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EXPLORING THE ATTITUDES OF BScN STUDENTS TOWARD THE INTEGRATION OF ARTIFICIAL INTELLIGENCE IN FUTURE NURSING PRACTICE

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Abstract

Objective: *To determine the attitudes of BScN students toward the integration of artificial intelligence in future nursing practice and to examine their association with digital health literacy and perceived professional impact.*

Methods: *The present study used a descriptive cross-sectional design where 150 BScN students from two nursing colleges in Mirpurkhas, Sindh, Pakistan were surveyed using an online self-administered questionnaire including demographic information and Attitudes and Competency Assessment Scale (ACAS) with 21 questions. The descriptive statistics, independent samples t-test, one-way ANOVA, Pearson's correlation coefficients, and Cronbach's alpha were determined using IBM SPSS Statistics for version 27.*

Results: *Mean age of participants was 23.1±1.6 years, and 74.0% were males. The mean score regarding attitude towards AI was neutral to moderately positive (3.19±1.27). Attitude score had a highly positively correlated relationship with digital health literacy (r=0.82, p<0.001) and moderately correlated with the impact on professional practice (r=0.68, p<0.001). There were no significant differences based on gender, institution, previous experience in AI training, and academic year (p>0.05). Benefits from the qualitative analysis included improvement in clinical decision-making and documentation process, whereas concerns included lack of training, ethics, privacy, cost of implementation, and decreased interpersonal patient interactions.*

Conclusion: *The BScN students exhibited a reserved yet overall positive attitude towards the incorporation of AI in nursing. Digital health literacy was found to be the highest correlation for having a positive attitude, highlighting the need for incorporating AI skills into the nursing undergraduate curriculum.*

INTRODUCTION

Artificial Intelligence (AI) is one of those technologies that have proven revolutionary in healthcare by providing many chances to enhance clinical decision-making, patient monitoring, diagnostics, workflow efficiency, and resource management[1]. AI clinical decision support systems, predictive analytics, and machine learning algorithms are more commonly used in healthcare to facilitate evidence-based clinical decision-making and improve patients' results[2]. In terms of nursing practice, there have been numerous examples of how AI can be helpful for early signs of patient deterioration, pressure injuries and falls prediction, efficient documentation, and patient safety improvement using clinical decision support systems[3-5]. Nevertheless, AI is supposed to be a supplement to clinical skills and professional judgment of nurses[6].

The fast integration of AI into the healthcare sector implies important aspects for the education of future nurses. Future nurses need to be competent in digital health, health informatics, AI recommendation analysis, and proper use of new technologies[7,8]. In such a situation, there is an educational challenge for nursing education to ensure that nurses can appropriately integrate AI into their practices without losing the essence of patient care and professionalism. Otherwise, improper education will contribute to automation bias and the decline in critical thinking skills of nurses in providing healthcare services[9,10].

While there is international literature indicating positive perceptions of AI among nursing students and healthcare professionals, issues concerning inadequate knowledge, lack of education, algorithmic bias, data privacy, and effect of AI on professional roles still remain[3,8,11]. Nursing students who have higher levels of digital health literacy and competency in informatics seem to exhibit higher acceptability towards AI[12], which indicates that preparedness through education plays a significant role in its success. Although literature is available at an international level, literature from LMICs, especially Pakistan, is still lacking.

Digital health applications have started to be incorporated into Pakistan but the introduction of AI education in the undergraduate nursing curriculum is quite new. There is little knowledge about the readiness of nursing students towards AI, their perceptions and acceptance of AI, especially from regional universities located beyond big cities. It is important to know the attitude of nursing students toward AI. Therefore, the objective of this study was to explore the attitude of BScN students towards the application of artificial intelligence in nursing practice in the future. The objectives included assessing the attitude of students towards AI, assessing the level of digital health literacy of students, assessing the perception of professional implications of AI among students, and examining the relationship between the variables and demographics of the respondents. The results have yielded situational evidence from Sindh, Pakistan, and will help in the development of AI competency-based curricula for future nurses.

2. METHODS

2.1 Study Design and Setting

This is a descriptive cross-sectional study carried out from August 2025 to May 2026 on BScN students studying at Bhittai College of Nursing and Female College of Nursing, Mirpurkhas, Sindh, Pakistan.

2.2 Study Population and Sampling

The study population consisted of BScN students enrolled in Year 1-4 in the two study institutions. Eligible participants were students who were registered in the institution, were above 18 years of age, and were ready to sign the informed consent forms. Participants who did not agree to take part or those who provided incomplete information were excluded from the analysis. The minimum number of participants needed for the study was computed using Cochran's formula and was found to be 150 participants. The sampling strategy used was that of convenience sampling.

2.3 Study Instrument

Data collection was done through an adapted self-administered questionnaire based on a validated instrument previously found to be internally consistent with excellent reliability (Cronbach's α=0.92).15 The instrument comprised of two sections. Section one asked for demographic details such as age, gender, institution, year of study, and prior education or training in AI-related matters. Section two had the 21-item Attitudes and Competency Assessment Scale (ACAS) scored on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). The instrument measured the following three domains:

- Attitudes toward AI in Nursing Practice (10 items)
- Digital Health Literacy and Informatics Competency (6 items)
- Perceived Impact of AI on Nursing Practice (5 items)

The questionnaire was reviewed independently by two senior nursing faculty members to assess face and content validity. Minor wording modifications were made to improve clarity and contextual relevance without changing the conceptual meaning of the original items.

2.4 Data Collection Procedure

Data was obtained through the use of Google forms. Survey links were sent out via WhatsApp groups and communication channels of the institution. Participants who wished to fill out the survey first read an online information form regarding the objectives of the study, voluntary nature of participation, and confidentiality and anonymity of data. Online informed consent from the participants was attained prior to filling out the survey. Participants were advised to fill out the survey only once using the communication channel of the institution. No monetary or educational incentives were offered. All questions in the survey were compulsory in Google forms.

2.5 Data Analysis

The data exported from Google Forms were statistically analyzed in IBM SPSS Statistics version 27.0. The descriptive statistics, such as frequencies, percentages, means, and standard deviations, were used to describe participants' characteristics and questionnaire responses. To analyze the reliability of the questionnaire and domains in terms of internal consistency, Cronbach's alpha coefficient was utilized. For comparison of means of attitude scores by gender, institution, and prior AI experience, independent-samples t-tests were performed. One-way analysis of variance (ANOVA) was used to compare attitudes by academic year. Correlation coefficients were estimated to explore associations between attitude scores, digital health literacy, AI impact, and age. Before performing any statistical analysis, the normality of composite scores was checked. The level of statistical significance was established as $p < 0.05$. To assess the practical significance, standardized effect sizes (Cohen's d for t-tests and eta-squared [η^2] for ANOVA) were calculated. Content analysis was applied to the qualitative data collected with an open-ended question. Two investigators independently analyzed and coded qualitative data, grouped similar codes into themes, and discussed the findings until reaching agreement on each issue.

2.6 Ethical Considerations

The ethical approval was gained from the Ethical Review Committee of Bhittai College of Nursing, Mirpurkhas, Pakistan (Ethical Approval No.: BCNAHS/RC/ERC/2026-15). Voluntary participation was ensured and the informed consent in the electronic form was taken from all the participants prior to the collection of the data. The anonymity and confidentiality of the participants was assured throughout the study. Personal identifiers were not collected and the collected data was kept confidential.

3. RESULTS

3.1 Participant Characteristics

A total of 150 Bachelor of Science in Nursing (BScN) students participated in the study, and all questionnaires were complete and included in the final analysis. The mean age of the participants was **23.1 ± 1.6 years** (range: 18–29 years). Most participants were male (**111, 74.0%**), while **36 (24.0%)** were female and **3 (2.0%)** preferred not to disclose their gender. The majority were enrolled at Bhittai College of Nursing (**111, 74.0%**), whereas **39 (26.0%)** were from the Female College of Nursing. Regarding the

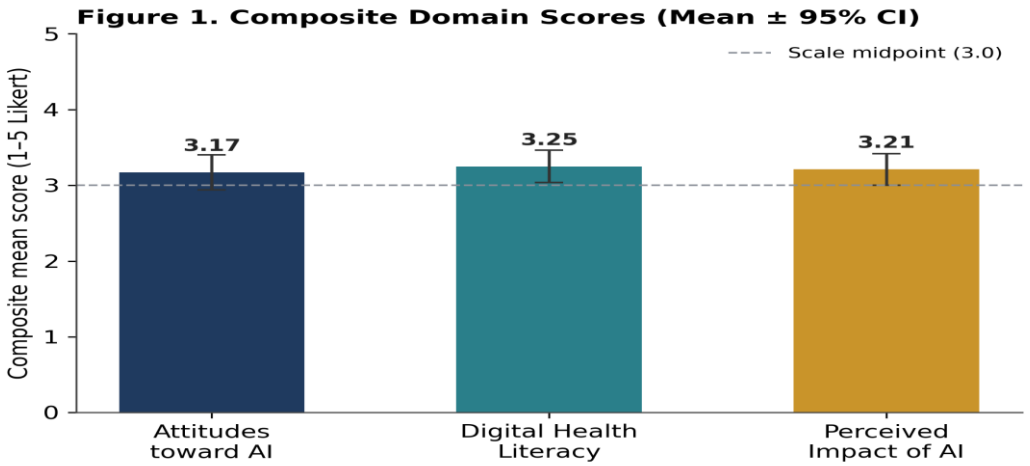
academic year, **11 (7.3%)** were first-year students, **10 (6.7%)** second-year, **32 (21.3%)** third-year, and **97 (64.7%)** fourth-year students. Overall, **115 (76.7%)** participants reported previous formal instruction or training related to artificial intelligence, while **35 (23.3%)** had no previous AI-related training (Table 1).

Table 1. Demographic characteristics of participants (N = 150)

Characteristic	n	%	Notes
Age in years — M (SD), range			23.1 (1.6); 18–29
Gender			
Male	111	74.0	
Female	36	24.0	
Prefer not to say	3	2.0	
Institution			
Bhittai College of Nursing	111	74.0	Male-only intake
Female College of Nursing	39	26.0	Female-only intake
Year of study			
1st Year	11	7.3	
2nd Year	10	6.7	
3rd Year	32	21.3	
4th Year	97	64.7	Over-represented
Previous AI Training			
Yes	115	76.7	
No	35	23.3	

3.2 Attitude Toward Artificial Intelligence

The overall mean attitude score toward the integration of artificial intelligence in future nursing practice was **3.19 ± 1.27**, indicating a neutral to moderately positive attitude among the participants. Among the three domains, the highest mean score was observed for **Digital Health Literacy and Informatics Competency (3.25 ± 1.34)**, followed by **Perceived Impact of AI (3.21 ± 1.29)** and **Attitudes Toward AI in Nursing Practice (3.17 ± 1.45).**



Internal consistency analysis demonstrated excellent reliability for all domains. Cronbach's alpha coefficients ranged from **0.95 to 0.98**, while the overall questionnaire showed a Cronbach's alpha of **0.98** (Table 2).

Table 2. Domain scores and internal consistency of the study instrument

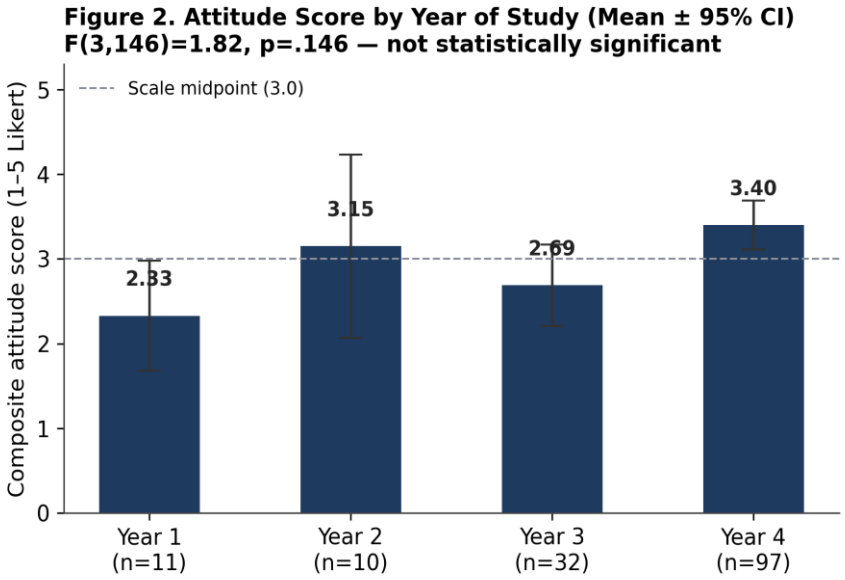
Domain	Items	Mean ± SD	Cronbach's α
Attitudes toward AI in Nursing Practice	10	3.17 ± 1.45	0.98
Digital Health Literacy and Informatics Competency	6	3.25 ± 1.34	0.96
Perceived Impact of AI	5	3.21 ± 1.29	0.95
Overall Scale	21	**3.19 ± 1.27**	**0.98**

3.3 Comparison of Attitude Scores According to Participant Characteristics

Independent-samples *t*-tests and one-way ANOVA were performed to compare overall attitude scores according to demographic and educational characteristics (Table 3). Female students demonstrated a higher mean attitude score than male students (**3.67 ± 1.33** versus **3.02 ± 1.44**); however, the difference was not statistically significant ($t = -1.86$, $p = 0.065$). Similarly, participants from the Female College of Nursing reported slightly higher scores than those from Bhittai College of Nursing (**3.64 ± 1.36** versus **2.96 ± 1.45**), although the difference was not statistically significant ($p = 0.093$). No significant difference was observed between students with previous AI training and those without prior training ($p = 0.675$). Likewise, overall attitude scores did not differ significantly across the four academic years.

Table 3. Comparison of overall attitude scores according to participant characteristics

Variable	Group	Mean ± SD	Test	p-value
Gender	Male	3.02 ±1.44	t = −1.86	0.065
	Female	3.67 ±1.33		
Institution	Bhittai College	2.96 ±1.45	t = −1.69	0.093
	Female College	3.64 ±1.36		
Previous AI Training	Yes	3.12 ±1.48	t = −0.42	0.675
	No	3.26 ±1.40		



3.4 Qualitative Findings

Out of 82 (54.7%) individuals, 28 (68.3%) comments were used for the thematic analysis after eliminating those which were irrelevant or did not have any information worth analyzing. Some of the main advantages of AI mentioned by the participants include better clinical decision-making (n = 11), less documentation load (n = 9), and patient monitoring and safety (n = 8). In terms of drawbacks, insufficient training about AI technologies (n = 12), overdependence on technology with little human interaction (n = 10), financial aspects related to the implementation process (n = 6), and privacy and ethical issues (n = 5) were the most prevalent. Overall, it was concluded that artificial intelligence is an important addition to the work of nurses.

4. DISCUSSION

According to the present research, overall, participants showed neutral to somewhat positive attitude towards AI. That means that nursing students understand how AI can improve healthcare delivery but are concerned about implementation of AI into practice. The results of the current study confirm the trend related to growing interest in AI in healthcare and correspond to growing importance of preparation of future nurses to perform their tasks in technologically advanced clinical environments[11,12]. Overall attitude score obtained in this study confirms the existing knowledge that nursing students tend to see AI as supportive technology that is going to improve healthcare quality but not to replace healthcare professionals[13]. According to Buchanan et al., there is huge potential for AI to improve many aspects of nursing practice such as decision-making, monitoring patients, working processes, and documenting, but AI should always support professional judgment of nurses1. At the same time, O'Connor et al. in their systematic review on AI in nursing and midwifery stated that although nurses see the potential of AI, its implementation requires good preparation of nurses[12,14].

Participants in the present study demonstrated relatively higher scores for **digital health literacy and informatics competency**, indicating that students with greater confidence in digital technologies were more receptive to AI integration. This observation supports previous findings that digital competency is a key determinant of AI acceptance among healthcare professionals[16,17]. Booth et al. emphasized that nursing education must evolve to prepare graduates with competencies in digital health, informatics, and AI literacy to meet the demands of modern healthcare systems[11]. Likewise, Topol argued that future healthcare professionals should possess sufficient digital knowledge to critically interpret AI-generated recommendations while maintaining patient-centered clinical decision-making[17,18].

In addition, there was a statistically significant positive correlation between attitudes towards AI and perceptions regarding professional effects of its use. The students who were convinced that AI can positively influence healthcare provision reported more positive attitudes to its implementation. This

result is consistent with the research conducted by Bodur et al., which showed that nurses find AI useful in terms of increasing the effectiveness of their work, ensuring the safety of patients and making decisions based on evidence, stressing that human judgment is also crucial in providing nursing care[3]. Likewise, Balpande et al. found that intelligent decision support systems are recognized as valuable means for improving healthcare outcomes[8].

Despite these positive perceptions, no statistically significant differences in attitude scores were observed according to gender, institution, academic year, or previous AI-related training. This suggests that acceptance of AI among nursing students may be influenced more by overall digital competency and exposure to technology than by demographic characteristics. Previous systematic reviews have similarly reported inconsistent associations between demographic variables and AI acceptance, indicating that educational preparedness and institutional support are more important determinants of successful AI adoption than age or gender alone[11,12]. Qualitative results have also helped to enhance the understanding gained from quantitative research. The benefits associated with integrating artificial intelligence included clinical decision-making improvement, patient safety enhancement, and decrease in documentation burden. These views correspond to the literature on how AI-based clinical decision support systems can contribute to the early detection of patient deterioration, optimization of nurses' workflows, and prevention of avoidable incidents through predictive analysis[5,13]. On the other hand, participants raised concerns about lack of technical skills, high costs of implementation, ethical considerations, data security, and reduced human contact during providing care to patients. Such issues are also similar to the problems described by the previous researchers in terms of ethical governance, algorithmic discrimination, transparency, accountability, and patients' privacy[9,14,17].

Overall, these results show that nursing students are open to using AI technology but also acknowledge that successful application involves education, ethics, support from the institution, and ongoing professional development. Improvement of AI competencies among the undergraduate nursing curriculum can help prepare students to use AI technology properly while retaining the humanistic principles essential for nursing[11,18].

Study Limitations

There are some limitations. Firstly, the cross-sectional nature of the research makes it impossible to establish cause-and-effect relationships between attitudes towards artificial intelligence and related variables. Secondly, a convenience sample was used in two nursing colleges in Sindh, which may affect the generalizability of the results in relation to other nursing institutes in Pakistan. Thirdly, the data collection method is the use of self-administered questionnaires online, which may lead to bias. Fourthly, the attitudes of the students were measured only once, so future longitudinal research should be conducted.

CONCLUSION

This study revealed that BScN students exhibited relatively positive attitudes towards the implementation of AI in nursing practice, while digital health literacy had a positive correlation with AI acceptance. While recognizing the benefits of AI in the form of improved decision making, increased patient safety, and improved efficiency in healthcare, participants also identified possible challenges related to insufficient preparation, ethics, data security, and possible effects on the nurse-patient relationship. These results indicate the importance of incorporating AI, digital health, and nursing informatics skills into nursing programs at the undergraduate level to adequately prepare future nurses to implement AI in clinical practice safely, effectively, and ethically. Additional studies are needed to investigate the impact of educational programs in AI on nursing students' knowledge, attitudes, and readiness to practice.

DECLARATIONS

AUTHOR CONTRIBUTIONS

Conceptualization: Zeeshan Ahmed, Imran Ali; **Methodology:** Nadeem Ahmed; **Data Collection:** Imran Ali, Ayaz Ali; **Formal Analysis:** Sarba Ali & Mudassar Ali; **Writing – Original Draft Preparation:** Imran

Ali; **Writing – Review & Editing: Zahid Chandio; Supervision: Zeeshan Ahmed.** All authors critically reviewed the manuscript and approved the final version.

Conflict of Interest: The authors declare no conflict of interest.

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Ethical Approval: Approval was obtained from the ethical review committee of Bhittai College of Nursing. Informed consent was obtained from all participants prior to data collection.

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