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Effect of a Green Management Educational Program on Nurse's Self-Efficacy in Applying Sustainable Practices: A Quasi-Experimental Study

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ABSTRACT:

Background: Green management progressively acknowledged as a fundamental element of sustainable healthcare. Nurses play an essential role in implementation of green practices, and self-efficacy emerges as a key determinant of their participation in environmentally sustainable behavior. however, limited knowledge and low self-efficacy may hinder their engagement in sustainable nursing practices.

Objectives: the study amide to evaluate the effect of a green management educational program on nurse's self-efficacy in applying sustainable practices within the health care settings.

Methodology: A quasi-experimental pretest–posttest design was used. The study was performed in four governmental hospitals in Al-Najaf City, Iraq, during the period from 19 August 2025 to 1 July 2026. To reduce contamination between groups, the hospitals were randomly allocated into study and comparative conditions, while nurses within each hospital were selected using a homogeneous purposive sampling method according to the inclusion criteria. The final sample consisted of 132 nurses, including 67 nurses in the study group and 65 nurses in the comparative group. The study group received the green management educational program, whereas the control group continued routine clinical duties during the study period. Data were collected using the Green Self-Efficacy Scale before and after the intervention.

Results: At baseline, both groups showed comparable self-efficacy at the pretest period ($p = 0.134$), with no statically significant between two groups. In contrast, a highly statistically significant difference was observed at the posttest period ($p < 0.001$), where the study group demonstrated a marked improvement in self-efficacy in applying sustainable practices compared with the comparative group.

Conclusions: The green management educational program significantly effectiveness in increasing nurses' self-efficacy regarding the implementation of sustainable practices.

Recommendation: integration of green management and sustainability principles into continuing nursing education programs to enhance environmentally responsible nursing outcomes.

INTRODUCTION

Health care sector constitutes a fundamental element of society and plays an essential role in enhancing individual health and well-being (Mousa et al., 2026). It contributes approximately 4% to 5% of global green-house gas emissions GHE, indicating that health services have an obligation to combat climate change by reducing their own carbon footprint and mitigating the health impacts linked with healthcare practices (Rodríguez-Jiménez et al., 2023). Specifically, the environmental impact linked to health sector is originated from various practices, most notably substantial carbon emissions, the production of medical waste, and the excessive consumption of resources resulting from the routine incineration of large volumes of medical waste, making its environmental consequences an immediate present concern rather than a future concern. For instance, the healthcare sector in the United States contributes about 10% of the nation's greenhouse gases emissions, underscoring the urgent necessity of incorporate sustainable practices within all levels of health care deliver (Anwar Shletan Aldhafeeri & Latifh Saud Alenazi, 2024; Lee & Lee, 2022). Within the healthcare system, nursing professionals assume crucial role in implementation sustainable practices (El-Sayed et al., 2026). As frontline caregivers, they are uniquely positioned to impact the adoption of environmentally responsible practices, including prudent water management, waste minimization, and the deployment of safer chemical alternatives within clinical environments. However, limited self-efficacy and awareness frequently impede the adoption of green management principles, which may diminish the overall effectiveness impact of sustainability initiatives in healthcare (Luque-Alcaraz et al., 2024; Zoromba & El-Gazar, 2025). Green management is the proses of integration of ecologically sustainable practices and guidelines into the operation and governance of medical facilities. within healthcare environments, it is considered a comprehensive, organization-wide strategy that employs innovation to attain sustainability, minimize waste and enhance social responsibility (Ismail Ibrahim Elksas et al., 2024; Yassin et al., 2025) In this context, that self-efficacy plays an instrumental role in the offering high quality nursing care, improving nurses effectiveness and the development of their proficiency and supporting the formation of their professional identities. For this reason, researchers and educators worldwide regard self-efficacy as a key process level and terminal program outcomes that can impact on nursing practice, Therefore, the design and implementation of educational programs that promote the advancement of self-efficacy are essential for healthcare practitioners. (Mousa Abusubhiah et al., 2023). Among employees, including nurses within healthcare setting, those with a strong perception in their own capacity to promote sustainability are more likely to engage in environmental efforts. Moreover, factors such as understanding of environmental concerns and the capacity to adopt eco-friendly practices also influence on the green self-efficacy of employes (Syamsiana et al., 2025). Green self-efficacy assesses the confidence of hospital professionals in their capacity to effectively perform environmental sustainable responsibilities. A heightened degree of green self-efficacy is linked with more effective and consistent adoption of green practices. In other mean green self-efficacy refers to an individual's perception in their own ability to implement environmental sustainability initiatives (Saleem et al., 2025). Therefore, this study aims to develop and implement a program about green management to enhance the self-efficacy of nurses as a key factor that influences their engagement in environmentally responsible behaviors ultimately supporting the adoption of sustainable practices.

METHODOLOGY:

Design of the study: a quasi-experimental pretest–posttest control group design has been adopted to evaluate the effect of a green management educational program on nurses' self-efficacy in applying sustainable practices. This design was considered appropriate because the study was conducted in real hospital settings where random assignment of individual nurses was difficult due to work schedules, clinical responsibilities, and the possibility of contamination between participants.

The settings of the study: The data were gathered from four governmental hospitals in Al-Najaf city: (Middle Euphrates Hospital, Al-Najaf Teaching Hospital, Al-Sadder Teaching Hospital and Al-Hakim Hospital and). These hospitals were chosen These hospitals were selected because they represent major healthcare institutions with different clinical departments and a large nursing workforce.

Study sample and sampling technique: To minimize the possibility of contamination between the study and control groups, the allocation was conducted at the hospital level instead of at the individual nurse level. The four selected hospitals were randomly allocated using a simple random allocation method into two groups: two hospitals were assigned to the study group and two hospitals were assigned to the comparative group. Within each allocated hospital, 132 nurses were selected using a non-probability (homogenous purposive) sampling method according to the study inclusion and exclusion criteria, 67 nurses in the study group and 65 nurses in the comparative group.

Ethical consideration: Ethical approval was secured from the Medical Ethical Committee at the College of Medicine, University of Kufa. Official administrative approvals were also obtained from Al-Najaf Al-Ashraf Health Directorate and the selected hospitals. The researcher demonstrated the study's objective to participants prior initiating data collection procedure. Nurses were informed that participation was voluntary and entitled to withdraw at any time without any adverse outcomes with written informed consent was obtained from all participants. Collected data were restricted to scientific research objectives. Anonymity and Confidentiality were maintained across the study.

Educational Program: The green management educational program was constructed to enhance nurse's self-efficacy in applying sustainable practices through improving their perception and understanding of green management in healthcare settings. The content of the program was developed based on the (international guidelines, scientific references, and previous studies related to green management, environmental sustainability, healthcare waste management, and sustainable nursing practices). The program was guided based on the several sources, including World Health Organization (WHO), Alliance of Nurses for Healthy Environments. (2023), Environmental health in nursing (3rd ed.), The Global Green and Healthy Hospitals (GGHH) initiative, and evidence from peer-reviewed nursing literature. The program's content was organized into three main lectures. The program's content was reviewed by a panel of experts. Their recommendations were considered, and necessary modifications were made before implementing the final version of program.

Study Instruments: Data were collected using the Green Self-Efficacy Scale for Green Nursing Practice. The scale consisted of 10 items designed to assess nurses' self-efficacy in applying environmentally sustainable nursing practices. Each item was assessed using a five-point Likert scale varying from 1 = not at all true to 5 = exactly true. Higher mean scores indicated higher levels of self-efficacy in applying sustainable nursing practices. The self-efficacy levels were classified as follows: low self-efficacy = 1.00–2.33, moderate self-efficacy = 2.34–3.67, and high self-efficacy = 3.68–5.00.

Validity and Reliability of Instrument: The Green Self-Efficacy scale content validity was evaluated by a panel of twelve experts using a four-point relevance rating scale. The item-Level Content Validity Index varied from 0.92 to 1.00, whereas, the scale-level Content Validity Index using the average method was 0.97. Cronbach's alpha was employed to evaluate the scale's reliability, which demonstrated acceptable internal consistency with a value of 0.743.

Statistical Data Analysis: The Statistical Package for Social Sciences SPSS were using to examine data. Descriptive statistics, including percentages, means, frequencies and standard deviations, were used to describe the study variables. The normality of data was assessed by the Kolmogorov–Smirnov and Shapiro–Wilk tests. Non-parametric statistical tests were used, because the data were not normally distributed, The Mann–Whitney U test was used to compare the study and comparative groups, while Spearman's rank correlation coefficient and the Kruskal–Wallis's test was used to examine relationships between self-efficacy and selected variables. At $p \leq 0.05$, the level of statistical significance was established.

Study Limitation: A quasi-experimental design was used without complete randomization may constrain the ability to manage all confounding variables, which could affect the internal validity of the study. Also, the (21) days interval between pre and post-test may insufficient for evaluating long-term knowledge retention and sustained changes in self-efficacy. Furthermore, variations in nurses' work schedules and workloads with different hospital units hindered to achieve full attendance and consistent participation in all educational sessions.

Table 1. Distribution of Nurses' Socio-Demographic, Professional, and Work-Related Characteristics in the Comparative and Study Groups

Variables	Categories	Comparative group n (%)	Study group n (%)	Total N (%)
Age group / years	21–27	28 (43.1)	33 (49.3)	61 (46.2)
	28–34	33 (50.8)	22 (32.8)	55 (41.7)
	35–41	1 (1.5)	4 (6.0)	5 (3.8)
	42–48	2 (3.1)	7 (10.4)	9 (6.8)
	≥49	1 (1.5)	1 (1.5)	2 (1.5)
	Mean ± SD	28.6 ± 5.6	30.2 ± 6.8	
Sex	Male	33 (50.8)	28 (41.8)	61 (46.2)
	Female	32 (49.2)	39 (58.2)	71 (53.8)
Educational level	Nursing school	6 (9.2)	8 (11.9)	14 (10.6)
	Nursing institute	31 (47.7)	23 (34.3)	54 (40.9)
	College of nursing	27 (41.5)	32 (47.8)	59 (44.7)
	Postgraduate nursing	1 (1.5)	4 (6.0)	5 (3.8)
Workplace	Emergency unit	31 (47.7)	28 (41.8)	59 (44.7)
	ICU	4 (6.2)	6 (9.0)	10 (7.6)
	CCU	5 (7.7)	6 (9.0)	11 (8.3)
	Medical ward	5 (7.7)	12 (17.9)	17 (12.9)
	Surgical ward	4 (6.2)	10 (14.9)	14 (10.6)
	Operating room	16 (24.6)	5 (7.5)	21 (15.9)
General nursing experience / years	≤3	23 (35.4)	23 (34.3)	46 (34.8)
	4–9	34 (52.3)	29 (43.3)	63 (47.7)
	10–15	5 (7.7)	8 (11.9)	13 (9.8)
	16–21	1 (1.5)	0 (0.0)	1 (0.8)
	≥22	2 (3.1)	7 (10.4)	9 (6.8)
	Mean ± SD	5.8 ± 5.2	3.9 ± 3.4	
Previous knowledge about green management	No	47 (72.3)	63 (94.0)	110 (83.3)
	Yes	18 (27.7)	4 (6.0)	22 (16.7)
Availability of environmental policies	Clearly available	4 (6.2)	4 (6.0)	8 (6.1)
	Partially available	31 (47.7)	32 (47.8)	63 (47.7)
	Not available	13 (20.0)	17 (25.4)	30 (22.7)
	I do not know	17 (26.2)	14 (20.9)	31 (23.5)
Total		65 (49.2)	67 (50.8)	132 (100.0)

Note. n = frequency; % = percentage; SD = standard deviation; ICU = intensive care unit; CCU = coronary care unit.

Table (1) shows the distribution of nurses in both groups according to demographic data. Regarding age; the largest proportion of participants in the comparative group (50.8%) were aged (28–34) years, whereas nearly half of participants in the study group (49.3%) were aged (21–27) years. Concerning sex; slightly more than half of participants in the study group (58.2%) were females. Regarding the level of education; the highest proportion of participants in the study group (47.8%) were graduates from the College of Nursing, while (47.7%) of participants in the comparative group were graduated from the Institute of Nursing. The workplace; nearly half of the participants in both groups were worked in the emergency unit (41.8% and 47.7%) in the study and comparative groups, respectively. Concerning years of experience in nursing; the highest percentages of participants in both groups had 4-9 of general nursing experience, (52.3%) in the study group and (43.3%) in the comparative group. The result showed that almost all participants in the study group (94.0%) and most participants (72.3%) in the comparative group reported had no previous knowledge about green Management. Concerning environmental policies; nearly half of participants in both groups, (47.8%) in the study and (47.7%) in the comparative group reported that such policies were partially available.

Table 2. Comparison of Nurses' Self-Efficacy in Applying Sustainable Practices between the Comparative and Study Groups

Measurement period	Level / statistic	Comparative group	Study group	Mann–Whitney U	Z	p-value
Pretest	Low, n (%)	4 (6.2)	4 (6.0)	1849.5	-1.496	0.134 NS
	Moderate, n (%)	36 (55.4)	26 (38.8)			
	High, n (%)	25 (38.5)	37 (55.2)			
	MS ± SD	3.29 ± 0.60	3.41 ± 0.58			
Posttest	Low, n (%)	5 (7.7)	0 (0.0)	234.5	-8.863	<0.001 S
	Moderate, n (%)	52 (80.0)	7 (10.4)			
	High, n (%)	8 (12.3)	60 (89.6)			
	MS ± SD	3.23 ± 0.57	4.27 ± 0.42			

Note. MS = mean of score; SD = standard deviation; S = significant; NS = not significant.

Table (2) Illustrated a non-significant difference between comparative and study group in the pre-test period measurement ($P = 0.134$), reflected comparable baseline (Self-Efficacy) levels. In contrast, a highly statistically significant difference is observed in the post-test period measurement ($P < 0.001$), where the study group demonstrated a marked improvement in general self-efficacy compared to the comparative group. These findings confirmed the effectiveness of the educational program in enhanced study group nurses' self-efficacy.

Table 3. Correlation between Nurses' Self-Efficacy and Selected Continuous Variables among the Study Group

Variable	Self-efficacy pretest r	Pretest p-value	Self-efficacy posttest r	Posttest p-value
Age	.282*	0.020 S	.033	0.790 NS
General years of nursing experience	.269*	0.020 S	.040	0.690 NS

Note. Spearman's rho was used. r = correlation coefficient; * at the 0.05 level, correlation is significant; S = significant; NS = not significant.

Table (3) demonstrated the relationship between nurses' self-efficacy, and selected continuous demographic variables among the study group at the posttest period. The findings indicated that relationships were not statistically significant, suggesting that age, general years of nursing experience.

Table 4. Relationship between Nurses' Self-Efficacy and Selected Categorical Variables among the Study Group at Posttest

Variable	Category	n	Kruskal–Wallis H	df	p-value
Educational level	Nursing school	8	1.265	3	0.737 NS
	Nursing institute	23			
	College of nursing	32			
	Postgraduate nursing	4			
Workplace	Emergency unit	28	4.987	5	0.417 NS
	ICU	6			
	CCU	6			
	Medical ward	12			
	Surgical ward	10			
	Operating room	5			
Availability of environmental policies	Clearly available	4	10.007	3	0.010 S
	Partially available	32			
	Not available	17			
	I do not know	14			

Note. S = significant; NS = not significant; ICU = intensive care unit; CCU = coronary care unit.

Table (4) reported that no statistically significant relationship is found between categorical demographic variables (educational level, workplace) and self-efficacy at the post-test phase. while, a statistically significant relationship is found between the availability of environmental policies and self-efficacy, indicated that nurses worked in environments with clearer environmental policies demonstrated higher self-efficacy.

DISCUSSIONS:

Table (1) According to the results of the current study, regarding age; the largest proportion of participants in the comparative group (50.8%) were aged (28–34) years, whereas nearly half of participants in the study group (49.3%) were aged (21–27) years. These findings supported by another study done by **Winarti et al. (2025)** that most nursing participants were aged between 22 and 35 years, reflecting the dominance of younger age groups in the nursing workforce. Concerning sex; The finding revealed slightly more than half of participants in the study group (58.2%) were females. This result is consistent with another study conducted at Al-Najaf governorate hospitals by **Naseem et al. (2022)** with 443 participants, female was represented (58.9%). The higher proportion of female participants may be attributed to the female-dominated nature of the nursing profession. This trend is further substantiated by recent admission patterns in Iraq, which have seen a majority of accepted students in nursing colleges and institutes being females thereby increasing their representation within this particular sample. According to the nurses' educational attainment. The present study identified the largest of participants (47.8%) were graduates from the college of nursing, while (47.7%) of participants were graduated from the institute of nursing. This finding aligns with study employed with a targeted population 377 nurses within 13 hospitals in Iraq, revealed that more than two-fifths of the nurses held bachelor's degrees (41.4%), followed by those with an associate degree (40.6%) (**Yousif et al., 2025**). Educational attainment significantly influences on nurses' capacity to benefit from green management programs, individuals with higher educational levels possess a deeper understanding of concepts related to sustainability, waste sorting and resource conservation, As regards the workplace; nearly half of the participants in both groups worked in the emergency unit, this result is compatible with study conducted at Al-Najaf City by **Mustafa Aljanabi and M (2022)**, revealed the emergency units had most of nurses (55.9%). This finding may be explained by hospitals staffing policies that assign a greater proportion of nurses to emergency departments due to their rapid patient throughput and substantial workload. Concerning years of experience in nursing; the highest

percentages of participants in both groups had 4-9 of general nursing experience. This result was supported by another descriptive study, 53% of the participants had 5 to 9 years of experience in nursing (Al-Haroon & Al-Qahtani, 2020). The result showed that almost all participants in the study and comparative group had no prior knowledge of green management. It was consistent with previous research, who indicated that a majority of participants (89% of nurses) had not engaged in green management programs. (Ismail Ibrahim Elksas et al., 2024). The results demonstrated lack of training programs and formal education on sustainability and environmental practices within healthcare environments that explain the notable deficiency in awareness and understanding of green management concepts among participants. **Table (2)** The results of nurses' self-efficacy illustrated a non-significant difference between comparative and study group in the pre-test period measurement ($P = 0.134$). The absence of a statistically significant difference between the study and comparative groups on the pre-test indicates that these groups exhibited comparable levels of self-efficacy prior to the educational program's implementation. While, no studies have directly evaluated the relationship across green management education programs and nurses' self-efficacy in performing sustainable practices. Nevertheless, the findings of this study find indirect support from prior research showing that educational interventions can enhance nurses' knowledge, awareness, confidence, and environmentally responsible behaviors. This result congruent with result conducted by a randomized control trial design done by Atta et al. (2025) was adopted on 124 nurses completed pre- and post-intervention assessments using environmental self-efficacy Scale scores, showed no significant difference across intervention group and control group. Moreover, Azizi et al. (2022) conducted a quasi-experimental study and adopted a pre and post-test design using questionnaire assessed the self-efficacy of nursing students and clinical performance. Additionally, Kamali et al. (2023) demonstrated at base line, there is no significant difference regard self-efficacy scores of the control and intervention groups. The findings showed that no significant differences founded between the study and control. The two groups had almost similar mean scores. The present study found highly statistically significant difference is observed in the post-test period measurement ($P < 0.001$), where the study group demonstrated a marked improvement in general self-efficacy compared to the comparative group. This result was in line to result conducted by Eweida et al. (2025), a randomized controlled trial design was employed with 140 nursing students who completed a survey pertaining to climate change and the Environmental Self-Efficacy Scale. The intervention group demonstrated a significant improvement in climate change awareness and environmental self-efficacy relative to the control group. Further, quasi-experimental done by Alhowaymel et al. (2025), the result revealed highly significant difference at ($p \leq 0.0001$) in the students' self-efficacy, that mean scores were improved in total students' self-efficacy at post-intervention for the study group. Another study done by Seham et al. (2020) revealed that the head nurses have low self-efficacy in preprogram, but high self-efficacy in immediate post program implementation with follow up phase. Also quasi-experimental pre and post-test study done by Zarshenas et al. (2022) reported the mean score was statistically significant ($p = 0.001$) of the self-efficacy level to the study group nursing students before and after the intervention. A systematic review examining self-efficacy within nursing education included 47 studies, comprising 39 quasi-experimental pretest–posttest designs and 8 randomized controlled trials. Of 28 single-group studies reporting self-efficacy outcomes, 25 demonstrated significant changes in overall or subscale self-efficacy following the intervention. Post-intervention mean self-efficacy scores increased significantly in 21 of the 28 studies (M. Abusubhiyah et al., 2023). The enhancement in nurses' self-efficacy following program implementation may be attributed to the knowledge and comprehension acquired through the educational program concerning green management and sustainable nursing practices. The program facilitated nurses' familiarity with the meaning and significance of green management, potentially increasing their awareness and bolstering their confidence in effectively applying environmentally responsible practices within the clinical setting. As nurses' knowledge and understanding progressed, their self-efficacy and perceived capability to perform sustainable practices also improved. **Table (3)** displays no statistically significant correlation is found between nurses' self-efficacy, and selected continuous demographic variables including age, overall years of nursing experience, within the study cohort. Suggesting that these demographic factors were not strongly related to nurses' self-efficacy outcomes. This finding in aligns with Mannethodi et al. (2023), who reported no statistically significant correlations between length of clinical experience, age and the subscales of self-efficacy. Similarly, Sheikhbardsiri et al. (2019) who found no significant associations were detected between age, work experience, and nurses' self-efficacy scores prior to and following an educational workshop. These results suggest that self-efficacy is more strongly influenced by educational exposure, professional motivation, and the characteristics of the training provided rather not determined exclusively by demographic variables. **Table (4)** reported that no statistically significant relationship is found between self-efficacy and categorical demographic variables (educational level, workplace) and at the post-test phase. This finding aligns with Elmansy et al. (2025), who reported that educational level does not significantly influence nurses' self-efficacy. It also corroborates Kazim and Tamimi (2024), who observed no significant relationship

between workplace setting and nurses' general self-efficacy. While, a statistically significant relationship is found between the availability of environmental policies and self-efficacy, indicated that nurses worked in environments with clearer environmental policies demonstrated higher self-efficacy. This finding supported by **Yi and Yi (2025)**, who documented positive associations among environmental information, beliefs, and self-efficacy. It is also consistent with **Irawati Al Muhdhar et al. (2023)**, who reported the relationship between environmental literacy and self-efficacy was significant, the results indicate that many categorical demographic variables exerted limited influence on nurses' posttest self-efficacy. By contrast, the presence of environmental policies showed greater relevance to nurses' self-efficacy. This highlights the importance of institutional role that support explicit environmental guidelines in strengthening nurses' efficacy to implement sustainable practices. Consequently, the effectiveness of green management programs may be improved when educational interventions are buttressed by clear hospital policies and an organizational climate conducive to sustainable nursing practice. Overall, the findings of the current study indicate that the green management educational program was effective in improving nurses' self-efficacy in applying sustainable practices. Therefore, the integrating of green management education into continuing nursing education programs may enhance the development of sustainable nursing practice in healthcare settings.

CONCLUSIONS:

Based on the study finding, discussion, and supporting evidence, the green management educational program was effective in enhancing nurses' self-efficacy in applying sustainable practice. Therefore, the research hypothesis was accepted and the null hypothesis was rejected. The findings revealed the integrating the green management and sustainability programs into nursing education is important to strengthen environmentally responsible nursing practices and promote outcomes of sustainable health.

RECOMMENDATION

The findings support integrating of green management and sustainability guidelines into continuing nursing education and nursing curricula. Hospitals should provide activate clear environmental policies and regular training programs related to waste segregation, recycling, and resource conservation to enhancing nurses' self-efficacy and sustainable practice. Further studies with different healthcare settings, larger samples, and longer follow-up periods are recommended to assessed the long-term impact of green management education on nurses' actual practices.

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