



**IMPACT OF A STRUCTURED E-LEARNING PACKAGE ON
ENHANCING KNOWLEDGE REGARDING EMERGENCY CRASH
CART UTILIZATION AMONG UNDERGRADUATE NURSING
STUDENTS**

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Article Information:

Type of Article: Original Article

Received On: 18.03.2026

Accepted On: 23.03.2026

Published On: 01.04.2026

Abstract

Background: Emergency crash carts are essential in managing life-threatening clinical situations, as they provide immediate access to critical drugs and equipment. However, undergraduate nursing students often demonstrate inadequate knowledge regarding crash cart organization, utilization, and maintenance. With the advancement of digital education, structured e-learning has emerged as an effective strategy to enhance knowledge and clinical preparedness.

Objective: To evaluate the effectiveness of a structured e-learning package in improving knowledge regarding emergency crash cart utilization among undergraduate nursing students.

Methods: A quantitative pre-experimental one-group pre-test post-test design was adopted. The study was conducted among 100 second- and third-year B.Sc. Nursing students selected through purposive sampling. Data were collected using a validated 30-item structured multiple-choice

questionnaire (KR-20 = 0.80). Following the pre-test, participants underwent a structured e-learning intervention consisting of video demonstrations, interactive modules, and self-assessment quizzes. A post-test was conducted to assess knowledge improvement. Data were analyzed using descriptive and inferential statistics, including paired t-test and chi-square test.

Results: The findings revealed a significant improvement in knowledge scores following the intervention. The mean post-test score (21.80 ± 2.88) was significantly higher than the pre-test score (12.40 ± 3.15), with a mean difference of 9.40. The paired t-test value ($t = 25.72, p < 0.001$) indicated a highly significant effect of the e-learning package. The proportion of students with adequate knowledge increased from 2% in the pre-test to 74% in the post-test. Significant associations were found between knowledge gain and year of study ($p = 0.04$) and previous emergency training ($p = 0.02$).

Conclusion: The structured e-learning package was highly effective in enhancing knowledge regarding emergency crash cart utilization among undergraduate nursing students. Integrating such digital learning modules into nursing education can improve clinical competence, emergency preparedness, and patient safety.

Keywords:

Emergency Crash Cart, E-learning, Nursing Students, Knowledge Enhancement, Emergency Preparedness, Nursing Education, Digital Learning, Clinical Competency, Teaching Intervention, Patient Safety.

INTRODUCTION

Emergency situations in healthcare settings demand rapid, accurate, and well-coordinated responses from healthcare professionals. Among the essential tools used in such scenarios is the emergency crash cart, which contains life-saving medications, equipment, and supplies required for immediate patient care. The proper utilization of crash carts is critical in emergencies such as cardiac arrest, respiratory failure, and other life-threatening conditions. Nursing students, as future frontline healthcare providers, must be adequately trained to handle these situations effectively.

However, several studies have reported gaps in knowledge and preparedness among nursing students regarding crash cart utilization. These gaps may stem from limited clinical exposure, insufficient practical training, and reliance on traditional teaching methods that may not adequately address the complexities of emergency care. Inadequate knowledge can lead to delays in intervention, improper use of equipment, and ultimately compromise patient outcomes.

With the increasing integration of technology in education, e-learning has emerged as a promising solution to address these challenges. E-learning provides flexible, self-paced, and interactive learning opportunities that cater to diverse learning styles. It allows students to revisit complex concepts, engage with multimedia content, and practice decision-making through simulated scenarios. In nursing education, e-learning has been shown to enhance knowledge retention, clinical reasoning, and skill acquisition.



The present study is grounded in the Input–Process–Output (IPO) model, which provides a systematic framework for evaluating educational interventions. The input consists of the structured e-learning package, the process involves cognitive engagement and knowledge assimilation, and the output is reflected in improved knowledge scores. Additionally, theoretical support is drawn from Bandura’s Self-Efficacy Theory and Cognitive Load Theory, which emphasize the importance of interactive and structured learning in enhancing competence and reducing cognitive overload.

Given the increasing burden of emergency conditions and the need for competent nursing professionals, it is essential to adopt innovative teaching strategies that can effectively bridge knowledge gaps. This study aims to evaluate the impact of a structured e-learning package on knowledge regarding emergency crash cart utilization among undergraduate nursing students. The findings are expected to contribute to evidence-based educational practices and support the integration of digital learning tools in nursing curricula.

METHODOLOGY

A quantitative research approach was adopted for this study, utilizing a pre-experimental one-group pre-test post-test design ($O_1 \rightarrow X \rightarrow O_2$). This design was chosen to assess the effectiveness of a structured e-learning package in improving knowledge among undergraduate nursing students.

The study was conducted at the College of Nursing, Kannur Medical College, Anjarakandy, Kannur. The target population comprised undergraduate nursing students enrolled in the second and third years of the B.Sc. Nursing program. A sample size of 100 students was selected using purposive sampling, based on inclusion criteria such as willingness to participate and availability during the study period.

Data collection was carried out using a structured multiple-choice questionnaire consisting of 30 items related to emergency crash cart utilization. The tool covered areas such as identification of equipment, drug arrangement, emergency protocols, and maintenance procedures. The reliability of the tool was established using the Kuder-Richardson formula (KR-20), yielding a coefficient of 0.80, indicating good internal consistency. Content validity was ensured through expert review.

The study was conducted in three phases. In the first phase, a pre-test was administered to assess baseline knowledge. In the second phase, the structured e-learning package was delivered. The package included video demonstrations, digital modules explaining crash cart components, and interactive quizzes designed to reinforce learning. The content was made accessible online, allowing students to learn at their own pace.

In the third phase, a post-test was conducted using the same questionnaire to evaluate the effectiveness of the intervention. Data were analyzed using descriptive and inferential statistics. Mean, standard deviation, and percentage distributions were used to describe the data. A paired t-test was applied to determine the significance of differences between pre-test and post-test

scores. Chi-square tests were used to assess associations between knowledge levels and demographic variables.

Ethical considerations were strictly followed. Informed consent was obtained from all participants, confidentiality was maintained, and participants were assured that their data would be used solely for research purposes.

RESULTS

The results of the study highlight the effectiveness of the structured e-learning package in enhancing knowledge regarding emergency crash cart utilization among undergraduate nursing students.

At baseline, the pre-test results indicated a significant lack of knowledge among participants. Approximately 62% of students demonstrated inadequate knowledge, while only 2% had adequate knowledge. The mean pre-test score was considerably low, reflecting insufficient preparedness in handling emergency crash carts.

Following the intervention, a notable improvement was observed in the post-test scores. The mean post-test score increased to 21.80 ± 2.88 , indicating a substantial gain in knowledge. The percentage of students with adequate knowledge rose dramatically to 74%, while those with inadequate knowledge significantly decreased.

A paired t-test was conducted to evaluate the statistical significance of the improvement. The calculated t-value of 25.72 at $p < 0.001$ indicates a highly significant difference between pre-test and post-test scores. This confirms that the structured e-learning package was effective in enhancing knowledge.

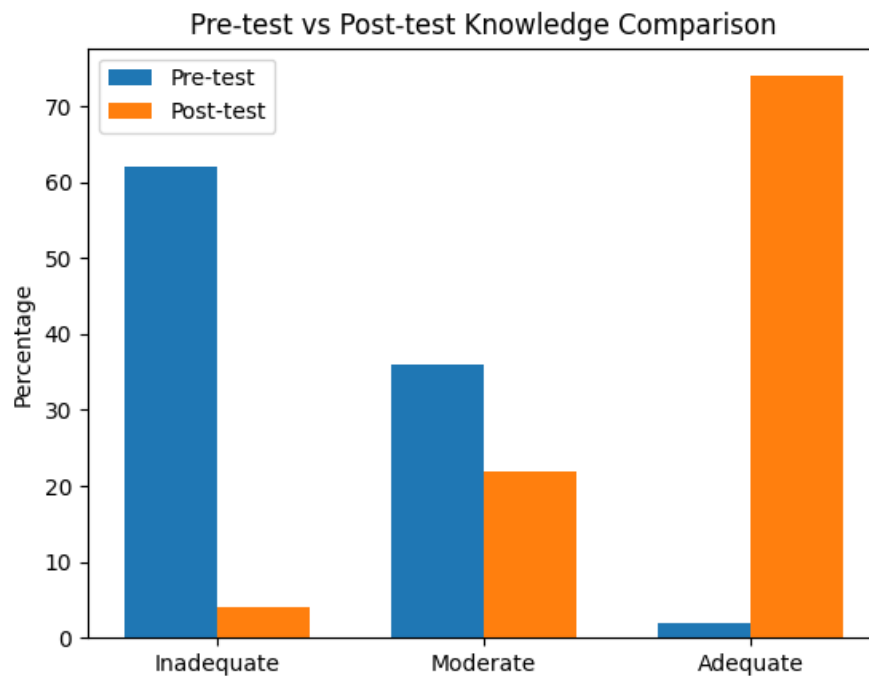
Table 1: Comparison of Pre-test and Post-test Knowledge Scores (N = 100)

Test	Mean Score	Standard Deviation	Mean Difference	t-value	p-value
Pre-test	12.40	3.15			
Post-test	21.80	2.88	9.40	25.72	<0.001

The post-test mean score is significantly higher than the pre-test score, indicating that the e-learning package was highly effective.

Table 2: Distribution of Knowledge Levels Before and After Intervention

Knowledge Level	Pre-test (n, %)	Post-test (n, %)
Inadequate (0–10)	62 (62%)	8 (8%)
Moderate (11–20)	36 (36%)	18 (18%)
Adequate (21–30)	2 (2%)	74 (74%)



There is a dramatic shift from inadequate to adequate knowledge levels after the intervention.

Table 3: Association between Knowledge Gain and Demographic Variables

Variable	Category	χ^2 Value	p-value	Significance
Year of Study	2nd Year / 3rd Year	4.21	0.04	Significant
Previous Emergency Training	Yes / No	5.36	0.02	Significant
Gender	Male / Female	1.12	0.28	Not Significant

Further analysis examined the association between knowledge improvement and selected demographic variables. The results revealed a statistically significant association between knowledge gain and the year of study ($p = 0.04$), indicating that third-year students showed slightly higher improvement compared to second-year students. Additionally, previous exposure

to emergency training was significantly associated with knowledge gain ($p = 0.02$), suggesting that prior experience enhances learning outcomes.

Overall, the results clearly demonstrate that the structured e-learning package had a positive and statistically significant impact on students' knowledge regarding emergency crash cart utilization.

DISCUSSION

The findings of the present study indicate that the structured e-learning package significantly improved knowledge among undergraduate nursing students regarding emergency crash cart utilization. The substantial increase in post-test scores highlights the effectiveness of digital learning strategies in nursing education.

The initial findings of inadequate knowledge among students are consistent with previous studies, which reported gaps in emergency preparedness due to limited clinical exposure and traditional teaching methods. The improvement observed in this study supports the growing body of evidence emphasizing the effectiveness of e-learning in enhancing knowledge and skills.

The study findings align with Bandura's Self-Efficacy Theory, which suggests that repeated exposure to learning materials increases confidence and competence. The use of multimedia elements such as videos and quizzes likely contributed to improved engagement and retention. Similarly, Cognitive Load Theory supports the use of structured and segmented content to reduce cognitive burden and facilitate learning.

The significant association between knowledge gain and previous emergency training suggests that experiential learning complements digital education. Students with prior exposure were better able to integrate new knowledge, highlighting the importance of blended learning approaches.

The results are also consistent with studies by Cant and Cooper (2017) and Patel & Sharma (2020), which demonstrated that simulation and e-learning improve clinical competencies. The flexibility and accessibility of e-learning make it a practical solution for large groups of students.

However, the study has certain limitations, including the absence of a control group and reliance on self-reported knowledge measures. Future studies may incorporate experimental designs and assess skill performance in clinical settings.

CONCLUSION

The study concludes that a structured e-learning package is highly effective in enhancing knowledge regarding emergency crash cart utilization among undergraduate nursing students. The significant improvement in post-test scores demonstrates the potential of digital learning tools in bridging educational gaps and improving clinical preparedness.

E-learning provides a flexible, scalable, and engaging approach to nursing education, enabling students to acquire critical knowledge essential for emergency care. The findings support the integration of structured e-learning modules into nursing curricula to enhance patient safety and clinical competence.

It is recommended that nursing institutions adopt blended learning approaches combining e-learning with practical training to maximize learning outcomes. Further research is needed to evaluate long-term retention and the impact on clinical performance.

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