

Enhancing Critical Care Nurses' Awareness, Problem-Solving Skills, and Attitudes Through AI-Integrated Learning Designs

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ABSTRACT

Objective: To assess the effects of an AI-integrated learning designs on enhancing awareness, problem-solving skills and attitude of critical care nurses.

Study Design: A quasi-experimental, two-group pretest–posttest study

Place and Duration of Study: This study was conducted at the critical care units of Doctors Hospital and Medical Center, Lahore from June 2025 to August 2025.

Methods: About 84 nurses were selected through convenient sampling technique and equally assigned to experimental (n=42) and control (n=42) groups. Data were collected using an artificial intelligence knowledge questionnaire, problem solving inventory, and attitude questionnaire. Data were analyzed using SPSS version 25. Wilcoxon sign rank test and Mann Whitney U test were employed, with $p \leq 0.05$ considered significant.

Results: Results demonstrated that most of participants were aged 20–40 years, with equal gender distribution and no significant differences in age, gender, marital status, experience, or department across groups. The AI-integrated educational intervention significantly improved nurses' awareness, problem-solving skills, and attitudes. In the experimental group, poor awareness good awareness rose to 45.2%. Problem-solving skills improved markedly, with 78.6% achieving good skills post-intervention compared to none at baseline. Attitudes also shifted substantially, as 90.5% of nurses developed good attitudes post-intervention compared to 100% poor attitudes at baseline.

Conclusion: The AI-integrated educational intervention significantly enhanced the experimental group nurses' awareness, problem-solving skills, and attitudes compared to the control group. These findings highlight the effectiveness of structured training in preparing nurses for technology-driven healthcare.

Key Words: Critical Care Nursing, Artificial Intelligence, Problem Solving, Attitude of Health Personnel, Education

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INTRODUCTION

The rapid evolution of healthcare, driven by technological innovations, has positioned Artificial Intelligence (AI) as a transformative force in improving the quality of care^{1,2}. AI's growing role in healthcare extends to nursing education, where it is redefining traditional learning by fostering critical thinking, clinical reasoning, and decision-making skills among students³. By simulating human intelligence, AI performs complex tasks such as data analysis, pattern recognition, and predictive modelling, enabling healthcare professionals to make informed decisions⁴.

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The integration of AI into nursing education introduces tools like machine learning, deep learning, and natural language processing, enhancing both teaching and clinical training⁵.

In nursing education, the development of professional identity is deeply influenced by factors such as clinical experience, ethical standards, and educational environments⁶. The integration of AI into curricula offers opportunities to strengthen this identity through innovative learning strategies and exposure to technology-driven clinical scenarios⁷. Successful implementation of AI in nursing education depends on thoughtful curriculum design, faculty training, and ethical considerations⁸. Preparing nurses who are technologically competent and ethically grounded ensures that they are capable of combining traditional nursing skills with AI-driven insights to deliver patient-centered care in an increasingly digital healthcare landscape (Abuzaid et al., 2022).

As AI technologies become integral to healthcare systems, their capacity to analyze vast datasets and support decision-making has gained significant attention⁹. AI health technologies (AIHTs) facilitate efficient organization of clinical data, enhancing

diagnostic accuracy and personalized care¹⁰. However, concerns persist regarding job displacement, ethical dilemmas, and data bias. Nurses play a pivotal role in shaping AI’s responsible use, making their active engagement essential. Embracing AI not only enhances nursing practice but also strengthens the collaboration between human expertise and machine intelligence, paving the way for innovation and improved patient outcomes in modern healthcare¹¹.

METHODS

A quasi-experimental two-group pre and post-test design was used to conduct the study at Doctors Hospital and Medical Center, Lahore. The study, conducted from June 2025 to August 2025 after ethical approval from the University of Lahore (REC-UOL-/448 Dated 28.08.2024), included 84 nurses equally divided into experimental and control groups, selected through convenient sampling. The independent variable was the AI-integrated learning design, while dependent variables were nurses’ awareness, problem-solving skills, and attitudes, measured using validated and reliable tools (CVI: 0.81–0.86; Cronbach’s α : 0.79–0.86). Data were collected in three phases—pre-intervention, intervention, and post-intervention. Data were analyzed with SPSS version 25 using non-

parametric tests (Wilcoxon signed-rank and Mann–Whitney U), with $p \leq 0.05$ considered significant. Ethical principles of consent, confidentiality, anonymity, and voluntary participation were strictly maintained.

RESULTS

Among the participants, most were aged 20–40 years, with similar age distribution across groups ($p = 0.537$). Gender distribution was equal, and marital status also showed no significant difference ($p = 0.633$, $p = 0.182$). Educationally, 29.8% held a Diploma in General Nursing, 36.9% had Post RN BSN, and 33.3% had BSN, showing a significant difference between groups ($p = 0.001$). Most nurses (65.5%) had up to 5 years of experience, and the rest had more than 5 years ($p > 0.999$). Departmental distribution was 40.5% in Medical ICU, 40.5% in Surgical ICU, and 19% in Pediatric ICU, with no significant difference ($p = 0.337$).

Table 2 shows that the experimental group had significantly higher awareness scores than the control group both before (6.00 vs. 4.00, $p < 0.001$) and after the intervention (7.00 vs. 5.00, $p = 0.042$), indicating the intervention effectively improved nurses’ awareness.

Table No. 1: Comparison of demographic characteristics of control and experimental group of nurses(n=84)

Demographic Variables	Category	Group	
		Experimental f (%)	Control f (%)
Age in Years	20-30 Year	15(35.70%)	14(33.30%)
	31-40 Year	13(31.00%)	18(42.90%)
	41- 50 Year	6(14.30%)	6(14.30%)
	> 50 Year	8(19.00%)	4(9.50%)
Gender	Male	22(52.40%)	20(47.60%)
	Female	20(47.60%)	22(52.40%)
Marital Status	Single	28(66.70%)	22(52.40%)
	Married	14 (33.30%)	20(47.60%)
Education Qualification	Diploma in General Nursing	6(14.30%)	19(45.20%)
	Post RN BSN	15(35.70%)	16(38.10%)
	BSN	21(50.00%)	7(16.70%)
	MSN	0(0%)	0(0%)
Experience	1-5 years	28(66.70%)	27(64.30%)
	> 5 years	14(33.30%)	15(35.70%)
Department	Medical ICU	14(33.30%)	20(47.60%)
	Surgical ICU	18(42.90%)	16(38.10%)
	Paeds ICU	10(23.80%)	6(14.30%)

Table No. 2: Comparison of awareness before and after intervention of experimental group and control group nurses (n=84)

Variable	Control Group Median (IQR)	Experimental Group Median (IQR)	p-value
Pre-Intervention Awareness	4.00(3.00-5.00)	6.00(5.00-7.00)	<0.001
Post- Intervention Awareness	5.00 (3.75-6.00)	7.00(6.00-8.00)	0.042

Table No. 3: Comparison of problem-solving skills of experimental group and control group of nurses before and after intervention (n=84)

Variable	Control Group Median (IQR)	Experimental Group Median (IQR)	p-value
Pre-Intervention Problem Solving Skills	112.00(104.00-118.00)	118.50(111.25-125.25)	<0.001
Post- Intervention Problem Solving Skills	112.00(104.00-118.00)	165.50(156.00-177.50)	<0.001

Table No. 4: Comparison of attitude of experimental group and control group of nurses before and after intervention (n=84)

Variable	Control Group Median (IQR)	Experimental Group Median (IQR)	p-value
Pre-Intervention Attitude	47.00(43.00-50.00)	44.00(41.00-48.00)	0.006
Post- Intervention Attitude	46.00(43.00-51.00)	87.00(84.00-91.00)	<0.001

Table 3 shows a significant improvement in problem-solving skills among the experimental group, with scores increasing from 118.50 to 165.50 after the intervention, while the control group remained unchanged at 112.00. The difference was highly significant ($p < 0.001$), indicating the intervention effectively enhanced nurses' problem-solving abilities. Table 4 shows a significant improvement in nurses' attitudes in the experimental group, with scores rising from 44.00 to 87.00 after the intervention, while the control group remained nearly the same (47.00 to 46.00). The difference was highly significant ($p < 0.001$), indicating the intervention greatly enhanced nurses' attitudes.

DISCUSSION

The demographic results of this study align with recent literature (2021–2025), showing that most nurses were young (20–40 years), single, and had less than five years of ICU experience, reflecting a growing early-career nursing workforce. Gender distribution was balanced, and educational qualifications indicated a gradual shift from diploma to degree programs, consistent with regional trends. These findings mirror studies by Glauber et al. (2023)¹² and De Gagne (2023)¹³, confirming that critical care units are primarily staffed by younger, transitioning professionals. The study found that the AI-integrated learning intervention significantly improved nurses' awareness. In the experimental group, poor awareness declined sharply, while fair and good awareness increased considerably, showing the intervention's effectiveness. These results are supported by Schneidereith & Thibault (2023)¹⁴ and Taskiran (2023)¹⁵, who noted that AI-based learning enhances engagement and knowledge. The findings also reflect Abuzaid et al. (2024)¹⁶, emphasizing that AI promotes active learning and greater understanding of complex healthcare concepts. Problem-solving skills also improved substantially among nurses in the experimental group, while the control group showed no change. This outcome supports prior studies (El Arab et al., 2025; Cucci et al., 2025) (El Arab et al., 2025),

(Cucci et al., 2025) that demonstrated AI's ability to strengthen analytical and decision-making skills through adaptive simulations and problem-based learning. The intervention enabled nurses to practice reasoning in realistic scenarios, improving their confidence and readiness for critical situations¹⁷. Nurses' attitudes toward AI showed the most notable change, with 90.5% of participants in the experimental group developing positive attitudes post-intervention. This aligns with findings by Lifshits & Rosenberg (2024)¹⁸, who reported that structured AI education fosters openness and confidence in technology use. Overall, the study highlights that AI-integrated learning effectively enhances nurses' awareness, problem-solving abilities, and attitudes, preparing them for evolving, technology-driven healthcare environments¹⁹.

CONCLUSION

The study concluded that both groups were demographically comparable, except for a difference in educational qualifications. The AI-integrated learning intervention had a significant positive impact, greatly improving nurses' awareness, problem-solving skills, and attitudes. The experimental group showed marked gains in all areas, while the control group showed little or no change. Overall, AI-integrated education proved highly effective in enhancing knowledge, critical thinking, and positive attitudes among critical care nurses, equipping them for the evolving demands of modern healthcare.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Ejaz Khan, Sarfraz Masih
Drafting or Revising Critically:	Ejaz Khan, Madiha Mukhtar
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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