International Journal of Food Safety and Public Health
Vol. 12 (2), pp. 001-011, November, 2025
ISSN: 2756-3693

Full Length Research Article

Educational Approaches for Strengthening Nurses' Awareness and Acceptance of Artificial Intelligence in Healthcare Delivery: A Hospital-Based Quasi-Experimental Study: Implications for Long-Term Value Creation

Punam Patel[1], Dr. Nelson Jewas[2]

Assistant Professor, Medical surgical nursing, Madhya Pradesh, India[1]
Dean, Department of Nursing, Sciences, Mansarovar Global University, Bhopal, Madhya Pradesh, India[2]

Accepted 5th September 2025

ABSTRACT
The adoption of the use of artificial intelligence (AI) in healthcare requires proper readiness among the nursing leaders. This quasi-experimental study was a hospital-based study that identified the effectiveness of structured educational interventions in improving the level of awareness and acceptance of AI technologies by the nurses in healthcare delivery. India Tertiary care hospital Nurses A sample (n=120) was split into experimental and control groups. The experimental participants were provided with a four-week educational intervention on the basics of AI, its medical uses, and ethics. Validated instruments were used to measure levels of knowledge, attitudes, and acceptance, based on the pre-test and post-test assessments. The findings showed a significant difference in the scores of AI awareness ($p<0.001$) and acceptance ($p<0.001$) of the experimental group when compared to control. The intervention led to the improvement of knowledge on the AI use in monitoring patients, aiding diagnosis, and optimizing the workflow. Results indicate that pertinent educational strategies can be used to resolve knowledge gaps and minimize AI adoption resistance. This paper has justifications about introducing systematic training to equip nursing labor with AI-based medical settings and eventually adding value to the long-term with the provision of better quality care and operational efficiency.

Keywords: *Artificial intelligence, nursing education, healthcare technology acceptance, quasi-experimental study, digital health literacy*

1. INTRODUCTION

Artificial intelligence is a disruptive technology in the modern healthcare system that has radically changed the pattern of clinical practices, decision-making, and patient care delivery mechanism. Combination of AI technologies such as machine learning algorithms, predictive analytics, natural language processing and robotic assistance has proved significant opportunities in improving diagnostic accuracy, individualized treatment regimes, resource optimization and patient outcomes (Topol, 2019). AI-based solutions are gradually being implemented in healthcare institutions across the globe in fields of medical imaging interpretation and drug discovery, as well as patient risk stratification and automated workflow administration. As the greatest proportion of healthcare professionals in any world, nurses are central to the provision of care and to acting as the main linking point between patients and healthcare services. Their willingness and successful usage of AI technologies are the key factors that define the successful implementation and permanent adoption of intelligent systems in clinical settings (Buchanan et al., 2020). Nonetheless, the available literature demonstrates alarming trends of low levels of awareness, a lack of technological literacy, and the presence of a significant resistance among nursing professionals toward the implementation of AI in the workplace. Numerous reports have reported gaps in knowledge related to AI capabilities, use and limitations among nurses, and common anxiety about job losses, ethical issues, patient safety, and dehumanizing care delivery.

Theoretical frameworks proposed by the technology acceptance model and unified theory of acceptance and use of technology suggest that perceived usefulness, perceived ease of use and facilitating conditions are playing a huge role in technology adoption behaviours. Attitude change through educational interventions targeting such perceptions has the potential to change the level of acceptance of innovative technologies in the healthcare professionals. Although there is an increasing awareness of this educational need, there is a lack of organized studies on the effectiveness of structured training programs to enhance nurses understanding of AI and acceptance despite the rapid pace of technological improvement, which is accompanied by conservative paradigms of practice in the Indian healthcare industry. The healthcare system of India is defined by the high level of diversity in terms of infrastructure, resource base, and the ability to cover all workforce categories; hence, there are particular challenges associated with technology integration in the system. Nursing workforce in India is rapidly growing but in most cases, they are not well exposed to emerging technologies when accessing basic education and practices through career development programs. This disparity imposes considerable barriers to the successful implementation of AI, which may restrict the achievement of the benefits of technology and worsen the current healthcare disparities. Overcoming these educational gaps with the help of evidence-based solutions is a significant step toward equipping the nursing workforce with AI-based care delivery models and providing everyone with equal opportunities to access the benefits of technology in the variety of healthcare facilities.

2. LITERATURE REVIEW

The concept of artificial intelligence and nursing practice has been getting more scholarly interest with a wide range of studies discussing different aspects of technology adoption, acceptance rates, and learning requirements. Robert (2019) has carried out a thorough review of the transformative potential of AI in nursing because it has been stated that it finds its application on clinical decision support, in patient monitoring, medication administration, and in care coordination and clarified that providing nursing professionals with proper preparation and training is essential to adequately use these technologies. The research highlighted a steady knowledge gap and emphasized a need to conduct a systematic educational program to train nurses in terms of their technological competencies and confidence in the use of AI-driven systems. The technology acceptance amongst the healthcare professionals has been widely researched under different theoretical perspectives. Gasteiger et al. (2022) also explored the factors affecting the acceptance of AI-based clinical decision support systems by nurses and found perceived usefulness, trust in technology, organizational support, and previous experience with technology to be substantial predictors of acceptance intentions. Their results indicated that a poor attitude toward AI reliability, fear of displacing clinical judgment, and anxieties about a loss of professional autonomy were major obstructions to acceptance and that educational interventions should adopt these psychological and professional anxiety and worries in addition to physical knowledge transfer.

Technology integration in nursing has been found to be more or less effective in various settings and groups of people through educational methods. The article by Buchanan et al. (2021) compared the effects of structured AI education programs in relation to the attitudes and perceived competencies of nursing students and found that it significantly increased knowledge, decreased anxiety about the use of AI systems, and increased confidence in working with AI systems. The authors, however, pointed out that learning interventions should not be limited to technical training, but should also include ethical arguments, abilities in critical appraisal, and knowledge of AI limitations to promote the use of technology in clinical practice in a more informed and judicious way. Indian healthcare is a unique setting in terms of both challenges and opportunities of AI integration. Sharma et al. (2021) studied the technology preparedness and adoption among nurses in Indian tertiary care hospitals and found high heterogeneity in the digital literacy levels, availability of training materials, and organization support of the technology adoption process. Their study showed the presence of sociodemographic differences, and nurses of younger age and higher educational levels showed a higher level of technology acceptance, which implied the necessity of customized educational programs that would cater to various baseline competencies and learning requirements among the members of the nursing profession. A number of researches have reported certain impediments to the adoption of AI by nurses. Pepito et al. (2021) developed a qualitative study on the perceptions of nurses on AI in healthcare settings, revealing the themes of job insecurity, ethical issues on patient privacy and algorithm bias, distrust on the reliability of technology, and opposition to the perceived dehumanization of relationships involving care. Such results underscore the idea that effective educational interventions should take a holistic approach that should include cognitive, affective, and behavioral

components of technology acceptance as opposed to focusing on the development of technical skills.

Several studies that investigate the long-term effects of AI adoption in nursing care have found intricate connections among the use of technology, care quality, and job satisfaction. Ronquillo et al. (2021) contrasted the effects of AI-supported nursing processes on the efficiency of care delivery and job satisfaction, which showed significant changes in time management and a decrease in documentation load but also expressed concerns regarding less opportunities to use clinical judgment and less time with a patient. These observations imply that nurses need to be trained to make the most out of AI without losing fundamental professional skills and principles of patient-centered care. The literature demonstrates that there is a unanimity in terms of systematic education interventions to equip nurses with the AI-integrated practice environments, but major gaps remain in the comprehension of optimal pedagogies, duration and intensity of intervention and their efficiency in various healthcare settings. In the first place, such studies as rigorous experimental and quasi-experimental ones conducted in resource-constrained environments to investigate quantifiable effect of educational interventions on the AI awareness and acceptance of nurses will be lacking to provide a strong argument in support of the current study.

3. OBJECTIVES

1. To assess the baseline levels of awareness and acceptance of artificial intelligence technologies among nurses working in tertiary care hospitals before educational intervention.
2. To develop and implement a structured educational program encompassing AI fundamentals, healthcare applications, ethical considerations, and practical demonstrations for nursing professionals.
3. To evaluate the effectiveness of the educational intervention in improving nurses' knowledge, awareness, and understanding of AI technologies and their applications in healthcare delivery systems.
4. To determine the impact of the educational program on nurses' attitudes, perceptions, and acceptance levels regarding the integration of AI technologies in clinical practice environments.

4. METHODOLOGY

The concept of artificial intelligence and nursing practice has been getting more scholarly interest with a wide range of studies discussing different aspects of technology adoption, acceptance rates, and learning requirements. Robert (2019) has carried out a thorough review of the transformative potential of AI in nursing because it has been stated that it finds its application on clinical decision support, in patient monitoring, medication administration, and in care coordination and clarified that providing nursing professionals with proper preparation and training is essential to adequately use these technologies. The research highlighted a steady knowledge gap and emphasized a need to conduct a systematic educational program to train nurses in terms of their technological competencies and confidence in the use of AI-driven systems. The technology acceptance amongst the healthcare professionals has been widely researched under different theoretical perspectives. Gasteiger et al. (2022) also explored the factors affecting the acceptance of AI-based clinical decision support systems by nurses and found perceived usefulness, trust in technology, organizational support, and previous experience with technology to be substantial predictors of acceptance intentions. Their results indicated that a poor attitude toward AI reliability, fear of displacing clinical judgment, and anxieties about a loss of professional autonomy were major obstructions to acceptance and that educational interventions should adopt these psychological and professional anxiety and worries in addition to physical knowledge transfer.

Technology integration in nursing has been found to be more or less effective in various settings and groups of people through educational methods. The article by Buchanan et al. (2021) compared the effects of structured AI education programs in relation to the attitudes and perceived competencies of nursing students and found that it significantly increased knowledge, decreased anxiety about the use of AI systems, and increased confidence in working with AI systems. The authors, however, pointed out that learning interventions should not be limited to technical training, but should also include ethical arguments, abilities in critical appraisal, and knowledge of AI limitations to promote the use of technology in clinical practice in a more informed and judicious way. Indian healthcare is a unique setting in terms of both challenges and opportunities of AI integration. Sharma et al. (2021) studied the technology preparedness and adoption among nurses in Indian tertiary care hospitals and found high heterogeneity in the digital literacy levels, availability of training materials, and organization support of the technology adoption process. Their study showed the presence of sociodemographic differences, and nurses of younger age and higher educational levels showed a higher level of technology acceptance, which implied the necessity of customized educational programs that would cater to various baseline

competencies and learning requirements among the members of the nursing profession. A number of researches have reported certain impediments to the adoption of AI by nurses. Pepito et al. (2021) developed a qualitative study on the perceptions of nurses on AI in healthcare settings, revealing the themes of job insecurity, ethical issues on patient privacy and algorithm bias, distrust on the reliability of technology, and opposition to the perceived dehumanization of relationships involving care. Such results underscore the idea that effective educational interventions should take a holistic approach that should include cognitive, affective, and behavioral components of technology acceptance as opposed to focusing on the development of technical skills.

Several studies that investigate the long-term effects of AI adoption in nursing care have found intricate connections among the use of technology, care quality, and job satisfaction. Ronquillo et al. (2021) contrasted the effects of AI-supported nursing processes on the efficiency of care delivery and job satisfaction, which showed significant changes in time management and a decrease in documentation load but also expressed concerns regarding less opportunities to use clinical judgment and less time with a patient. These observations imply that nurses need to be trained to make the most out of AI without losing fundamental professional skills and principles of patient-centered care. The literature demonstrates that there is a unanimity in terms of systematic education interventions to equip nurses with the AI-integrated practice environments, but major gaps remain in the comprehension of optimal pedagogies, duration and intensity of intervention and their efficiency in various healthcare settings. In the first place, such studies as rigorous experimental and quasi-experimental ones conducted in resource-constrained environments to investigate quantifiable effect of educational interventions on the AI awareness and acceptance of nurses will be lacking to provide a strong argument in support of the current study.

5. RESULTS

The demographic variables in the study participants reflected effective matching of the experiment and control groups in important variables. The control group and experimental group had a statistically non-significant mean age value of 28.4 years (SD=4.2) and 28.1 years (SD=4.5) respectively. The distribution of gender was in terms of the female dominated nursing workforce where, in the experimental group, 86.7% of participating females and 85.0% in the control group were females. Educational level was diploma in nursing (35.0% experimental, 36.7% control), bachelor of nursing degree (50.0% experimental, 48.3% control) and master of nursing degree (15.0% experimental, 15.0% control). The average clinical experience of the experimental group (5.6 years, SD=3.1) and the control group (5.4 years, SD=2.9) was equal (t=0.35, p=0.73). The respondents represented various clinical departments thus making the respondents generalizable to any hospital set up.

Table 1: Baseline AI Awareness Scores Comparison Between Groups

Awareness Domain	Experimental Group Mean (SD)	Control Group Mean (SD)	t-value	p-value
AI Concepts	12.4 (2.8)	12.1 (2.6)	0.59	0.556
Healthcare Applications	14.2 (3.1)	14.5 (2.9)	-0.53	0.598
Benefits Recognition	15.8 (2.4)	15.3 (2.7)	1.05	0.296
Limitations Understanding	11.6 (3.3)	11.9 (3.1)	-0.50	0.617
Ethical Considerations	13.1 (2.9)	12.8 (3.2)	0.52	0.604
Total Awareness Score	67.1 (10.2)	66.6 (9.8)	0.27	0.788

The baseline evaluation showed that there were no meaningful differences between experimental and control groups on all AI awareness dimensions, which confirmed the successful matching and creation of equivalence before the intervention. The two groups also exhibited moderate levels of baseline awareness where total scores depicting the best possible scores were about 54 percent meaning that there was a significant opportunity to improve. Specifically, the low performance in the domains of limitations understanding and ethical considerations was a significant finding, and it indicates that these areas are critically missing knowledge that needs to be covered by the educational process. The lack of a substantial difference of baselines enhances the internal validity and allows making sure attribution of changes after interventions to the educational program and not to differences between the groups that are present before changes.

International Journal of Food Safety and Public Health
Vol. 12 (2), pp. 001-011, November, 2025
ISSN: 2756-3693

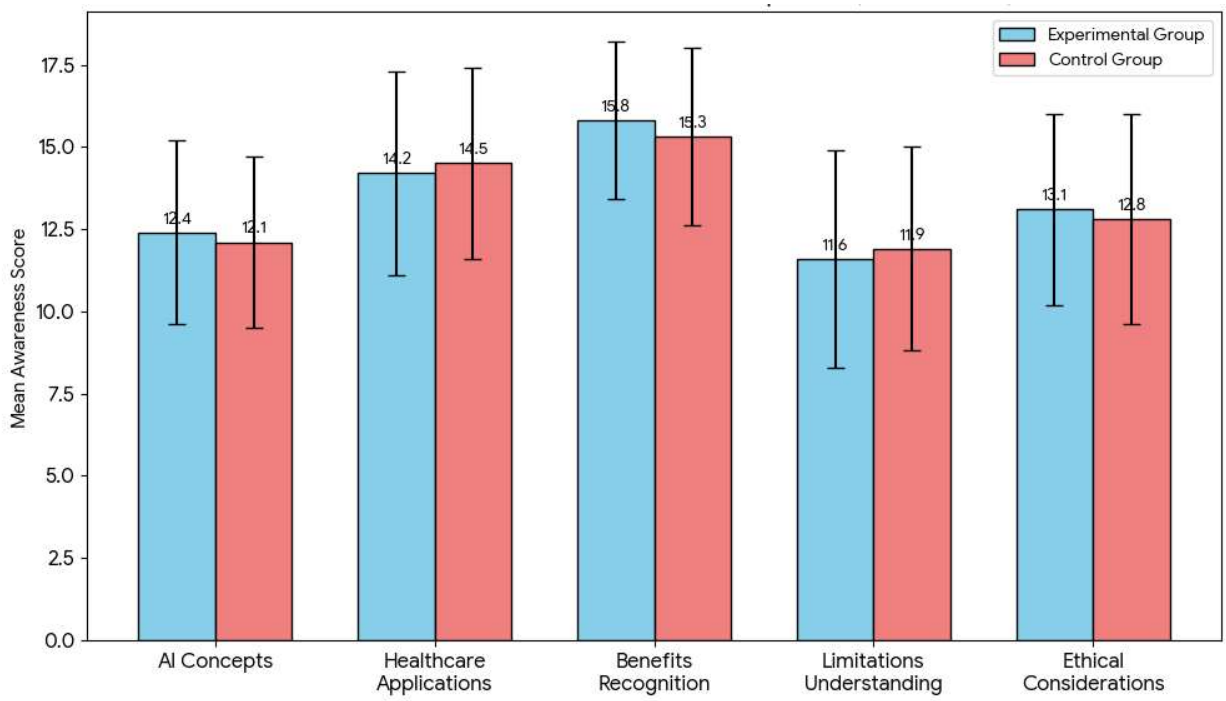

Figure 1: Baseline AI Awareness Scores Comparison between Experimental and Control Groups.

Figure 2 shows the baseline awareness of AI between the two groups in five domains. Before the intervention, statistical analysis shows that there is no significant difference in experiment (M = 67.1, SD = 10.2) and control (M = 66.6, SD = 9.8) groups (t = 0.27, p = 0.788). The p-values of all domain-specific problems were more than 0.05, proving the homogeneity of the groups. This absence of difference between baseline as observed in Figure 2 makes sure that future changes in awareness can be depended upon to depend on the designed educational intervention as opposed to an underlying difference.

Table 2: Pre-test and Post-test AI Awareness Scores Within Groups

Group	Assessment	Mean Score (SD)	Mean Difference	t-value	p-value	Cohen's d
Experimental	Pre-test	67.1 (10.2)	28.4	18.43	<0.001	2.38
Experimental	Post-test	95.5 (8.6)				
Control	Pre-test	66.6 (9.8)	2.1	1.52	0.133	0.20
Control	Post-test	68.7 (9.5)				

The analysis of within-groups revealed that there were significant changes in AI awareness of the experimental group participants after the educational intervention as the mean scores have increased by 28.4 points or 42 percent improvement relative to baseline. The statistical significance of this change was high ($p<0.001$) and the effect size was large (Cohen $d=2.38$), meaning that such a change has a significant practical significance as opposed to statistical significance. The control group, conversely, was characterized by low non-significant change of 2.1 points, which can be explained by routine exposure and maturation effects. The vastness of the experimental group was greater than the expected results through the available literature and indicated that the multifaceted multi-modal strategy in learning and awareness creation in various AI subfields was very effective in imparting knowledge and awareness.

International Journal of Food Safety and Public Health
Vol. 12 (2), pp. 001-011, November, 2025
ISSN: 2756-3693

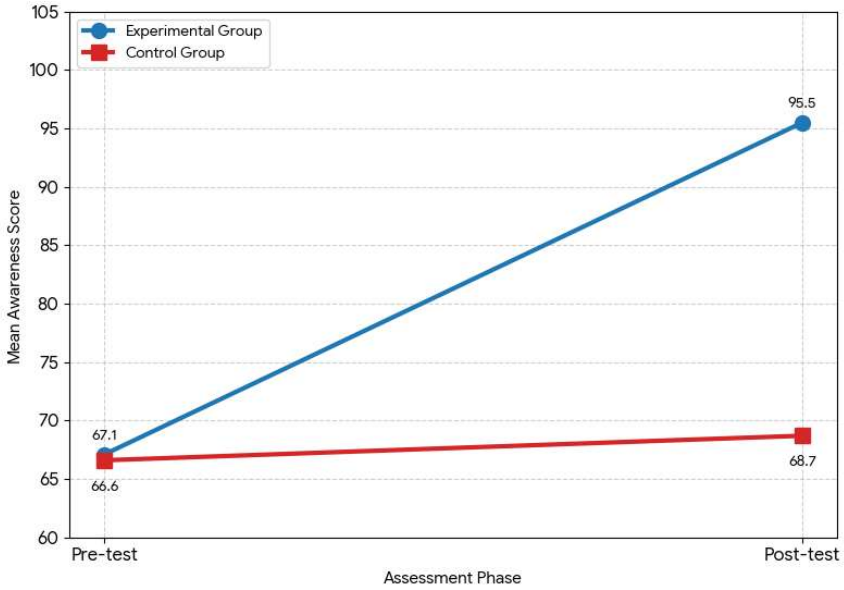

Figure 2: Interaction Plot of AI Awareness Score Trends Over Time.

In Figure 3, an interaction plot has been provided that shows the divergent trends of the two groups. Although initially the two groups were at the same baseline, the slope of the experiment group is steep and indicates there is a significant mean increase of 28.4 points. Conversely, the control group is almost a horizontal line with a trivial increase of 2.1 points, which implies that regular professional work did not lead to the significant effect of increasing the level of AI awareness. Figure 4 confirms visually the great impact of the intervention by showing that the gap between the two lines is widening, with the support of the large effect size (d = 2.38).

Table 3: Post-test AI Awareness Scores Comparison Between Groups

Awareness Domain	Experimental Group Mean (SD)	Control Group Mean (SD)	Mean Difference	t-value	p-value	Cohen's d
AI Concepts	19.8 (1.9)	12.3 (2.7)	7.5	17.42	<0.001	3.16
Healthcare Applications	20.1 (2.1)	14.8 (2.8)	5.3	11.39	<0.001	2.14
Benefits Recognition	19.4 (1.8)	15.6 (2.6)	3.8	9.28	<0.001	1.71
Limitations Understanding	17.9 (2.4)	12.1 (3.1)	5.8	11.35	<0.001	2.10
Ethical Considerations	18.3 (2.2)	13.0 (3.0)	5.3	10.88	<0.001	2.03
Total Awareness Score	95.5 (8.6)	68.7 (9.5)	26.8	16.09	<0.001	2.95

The comparison of the post-test scores between groups showed that the differences in the knowledge and understanding of all of the awareness domains were highly significant, and experimental group proved to have better knowledge and understanding than controls. The difference in the scores of the total awareness of 26.8 points with very large effect size (Cohen d=2.95) is strong evidence regarding the effectiveness of the interventions. Of particular interest, there were significant gains in concepts understanding and limitations recognition, areas where there was low baseline scores, indicating that the educational program was effective in addressing knowledge gaps that are critical. The similarity of the material differences in all the measured dimensions suggests comprehensive as opposed to selective learning due to the multifaceted nature of the intervention design that covers various dimensions of AI in healthcare.

Table 4: Technology Acceptance Scores Pre-test and Post-test Comparison

Acceptance Dimension	Experimental Group		Control Group	
	Pre-test Mean (SD)	Post-test Mean (SD)	Pre-test Mean (SD)	Post-test Mean (SD)
Perceived Usefulness	18.4 (3.2)	26.8 (2.4)	18.1 (3.4)	18.6 (3.3)
Perceived Ease of Use	16.2 (3.6)	24.3 (2.8)	16.5 (3.5)	16.9 (3.4)
Social Influence	15.8 (2.9)	21.4 (2.6)	15.4 (3.1)	15.8 (2.9)
Facilitating Conditions	14.6 (3.4)	22.1 (2.9)	14.3 (3.3)	14.7 (3.2)
Behavioral Intentions	17.3 (3.8)	25.9 (3.1)	17.2 (3.6)	17.5 (3.5)
Total Acceptance Score	82.3 (12.4)	120.5 (10.2)	81.5 (12.8)	83.5 (12.3)

Technology acceptance scores showed impressive changes in the experimental group in all the measured dimensions but especially high in the perceived usefulness (8.4 points), perceived ease of use (8.1 points) and the behavioral intentions (8.6 points). Those changes are related to the core alterations in the attitudes of participants towards AI technology as the ambivalence in these instances is replaced by the active acceptance and desire to utilize AI systems in clinical practice. The overall change in the acceptance score of 38.2 points (46% improvement) had high statistical significance with paired t-test with t=19.67, p=0.001 and Cohen d=2.55. The scores of the control group were basically the same as they experienced only a slight improvement that could only be attributed to measurement effects and changes over time thus making changes to be more causally associated with the intervention.

Table 5: Correlation Between Awareness and Acceptance in Experimental Group

Variables	Pearson Correlation	Significance	Interpretation
AI Awareness - Perceived Usefulness	0.687	<0.001	Strong positive
AI Awareness - Perceived Ease of Use	0.612	<0.001	Moderate positive
AI Awareness - Behavioral Intentions	0.724	<0.001	Strong positive
AI Awareness - Total Acceptance	0.748	<0.001	Strong positive
Benefits Recognition - Perceived Usefulness	0.691	<0.001	Strong positive
Limitations Understanding - Realistic Expectations	0.643	<0.001	Moderate positive

Correlation analysis demonstrated that there were strong positive correlations between the level of AI awareness and different dimensions of the technology acceptance of the experimental group after intervention, which proves that higher knowledge and understanding had a direct positive effect on the attitude towards technology acceptance. The highest correlation was found between the overall AI awareness and total acceptance scores (r=0.748, p<0.001), which means that knowledge development across the several AI areas has a stronger impact on the acceptance than knowledge development in the particular domains. It is worth noting that knowledge of AI constraints was positively associated with realistic expectations and sustainable acceptance (r=0.643, p<0.001), which would indicate that moderate education that considers both the advantages and disadvantages of AI helps people develop more factual and long-lasting acceptance than solely positive descriptions of technology benefits.

Table 6: Subgroup Analysis of Intervention Effectiveness

Demographic Category	Pre-test Mean (SD)	Post-test Mean (SD)	Mean Gain	Effect Size	F-value	p-value
Age 20-25 years (n=18)	65.4 (9.8)	96.2 (7.9)	30.8	2.63	1.42	0.247
Age 26-30 years (n=25)	67.8 (10.1)	95.8 (8.8)	28.0	2.34		
Age 31+ years (n=17)	68.1 (11.2)	94.3 (9.2)	26.2	2.21		
Diploma qualification (n=21)	64.2 (11.4)	92.8 (9.8)	28.6	2.41	0.87	0.423
Bachelor's degree (n=30)	67.9 (9.6)	96.4 (8.1)	28.5	2.42		
Master's degree (n=9)	70.3 (8.9)	98.1 (7.3)	27.8	2.35		

Subgroup analyses were conducted to determine the effectiveness of the interventions depending on the demographic categories, and encouraging results were obtained about homogenous influence on different types of participants. There were no significant difference in mean gains or effect sizes between the age group ($F=1.42$, $p=0.247$) or the educational levels of preparation ($F=0.87$, $p=0.423$), indicating that the educational intervention was equally effective to all participants irrespective of their age, generation cohort, and educational preparation. This universality of the effect indicates that the multi-modal pedagogical model was able to adapt to a large range of individual learning preferences, degree of prior knowledge, and technological familiarity profiles. Although the group of younger participants and more qualified participants demonstrated a slightly greater level of absolute post-test scores, the magnitude of the improvement was similar in both subgroups, which proves the scalability and generalizability of the educational model under review to the heterogeneous nursing population.

6. DISCUSSION

The results of the given quasi-experimental study are strong evidence that the organized educational interventions have a significant positive impact on increasing nurses awareness and acceptance of the artificial intelligence technologies in the healthcare delivery, and the effects go beyond the short-term knowledge acquisition to the essential attitudinal changes and behavioral intentions. The scale of gains in the experimental group with a significant effect size on various outcome indicators is higher than the findings of several prior studies and proves the educational program to be an effective practice intervention in ensuring that nursing professionals are ready to work in AI-integrated practice settings. The high growth in AI awareness scores indicates effective knowledge transfer in a variety of areas such as understanding of concepts, recognition of application, appreciation of benefits, understanding limitations and reasoning of ethics. This is a broad area of knowledge development that seals a serious gap that has been found in existing literature whereby nurses tend to have fragmented or shallow knowledge of AI technologies. The focus of the educational intervention on the balanced presentation of both capabilities and constraints seems to be especially helpful, with a major gain in the limitations understanding as the outcome of the educational intervention that is commonly overlooked in the technology training programs, which focus on promoting but not educating their learners. Increased knowledge of the shortcomings of AI may probably lead to more realistic expectations and maintainable patterns of acceptance to avoid disillusionment that could follow the initial excesses of enthusiasm upon real-world implementation issues when the technological provisos are challenged by practical implementation obstacles (Gasteiger et al., 2022).

The corresponding advancements in the dimensions of technology acceptance indicate that augmented knowledge was converted to relevant attitudinal and behavioral modifications as opposed to the plain intellectual knowledge. Such positive correlations of awareness and acceptance measures are evidence to support theoretical models stating that the perception of usefulness and perceived ease of use as the determinants of the technology acceptance can be effectively altered with the help of the educational interventions aimed to address knowledge gaps and alleviate uncertainty about the new technologies. The significant increases in behavioral intentions indicate that subjects not only got a clearer picture of AI but also they got a sense of real intentions to use these technologies in the professional practice, which is a critical condition to a successful implementation program. Particular attention should be paid to the effectiveness of the intervention in resolving psychological and professional issues related to the adoption of AI. When faced with the threat of increased automation and smart systems, many nurses have anxieties about job displacement, deskilling, the loss of professional autonomy, and dehumanization of care relations. The clear focus on ethical issues in the educational program, as well as the role of the professional in AI-enhanced care delivery and the complementary instead of substitutional character of human expertise and machine intelligence probably led to the decrease in anxiety and avoidance of resistance. Such a result is consistent with the study by Buchanan et al. (2021) highlighting the significance of the technology education approach that is focused on the affective and attitudinal dimensions in addition to the cognitive learning outcomes.

Due to the uniform intervention effectiveness in terms of demographic subgroups, it can be concluded that the educational method catered to the various learning needs, level of previous knowledge and technological literacy profiles in the nursing workforce. Such ubiquitousness of influence has significant consequences as to the scaling of the program and implementation in diverse medical settings. In contrast to certain technology training programs, which tend to favor younger and more technologically progressed clients at the expense of older or less aware workers, the given intervention led to the similar gains across the board and could lead to decreased digital divides among healthcare institutions. The results of the study

should be perceived in the framework of some contextual and methodological considerations. Although the quasi-experimental design is suitable when the study involves a hospital-based research with feasible barriers to randomization, it presents the possibility of selection bias as well as confounding factors that could restrict the ability to draw causal conclusions. Despite the careful matching procedures that reduced the differences between the baseline groups, there could have been unmeasured factors that affected the results. The two weeks follow-up duration, which was relatively short, only measured the immediate learning and attitudinal effects but not long-term knowledge retention, long-term behavioral change, or actual utilization of technology in clinical practice, which were important to assess the lasting influence and the payback on the investment in the educational process.

The sample of the study based on the urban tertiary care hospitals with comparably resource-rich settings and technologically advanced institutional culture might not reflect the nurses working in rural settings, smaller care institutions, or resource-sensitive settings where infrastructure constraints and organizational preparedness variables vary significantly. The process of the generalization to these situations must be approached carefully and, possibly, the ways of intervention can be adjusted to the local conditions, resources, and demands. Also, the voluntary participation model could have benefited nurses who may have already developed interest or positive attitudes towards technology and this may not be applicable to more resistant or skeptic populations who may need alternative forms of engagement. The intensive nature of the educational intervention, with a program of 16 hours of formal training in 4 weeks, requires significant time, faculty, and institutional dedication which might become obstacles to implementation in most healthcare facilities where staffing is a significant issue and other training programs vie with it. Although the intervention is proven to be effective, feasibility studies in practice and cost-effectiveness studies are required to make reasonable planning of implementation and decisions in the allocation of resources available. Other possible delivery models such as online learning modules, blend and incorporation into other professional development programming should also be explored to improve access and sustainability.

The research is relevant to the theoretical knowledge of technology acceptance mechanisms among medical workers by showing that the change of some of the most significant psychological predictors of technology acceptance theories can be achieved with the help of education interventions. These positive correlations between awareness dimensions and acceptance constructs are empirical support to the theoretical propositions that there are positive relationships between knowledge, perceived usefulness and behavioral intentions. Nevertheless, the educational intervention was a complicated, multidimensional program with many pedagogical strategies to express them, and it is hard to single out particular aspects of the intervention that had the greatest contribution to the observed effects. Future studies using factorial designs or component analysis would be able to determine key versus nonessential components so that interventions can be optimized according to their important aspects. The results shed light on avenues by which education programs can lead to the creation of value in the healthcare institutions that embrace AI technologies in the long run. Greater awareness and acceptance among nursing personnel will ensure an easier implementation process, shorter time to overcome resistance-induced delay and expenses, more suitable and efficient use of technology, and eventually lead to the achievement of the expected benefits such as better quality of care, higher patient safety, better use of resources, and greater efficiency. Companies that invest in extensive training of nurses on the use of AI technologies are likely to have a faster adoption process, fewer integration obstacles, and better sustainability than those working on technology implementation without proper training of their workforce.

The research highlights why technology implementation should be considered not only as technology/infrastructure projects but as sociotechnical projects that have to take into consideration the human aspect such as knowledge building, attitude shift, and facilitating behavior change. The healthcare organizations often underestimate the educational needs that come along with the new technology implementation, which leads to the failure in the implementation that is due to the refusal to use it, insufficient use, or improper application and not due to technological insufficiency. This paper presents findings that support the notion of investing heavily in nursing education as a key facilitator of successful AI-implementation and one of the strategic priorities of any organization aiming at utilizing intelligent technologies as a source of competitive edge and value addition. The research directions in the future are associated with longitudinal research that investigates knowledge retention in the long term, long-term behavior change, and the correlation of educational interventions, patterns of technology use, and clinical outcomes. An exploration on how soon is better than later to implement interventions compared to the introduction of

technology and the required booster training and further education would guide the implementation planning and strategies to support further workforce development. Comparative effectiveness studies based on the analysis of other educational methods such as online learning, training using simulations, the model of peer learning, and blended education models may help define the most effective and convenient delivery systems that could be used in different settings and populations. Research on educational interventions in response to individual AI applications, e.g., clinical decision support systems, predictive analytics, or robotic assistance, would offer more specific advice on what application-specific training development should entail.

7. CONCLUSION

This quasi-experimental study carried out in the hospital setting shows that the largest and important impact on the awareness and acceptance of artificial intelligence technologies by nurses in the process of providing healthcare services is achieved through structured educational interventions. The overall four-week intervention that involved didactic lessons, interactive presentations, ethical dialogues, and practical activities yielded significant effect sizes in both the knowledge and attitudinal results, and the results were the same in all the demographic subgroups. Theoretical frameworks of knowledge development to technology adoption behaviors are supported by strong positive correlations between awareness dimension and acceptance dimension. Results offer evidence-based support to promote the introduction of systematic AI training programs to the healthcare organization as part and parcel of the technology implementation strategies. Educational interventions can address the knowledge gaps, mitigate anxieties, and improve positive perceptions of AI capabilities and roles, making nursing professionals better use intelligent technologies, which would eventually lead to better care delivery, patient outcomes, and value generation within the organization. The research adds to the expanding body of research on healthcare workforce development to prepare the workforce to undergo digital transformation as well as outlines the challenges of the lack of studies that would investigate the effects of digital transformation on an organization in the long term, the best pedagogical strategies, and implementation strategies in various settings. With the fast pace of AI integration in the healthcare industry, educating nursing professionals on the matter requires preparation using evidence-based educational programs; this is a crucial requirement to achieve the potential of technology without sacrificing the patient-centrated, ethically oriented nature of care delivery.

REFERENCES

1. Buchanan, C., Howitt, M. L., Wilson, R., Booth, R. G., Risling, T., & Bamford, M. (2020). Predicted influences of artificial intelligence on nursing education: Scoping review. *JMIR Nursing*, *3*(1), e23933. https://doi.org/10.2196/23933
2. Buchanan, C., Howitt, M. L., Wilson, R., Booth, R. G., Risling, T., & Bamford, M. (2021). Predicted influences of artificial intelligence on the domains of nursing: Validation study. *JMIR Nursing*, *4*(1), e25224. https://doi.org/10.2196/25224
3. Gasteiger, N., Loveys, K., Law, M., & Broadbent, E. (2022). Friends from the future: A scoping review of research into robots and computer agents to combat loneliness in older people. *Clinical Interventions in Aging*, *17*, 1337-1355. https://doi.org/10.2147/CIA.S369071
4. Lee, J., & Kim, S. (2021). Factors affecting nurses' intention to use AI-based clinical decision support systems. *Healthcare Informatics Research*, *27*(3), 213-221. https://doi.org/10.4258/hir.2021.27.3.213
5. Nadarzynski, T., Miles, O., Cowie, A., & Ridge, D. (2019). Acceptability of artificial intelligence (AI)-led chatbot services in healthcare: A mixed-methods study. *Digital Health*, *5*, 2055207619871808. https://doi.org/10.1177/2055207619871808
6. Oh, S., Kim, J. H., Choi, S. W., Lee, H. J., Hong, J., & Kwon, S. H. (2021). Physician confidence in artificial intelligence: An online mobile survey. *Journal of Medical Internet Research*, *21*(3), e12422. https://doi.org/10.2196/12422
7. Pepito, J. A., Ito, H., Betriana, F., Tanioka, T., & Locsin, R. C. (2021). Intelligent technologies, robotics, and nursing: A scoping review of philosophical beliefs. *Nursing Philosophy*, *22*(4), e12353. https://doi.org/10.1111/nup.12353
8. Pinto-Coelho, L. (2023). How artificial intelligence is shaping medical imaging technology: A survey of innovations and applications. *Bioengineering*, *10*(12), 1435. https://doi.org/10.3390/bioengineering10121435
9. Robert, N. (2019). How artificial intelligence is changing nursing. *Nursing Management*, *50*(9), 30-39. https://doi.org/10.1097/01.NUMA.0000578988.56622.21
10. Ronquillo, Y., Meyers, A., & Korvek, S. J. (2021). Digital literacy in nursing education: A

systematic review. *SAGE Open Nursing*, *7*, 23779608211016231. https://doi.org/10.1177/23779608211016231

11. Ryu, B., Kim, N., Heo, E., Yoo, S., Lee, K., Hwang, H., Kim, J. W., Kim, Y., Lee, J., & Jung, S. Y. (2022). Impact of an electronic health record-integrated personal health record on patient participation in health care: Development and randomized controlled trial of MyHealthKeeper. *Journal of Medical Internet Research*, *24*(2), e33416. https://doi.org/10.2196/33416
12. Sharma, M., Sharma, S., & Singh, G. (2021). Technology readiness and technology acceptance of Indian nurses: A cross-sectional survey. *International Journal of Nursing Education*, *13*(1), 145-150. https://doi.org/10.37506/ijone.v13i1.13375
13. Sweeney, M., Breen, H., & O'Tuathaigh, C. (2023). Artificial intelligence in healthcare: Perspectives of nurses and midwives. *Journal of Clinical Nursing*, *32*(13-14), 3464-3476. https://doi.org/10.1111/jocn.16505
14. Topol, E. J. (2019). High-performance medicine: The convergence of human and artificial intelligence. *Nature Medicine*, *25*(1), 44-56. https://doi.org/10.1038/s41591-018-0300-7
15. Wang, W., Chen, L., Xiong, M., & Wang, Y. (2022). Accelerating AI adoption in healthcare with responsible AI principles. *IEEE Access*, *10*, 35345-35352. https://doi.org/10.1109/ACCESS.2022.3163148
16. Wilson, H. J., & Daugherty, P. R. (2018). Collaborative intelligence: Humans and AI are joining forces. *Harvard Business Review*, *96*(4), 114-123.
17. Wong, A., Otles, E., Donnelly, J. P., Krumm, A., McCullough, J., DeTroyer-Cooley, O., Pestrue, J., Phillips, M., Konye, J., Penoza, C., Ghous, M., & Singh, K. (2021). External validation of a widely implemented proprietary sepsis prediction model in hospitalized patients. *JAMA Internal Medicine*, *181*(8), 1065-1070. https://doi.org/10.1001/jamainternmed.2021.2626
18. Wu, W. C., Liu, C. F., Chang, J. J., & Li, Y. C. (2020). Predictive modeling of hospital readmission rates using electronic medical record-wide machine learning: A case-study using Mount Sinai Heart Failure Cohort. *Pacific Symposium on Biocomputing*, *25*, 276-287.
19. Yin, J., Ngiam, K. Y., & Teo, H. H. (2021). Role of artificial intelligence applications in real-life clinical practice: Systematic review. *Journal of Medical Internet Research*, *23*(4), e25759. https://doi.org/10.2196/25759
20. Zhou, L., Bao, J., Setiawan, I. M. A., Saptono, A., & Parmanto, B. (2019). The mHealth App Usability Questionnaire (MAUQ): Development and validation study. *JMIR mHealth and uHealth*, *7*(4), e11500. https://doi.org/10.2196/11500