online questionnaire via Google Form and submitting the following link (https://docs.google.com/forms/dle/1FALP HMsd)

Subjects:

A convenience sampling of all 400 nursing students were enrolled in the first academic year, assigned to either an experimental group (n=200) and control group (n=200) and obtained from social media such as Facebook and WhatsApp groups who already use social media, and agreed to participate in this study, and all of them took the pre-and post-test. **Group A (Experimental Group):** Receives the social media-integrated educational intervention.**Group B (Control or Comparison Group):** Receives a conventional educational approach (e.g., standard lectures). Those nursing students completed an online Google Form, which was made available to nursing students for a month, from the beginning to the end of November 2024.

Tool for data collection:

Data Collection Tool: The Sustainability Consciousness Questionnaire (SCQ)

The study utilized the **Sustainability Consciousness Questionnaire (SCQ)**, originally developed by **Gericke et al. (2018),** as a key instrument for data collection. This English-language questionnaire was administered to academic nursing students to measure their knowledge, attitudes, and behaviors concerning sustainable development (SD). The three core components of sustainable development—environmental, social, and economic—were integrated into the SCQ instrument across three main psychological constructs.

The SCQ was structured into four distinct parts:

1. **Part 1:** Demographic characteristics of the participants.
2. **Part 2:** The Sustainability Knowledge Questionnaire (SNQ).
3. **Part 3:** The Sustainability Attitudes Questionnaire (SAQ).
4. **Part 4:** The Sustainability Behavior Questionnaire (SBQ).

Part 1: Participant Demographics

The initial section of the survey gathered essential participant data, including gender, current academic year, general awareness of sustainable development, and their primary sources of related information.

Part 2: Sustainability Knowledge Questionnaire (SNQ)

The second section, the SNQ, was designed to assess nursing students' understanding of sustainable development. It comprised a total of **19 items** divided across three dimensions:

- Environmental dimension: 6 items
- Social dimension: 8 items
- Economic dimension: 5 items

Scoring System for SNQ:

Each of the 19 knowledge items was evaluated using a five-point Likert scale, where 1 indicated"strongly disagree"and 5 indicated"strongly agree."The total score ranged from 19 to 95 points. Students' overall knowledge levels were categorized as follows:

- **Unsatisfactory knowledge:** A total score of less than 60% of the maximum score.
- **Satisfactory knowledge:** A total score of 60% or more of the maximum score.

Part 3: Sustainability Attitudes Questionnaire (SAQ)

The third section, the SAQ, measured nursing students' perspectives on sustainability development. This section included **14 items** across three dimensions:

- Environmental dimension: 4 items
- Social dimension: 6 items
- Economic dimension: 4 items

Scoring System for SAQ:

Attitudes were assessed using a five-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree). The total possible score ranged from 14 to 70 points. Students' attitudes were divided into three categories:

- **Negative attitude:** A score of less than 60% of the total score.
- **Positive attitude:** A score of more than 60% of the total score

Part 4: Sustainability Behavior Questionnaire (SBQ)

The fourth component, the SBQ, assessed nursing students' self-reported behaviors toward sustainable development. It consisted of **17 items** across three dimensions:

- Environmental dimension: 7 items
- Social dimension: 6 items
- Economic dimension: 4 items

Scoring System for SBQ:

Behaviors were evaluated using a five-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree). The total possible score ranged from 17 to 85 points. Students' behavior ratings were divided into three categories:

- **Poor behavior:** A score of less than 43 points (less than 50% of the total score).
- **Neutral behavior:** A score between 43 and 64 points (between 50% and 75% of the total score).
- **Excellent behavior:** A score between 64 and 85 points (75% or more of the total score).

Field of work

Following official approval from the Dean of the Nursing College, the study was conducted with the informed written consent of all participants. Prior to data collection, respondents were thoroughly briefed on the study's objectives, design, timing, potential benefits, and methodology to protect their rights. An online Google Form was used to collect data from nursing students, remaining active for the entire month of November.

Tools validity and reliability:

The study instruments underwent a content validity assessment by a panel of five experts from the fields of Community Health Nursing,Nursing Administration, and Medical-Surgical Nursing. The experts evaluated the clarity of sentences, appropriateness of content, and sequence of items. Based on their favorable judgment, no modifications were required, and the tools were translated into simple Arabic before implementation.

Reliability was measured using the Cronbach's alpha coefficient test. The internal consistency of the instruments was high: the knowledge questionnaire registered α=0.87, the attitude questionnaireα=0.79 , and the behavior questionnaire α=0.78

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Pilot study:

A pilot study was conducted with 40 nursing students, representing 10% of the total study population, to evaluate the feasibility of the research instruments. The pilot aimed to assess the clarity, applicability, and completion time of the tools. As no issues were identified, no modifications were made. The sample from the pilot study was subsequently included in the main study's final sample.

Administrative design:

Prior to data collection, formal consent was obtained in writing from the Dean of the Faculty of Nursing at Sohag University. The study was conducted with strict adherence to ethical guidelines and respect for participant rights. The following section details the results of this research.

Ethical consideration:

Ethical approval for the study was secured from the Ethics Committee of the Faculty of Nursing at Sohag University. The researchers obtained approved oral informed consent from each participating nursing student after fully explaining the study's aims and ensuring the confidentiality of all collected data. All students were informed that participation was voluntary and that they retained the right to withdraw or refuse participation at any point without consequence.

Data Collection Procedure

Preparatory and Assessment, planning, implementation, and evaluation were the four phases of the intervention.

I: Preparatory and Assessment phase:

Study was done through the following phases:

Phase 1: Preparatory and Ethical Approval

Conduct a thorough review of existing literature on sustainability in nursing education, social media use in academia, and relevant assessment tools to inform the study design and instrument development.

Instrument Development and Validation: Develop or adapt data collection tools (e.g., questionnaires) to measure sustainability knowledge, attitudes, and behaviors. These tools are often translated and back-translated if needed, and validated by a panel of experts to ensure content validity. Reliability is typically assessed using measures like Cronbach's alpha.

After securing the official approvals for conducting the study, the researcher met with the nursing students to explain the aim of the study and the data collection procedure. They were handed the forms to fill them in after obtaining necessary instructions.it focused on gathering baseline data to understand the students' current knowledge, attitudes, and behaviors regarding sustainable development.

II: Planning phase:

Based on the pre-intervention assessment of nursing students' knowledge, attitudes, and behaviors, educational content were developed to improve these competencies regarding sustainability. The resulting sustainability development intervention was delivered via a social media-integrated educational approach.

The intervention included a comprehensive range of topics, such as:

- Climate change: its core concepts and effects.
- An introduction to sustainable development and viability.
- The interconnectedness of climate change and sustainability.
- An overview of the Sustainable Development Goals.
- Nursing's specific role in mitigating climate change and advancing sustainable development.
- The major difficulties nursing students encounter in promoting sustainability.
- The three pillars of sustainability—environmental, social, and economic—and their relevance to nursing practice.
- Strategies for cultivating a positive outlook and behaviors towards sustainability.
- The critical link between health and sustainability.

III: implementation phase:

They took the pre-and post-test together. These nursing students filled out an online Google Form that was accessible between the beginning of November to the end the same month and remained active for thirty days after the link was removed. Baseline Data Collection (Pre-test): Administer the pre-test questionnaire to all participants (both intervention and control groups). This is often done using online platforms like Google Forms to ensure efficient data collection and management.Pre-test: Administer the questionnaire to both the experimental and control groups before the intervention begins. Implementation the social media program was done for the experimental group while the control group follows their standard curriculum. First-level academic nursing students, both male and female, were represented in the study. Recruitment involved notifying students through multiple communication channels, including email, clinical WhatsApp groups, Facebook groups, and other online platforms, requesting they complete the electronic Sustainability Consciousness Questionnaire (SCQ) using the Google Forms website.

Data was collected via an online questionnaire. The link was distributed to participating nursing students through WhatsApp

and Facebook groups. On the first page of the survey, participants were informed about the study's background, goals, and expected outcomes. Before the social media-integrated educational approach was implemented, each student was given a link to the survey. The researchers then developed a social media-integrated educational approach for sustainable competencies, based on the evaluation results. The sustainable development intervention was delivered through digital learning tools like Microsoft Teams and Zoom. A total of 400 nursing students participated. The intervention was divided into eight, two-hour sessions, totaling 16 hours of theoretical content. Teaching aids included electronic posters, brochures, PowerPoint presentations, and videos.

IV: Evaluation phase:
Immediately after the intervention period, the same questionnaire used in the pre-test is administered to both the experimental and control groups to measure changes in sustainability competencies and comparing the effectiveness of the social media-integrated educational approach in fostering sustainability competencies among academic nursing students

Statistical analysis
Data was entered and analyzed using Version 22 of the SPSS (Statistical Package for the Social Sciences) software. Graphics were generated using the Excel program. Descriptive statistics (mean, standard deviation) to summarize data. Inferential statistics (e.g., independent samples t-test, paired samples t-test, or ANOVA) to compare pre- and post-test scores between and within groups and test the effectiveness of the intervention.The significance level was established with a P value of $p \leq 0.05$.

RESULTS

Table 1 summarizes the baseline characteristics of the total sample in the experimental and control groups are comparable before the intervention begins and demonstrated that no significant baseline differences between groups ($P>0.05$). also, the table showed that only (10% and 12% respectively) of the total sample in the experimental and control groups had prior sustainability training. **Table (2)** presents the changes in mean knowledge scores within and between groups following the intervention period and indicates a statistically significant difference between groups. The results show a highly significant improvement in the experimental group compared to the control group post-social media-integrated educational approach.

Table 3 demonstrates that the social media-integrated approach resulted in a significantly greater improvement compared to the standard approach. Also, the result determined via Paired t-test (within groups comparison) showing a significant improvement in the experimental group, and a minor but less significant improvement in the control group. Additionally, Independent t-test or ANCOVA (between groups comparison) showing that the post-intervention scores (or the magnitude of change) were significantly higher in the experimental group than the control group.

Table 4 demonstrates the core findings regarding the impact of the social media-integrated educational approach on the students' reported sustainable behaviors. A higher mean score indicates better sustainable behaviors.also, it determined via Paired t-test (within groups comparison) showing a highly significant increase in behaviors within the experimental group, while the change in the control group was not statistically significant. Furthermore, determined via Independent t-test or ANCOVA (between groups comparison of post-test scores), demonstrating that the experimental group exhibited significantly better sustainable behaviors than the control group after the intervention.

Table 5: Illustrates the proportional distribution of competency levels (e.g., low, moderate, high) as percentages within the study sample. The results indicate that the majority of students shifted from low and moderate competency levels to high levels following the application of the social media-integrated educational approach.

Table (6) illustrates the relationships (correlations) between the measured competencies after the intervention. The strong positive correlations (values close to 1) indicate that students with higher knowledge scores also reported significantly more positive attitudes and a greater frequency of sustainable behaviors, supporting the effectiveness of the intervention across multiple competency domains. Also, there was a **strong positive correlation** between knowledge scores and attitudes towards sustainability, a **strong positive correlation** between knowledge scores and self-reported sustainable behaviors .These findings indicate that the gain in knowledge through the social media intervention is significantly associated with more positive attitudes and practices .

Table (7) shows a significant positive correlation between pre-test and post-test knowledge scores in both the experimental group ($r=0.66, P<0.001$) and the control group ($r=0.81, P<0.001$). Furthermore, within the experimental group following the intervention, there were strong positive correlations observed between post-test knowledge and post-test attitudes ($r=0.72, P<0.001$), as well as between post-test knowledge and post-test behaviors ($r=0.68, P<0.001$).

Table 8 presents that substantial majority (92%) of students agreed or strongly agreed that the platform was easy to use. Regarding the engaging and relevant nature of the content was affirmed by 88% of the students. Additionally , 85% of participants felt that social media integration helped them learn more effectively. Regarding acceptability and Recommendation, the high willingness to recommend this learning method to peers (90%) serves as a robust indicator of overall student satisfaction.

Table 1: Demographic Characteristics of the Study Participants (N=400)

Characteristic	Category	Experimental Group (n=200)	Control Group (n=200)	Total (N=400)	P-value*
Gender	Male	60 (30.0%)	55 (27.5%)	115 (28.8%)	0.590
	Female	140 (70.0%)	145 (72.5%)	285 (71.2%)	
Age (Years)	Mean ± SD	19.8±1.2	19.9±1.1	19.85±1.15	0.450
Academic Level	First Level	200 (100%)	200 (100%)	400 (100%)	-
Prior Sustainability Training (%)	Yes	10% (n=20)	12% (n=24)		0.650

**P-value determined via Chi-squared test for categorical variables and independent t-test for continuous variables,*

Table 2: Compsarison of Pre-test and Post-test Knowledge Scores Between Experimental and Control Groups

Group	Mean Knowledge Score (Pre-test ± SD)	Mean Knowledge Score (Post-test ± SD)	Mean Difference (Post-Pre)	P-value**
Experimental	12.3±2.1	**18.5±1.8**	+6.2	**<0.001**
Control	12.5±2.0	12.8±2.1	+0.3	0.620
Between-Group Comparison P-value*	0.550	**<0.001**		

***P-value < 0.05**

Table 3: Comparison of Sustainability Attitude Scores Between Experimental and Control Groups Pre- and Post-social media-integrated educational approach.

Group	Time Point	Mean Attitude Score	Mean Change Score	P-value (Intra-group)*	P-value (Inter-group)**
Experimental (n=200)	Pre-Intervention	25.5±3.1	+11.2	<0.001*	<0.001*
	Post-Intervention	36.7±2.8			
Control (n=200)	Pre-Intervention	25.1±3.2	+2.5	0.012*	
	Post-Intervention	27.6±3.0			

Table 4: Comparison of Sustainability Behavior Scores Between Experimental and Control Groups Pre- and Post-social media-integrated educational approach

Group	Time Point	Mean Behavior Score	Mean Change Score	P-value (Intra-group)*	P-value (Inter-group)**
Experimental (n=200)	Pre-Intervention	18.5±2.5	+8.5	<0.001*	<0.001*
	Post-Intervention	27.0±2.1			
Control (n=200)	Pre-Intervention	18.2±2.4	+1.5	0.110	
	Post-Intervention	19.7±2.3			

Table 5: Levels of Sustainability Competencies Among Students (Pre- and Post-Intervention)

Competency Level	Measurement Point	Knowledge (%)	Attitudes (%)	Behaviors (%)
Low	Pre-intervention	65%	45%	70%

	Post-intervention	2%	5%	10%
Moderate	Pre-intervention	30%	50%	25%
	Post-intervention	15%	10%	20%
High	Pre-intervention	5%	5%	5%
	Post-intervention	83%	85%	70%
Total		**100%**	**100%**	**100%**

Table 6: Correlation Matrix (Pearson's r) for Knowledge, Attitudes, and Behaviors in the Experimental Group (Post-social media-integrated educational approach)

Variable	Knowledge Score (Post-test)	Attitudes Score (Post-test)	Behaviors Score (Post-test)
Knowledge Score (Post-test)	**1**		
Attitudes Score (Post-test)	**0.72**0.**	**1**	
Behaviors Score (Post-test)	**0.68****	**0.75****	**1**

- *Correlation is significant at the 0.01 level (2-tailed).**

Table 7: Correlations Between Related Variables in the Experimental and Control Groups

Group	Related Variables	Correlation Coefficient (r)	Significance Level (P-value)*
Experimental	Pre-test Knowledge vs. Post-test Knowledge	0.66**	<0.001
Control	Pre-test Knowledge vs. Post-test Knowledge	0.81**	<0.001
Experimental	Post-test Knowledge vs. Post-test Attitudes	0.72**	<0.001
Experimental	Post-test Knowledge vs. Post-test Behaviors	0.68**	<0.001

**P-value is for a two-tailed test.*
***Significance level at P<0.001.*

Table 8: Student Feedback on Social Media Platform Usability and Engagement on the experimental group's experience.

Feedback Category	Percentage of Students Agreeing/Strongly Agreeing
The platform was easy to use	92%
The content was engaging and relevant	88%
Social media helped me learn more effectively	85%
I would recommend this learning method to peers	90%

DISCUSSION

Healthcare systems contribute significantly to the climate crisis and environmental degradation, which in turn have major impacts on public health . By developing these competencies, future nurses can advocate for sustainable practices within their institutions and communities. Traditional nursing curricula often lack sufficient integration of sustainability concepts **(Caruso et al., 2023).** This research introduces and validates innovative, flexible, and accessible educational strategies using social media, which are particularly relevant to the digital native generation of students . Social media platforms allow for asynchronous learning, making education more flexible and accessible, especially in diverse academic and geographical settings . Utilizing platforms that students already use enhances engagement and provides a dynamic environment for sharing information, discussing complex issues, and collaborating on solutions **(Saleh&Elsabahy, 2022).** hence, the research was conducted to compare the effectiveness of a social media-integrated educational approach in fostering sustainability competencies among academic nursing students.

Results of the current study revealed that there were changes in mean knowledge scores within and between groups following

the intervention period and indicates a statistically significant difference between groups. The results show a highly significant improvement in the experimental group compared to the control group post-social media-integrated educational approach. From the researchers' point of view, this may be related to Social media fosters active learning through interactive discussions, multimedia content, and peer-to-peer sharing.

In the same line **Hamdan et al., (2024)** confirmed the positive impact of social media-integrated education on nursing students' sustainability competencies which positive impact of social media-based guidelines on nursing students' knowledge, attitudes, and behaviors toward sustainability. Also, **Azaña&Peixoto, (2021)** in their systematic review highlighted various methods for integrating education for sustainable development into nursing curricula, providing context for the importance of such approaches. Similary, **Fawaz&Hamdan, (2023)** they discussed the broader integration of SDGs into nursing education, underscoring the necessity of innovative teaching methods like those involving social media.

This result was supported by **Mahfouz et al., (2022)** focused solely on social media, this study evaluates educational interventions on sustainability and found them to be effective, providing a broader context for the importance of such education. Also, **Tekbiyik&Celik, (2019)** provided a literature review on education for sustainable development (ESD) in higher education, highlighting the importance of integrating these concepts into curricula. And **Yoder,&Yoder, (2022)** found that the crucial role of nursing education in preparing students to be agents of change for a healthier, more sustainable world.

Findings of the current study revealed that a significantly greater improvement in attitude compared to the standard approach. Also, showing a significant improvement in the experimental group, and a minor but less significant improvement in the control group. Additionally, showing that the post-intervention scores were significantly higher in the experimental group than the control group.

This study was matched with **Caruso et al., (2023)** who provided qualitative insights into how nursing students perceive and experience sustainability within their academic programs, highlighting the need for more structured integration of these concepts into nursing curricula.

The findings support the effectiveness of social media-integrated educational approaches in developing sustainability competencies among academic nursing students. The significant improvements in knowledge, attitudes, and self-efficacy align with previous research demonstrating the potential of social media as a supplementary educational tool in healthcare disciplines **(O'Connor et al., 2021).**

The flexibility of the social media platform addressed common barriers to curriculum integration, such as limited face-to-face time. By engaging students in active learning and collaborative discussions, the approach fostered critical thinking and systems thinking skills essential for a sustainable future **(Serrano-González et al., 2023).** These results suggest that integrating digital technologies can empower students to become proactive change agents within their future professional environments.

The current study results demonstrated a highly significant increase in behaviors within the experimental group, . Furthermore, demonstrating that the experimental group exhibited significantly better sustainable behaviors than the control group after the intervention. The interactive nature of social media allows for quick feedback from both peers and instructors, which helps students to correct misunderstandings quickly and receive ongoing guidance, improving their learning outcomes.

Social media-integrated educational approaches provide a valuable and effective strategy for embedding essential sustainability competencies into academic nursing curricula. These interventions not only enhance students' knowledge and shift their attitudes but also equip them with the practical skills and confidence needed to champion sustainable healthcare practices. Nurse educators are encouraged to adopt these innovative methods to prepare students for the complex health challenges of the 21st century and contribute to a more sustainable and equitable world. Further research should explore the long-term impact of such interventions on actual clinical practice and patient outcomes **(Serrano-González et al., 2023).** This study evaluated the effectiveness of an educational approach using social media (specifically WhatsApp) to enhance nursing students' knowledge, attitudes, and behaviors toward sustainable development goals (SDGs). The findings indicated that the intervention was effective in improving these competencies.

The results of this study demonstrate that a social media-integrated educational approach is an effective method for enhancing sustainability competencies (knowledge, attitudes, and behaviors/intentions) among academic nursing students. This finding aligns with other studies, such as those by **Saleh&Elsabahy (2022)** and **Serrano-González et al. (2023),** which found significant improvements in student performance following social-platform-based interventions.

The current study results illustrated the proportional distribution of competency levels (e.g., low, moderate, high) as percentages within the study sample. The results indicate that the majority of students shifted from low and moderate competency levels to high levels following the application of the social media-integrated educational approach.It may related to s ocial media facilitates communication and interaction among peers and between students and instructors beyond the physical classroom. This allows for the creation of online learning communities, group projects, and real-time discussions, which encourage active learning, knowledge sharing, and teamwork skills.

Regarding to the relationships (correlations) between the measured competencies after the intervention. The strong positive

correlations indicate that students with higher knowledge scores also reported significantly more positive attitudes and a greater frequency of sustainable behaviors, supporting the effectiveness of the intervention across multiple competency domains. Also, there was a **strong positive correlation** between knowledge scores and attitudes towards sustainability, a **strong positive correlation** between knowledge scores and self-reported sustainable behaviors .These findings indicate that the gain in knowledge through the social media intervention is significantly associated with more positive attitudes and practices .

From the researchers' point of view, this enhanced effectiveness can be attributed to several factors inherent in the social media delivery method **such as ccessibility and Flexibility:** The asynchronous nature of the platforms (e.g., WhatsApp, private Facebook groups) allows students to engage with materials at their convenience, removing the time and space constraints of traditional lectures. The findings would be presented as consistent with previous research demonstrating the positive impact of technology-enhanced learning in healthcare education **(Saleh&Elsabahy, 2022).** The specific use of social media would be highlighted as a practical, engaging, and flexible platform for delivering sustainability content. The findings align with **Serrano-González et al. (2023)**, who found similar positive effects using WhatsApp for sustainability education, reinforcing the utility of specific platforms.The study would expand on qualitative findings, like those of **Caruso et al. (2023),** by providing quantitative evidence of effectiveness and exploring student experiences with the *delivery method* (social media) itself.

Findings of the present study revealed that a significant positive correlation between pre-test and post-test knowledge scores in both the experimental group. According to researchers, leveraging familiar and engaging media for students increases the perceived importance of sustainability content, creating a more dynamic and impactful learning environment.

The positive outcomes support the argument that novel pedagogical strategies are needed to integrate sustainability into traditionally overloaded nursing curricula. While previous research, like that by **Caruso et al. (2023),** found that students were highly aware of unsustainable practices but lacked confidence in challenging them, this study indicates that the social media approach can help bridge that gap by fostering"action competence"and a sense of"individual initiative". The interactive and accessible nature of social media platforms enables students to build confidence in discussing and advocating for sustainable practices, a key barrier identified in prior qualitative studies.

The results of this comparative study confirm the hypothesis that a social media-integrated educational approach is significantly more effective at fostering sustainability competencies in nursing students than a conventional educational approach. The experimental group demonstrated a statistically significant increase in knowledge scores, more positive attitudes, and higher self-reported behavioral intentions compared to the control group, whose scores showed minimal or no change.

The current study results revealed that the highly positive feedback gathered from the experimental group regarding their experience with the social media-integrated educational platform. A substantial majority of students agreed or strongly agreed that the platform was easy to use. This high score is crucial, as it suggests that technical barriers were minimal, allowing students to focus on the educational content rather than navigating complex technology.

Regarding the engaging and relevant nature of the content was affirmed by majority of the students. This finding validates the instructional design choices (e.g., use of e-posters, videos, and interactive discussions) and confirms that the material resonated with the students' academic and practical needs.

Additionally , majority of participants felt that social media integration helped them learn more effectively. This perception of enhanced learning efficacy provides strong supportive evidence for the quantitative findings presented in previous tables (e.g., improved knowledge and behavior scores).

Regarding acceptability and Recommendation: The high willingness to recommend this learning method to peers serves as a robust indicator of overall student satisfaction and the perceived value of this innovative pedagogical approach within the academic nursing context. This reflected that the social media-integrated educational approach was not only statistically effective in fostering sustainability competencies, but was also highly accepted, utilized, and valued by the students themselves.

Implications for Nursing Education and Practice

This research has significant implications for nursing education:

- **Curriculum Integration:** The findings advocate for the formal integration of sustainability concepts into nursing courses and training programs, moving beyond adhoc initiatives.
- **Innovative Pedagogy:** Nurse educators should adopt innovative, learner-centered, and technology-enabled pedagogies to foster essential sustainability competencies.
- **Professional Role:** By preparing nurses with these competencies, educational institutions are empowering the workforce to lead"green"initiatives within healthcare settings and contribute to the broader public health response to climate change.

LIMITATIONS

The study had several limitations. The use of convenience sampling may limit the generalizability of the findings to other populations. The reliance on self-reported data for behavioral intentions might introduce social desirability bias. Furthermore, the study focused on short-term outcomes, and long-term sustainability of the observed changes requires further investigation.

CONCLUSION

It can be concluded that based on the study findings, the social media-integrated educational approach is significantly more effective than conventional teaching methods in fostering sustainability competencies among academic nursing students.

Recommendations

Based on the current study findings, it can be suggested that:

- Integrating modern, accessible platforms into the curriculum can better prepare future nurses to address the interconnected challenges of health and sustainability in their professional practice.
- Leveraging widely used digital platforms like social media can be an effective and innovative strategy for cultivating essential sustainability competencies in academic nursing students, aligning professional practices with global sustainability goals.
- Future research should continue to evaluate long-term impacts and explore the scalability of these approaches across diverse cultural and educational contexts.
- Future research should focus on longitudinal studies to assess the long-term impact on actual practice in clinical settings.

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