



Received: 14-06-2026
Accepted: 24-07-2026

International Journal of Advanced Multidisciplinary Research and Studies

ISSN: 2583-049X

Artificial Intelligence Awareness and Readiness among Nursing Students in Saudi Arabia: A Cross-Sectional Survey

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Abstract

Background: Artificial intelligence (AI) has emerged as a transformative technology in healthcare, offering significant opportunities to improve clinical decision-making, patient care, and healthcare efficiency. As AI applications continue to expand across healthcare settings, nursing students must develop adequate awareness and readiness to effectively utilize these technologies in future professional practice.

Aim: This study aimed to assess the level of awareness and readiness toward artificial intelligence among nursing students and to identify the factors associated with AI readiness.

Methods: A quantitative cross-sectional survey was conducted among 396 nursing students at Riyadh Elm University, Saudi Arabia. Data were collected using a structured questionnaire consisting of demographic characteristics, the Artificial Intelligence Awareness Scale, and the Artificial Intelligence Readiness Scale. Descriptive statistics, independent t-test, one-way ANOVA with Tukey HSD post hoc analysis, Pearson correlation, and multiple linear regression were performed using SPSS version 27. Statistical significance was set at $p < 0.05$.

Results: Nursing students demonstrated a moderate level of AI awareness (mean = 3.43 ± 0.44 , 68.57%) and a high level of AI readiness (mean = 3.93 ± 0.45 , 78.52%). Significant differences in AI awareness were observed according to academic level and self-rated computer skills. AI readiness was significantly associated with age, academic level, previous use of AI-related tools, and self-rated computer skills. A strong positive correlation was found between AI awareness and AI readiness ($r = 0.685$, $p < 0.001$). Multiple linear regression analysis identified AI awareness as the strongest independent predictor of AI readiness ($B = 0.681$, $p < 0.001$), with the model explaining 56.9% of the variance in AI readiness ($R^2 = 0.569$).

Conclusion: Nursing students demonstrated positive readiness toward artificial intelligence despite having only moderate awareness. Integrating AI-related education, practical training, and digital competency development into undergraduate nursing curricula may enhance students' awareness and strengthen their readiness to effectively utilize AI technologies in future nursing practice.

Keywords: Artificial Intelligence, Awareness, Readiness, Nursing Students, Nursing Education, Saudi Arabia

Introduction

Artificial intelligence (AI) has become one of the most rapidly advancing technologies in healthcare, transforming clinical practice, healthcare management, medical research, and professional education. AI refers to computer systems capable of performing tasks that typically require human intelligence, including learning, reasoning, problem-solving, decision-making, and language processing. The increasing adoption of AI has improved diagnostic accuracy, personalized treatment planning, disease prediction, and clinical decision-making, making it an essential component of modern healthcare systems (World Health Organization, 2021) ^[1]. AI technologies also contribute to improving healthcare efficiency while supporting safe, high-quality, and patient-centered care (Topol, 2019) ^[3].

The integration of AI into healthcare has expanded across multiple clinical disciplines, including radiology, pathology, intensive care, pharmacy, and nursing. In nursing practice, AI applications support patient monitoring, early detection of clinical deterioration, medication safety, electronic health records, workflow management, and evidence-based clinical decision-making. Rather than replacing nurses, AI is expected to enhance clinical performance by reducing routine

administrative tasks and allowing nurses to spend more time providing direct patient care (Jiang *et al.*, 2017; von Gerich *et al.*, 2022) ^[4, 5].

Nursing students represent the future nursing workforce; therefore, developing their knowledge and readiness regarding AI has become an educational priority. Nursing education institutions are increasingly expected to prepare graduates who possess sufficient digital competencies and the ability to use AI safely and effectively in clinical settings. Integrating AI into nursing curricula can improve students' critical thinking, clinical judgment, digital literacy, and readiness to adapt to technology-driven healthcare environments (World Health Organization, 2021; World Health Organization, 2021) ^[1, 2].

Previous studies have demonstrated that nursing students generally have positive perceptions toward AI and recognize its potential benefits in healthcare. However, the level of AI awareness and readiness varies among students according to academic level, previous AI experience, digital literacy, and educational opportunities. (Sallam, 2023) ^[6] reported that healthcare students generally expressed favorable attitudes toward AI despite having limited practical knowledge. Similarly, (Boztepe *et al.*, 2025) ^[10] found that higher AI literacy was significantly associated with greater readiness to integrate AI into future nursing practice. Furthermore, (Burucu & Türkben Polat, 2025) ^[9] observed that nursing students demonstrated positive attitudes toward AI while emphasizing the need for additional educational preparation before AI implementation in clinical practice.

Saudi Arabia has placed considerable emphasis on digital transformation through Vision 2030, encouraging the integration of artificial intelligence into healthcare services and higher education. Consequently, nursing colleges are expected to prepare graduates who are capable of utilizing AI technologies safely, ethically, and effectively. Recent evidence among Saudi nursing students demonstrated encouraging levels of readiness toward AI while highlighting the importance of strengthening AI-related education within undergraduate nursing programs (Dawood *et al.*, 2025) ^[13].

Despite the growing importance of AI in healthcare, evidence regarding nursing students' awareness and readiness remains limited in Saudi Arabia. Understanding students' current level of awareness and readiness is essential for identifying educational gaps, supporting curriculum development, and preparing competent nurses who can successfully integrate AI technologies into future clinical practice. Therefore, this study aimed to assess the level of artificial intelligence awareness and readiness among nursing students and examine the relationship between AI awareness, readiness, and selected demographic characteristics.

Aims

This study aims to assess artificial intelligence awareness and readiness among undergraduate nursing students in Saudi Arabia.

Research Questions

This study sought to answer the following research questions:

1. What is the level of artificial intelligence awareness

among undergraduate nursing students?

2. What is the level of artificial intelligence readiness among undergraduate nursing students?
3. Is there a significant relationship between artificial intelligence awareness and readiness among undergraduate nursing students?
4. What demographic characteristics are associated with artificial intelligence awareness and readiness among undergraduate nursing students?

Materials and Methods

Study Design

A quantitative cross-sectional survey design was employed to assess artificial intelligence awareness and readiness among undergraduate nursing students in Saudi Arabia.

Study Setting

The study was conducted among undergraduate nursing students enrolled in public and private universities across Saudi Arabia. Data collection was carried out electronically using an online questionnaire distributed through university communication channels and student social media groups.

Study Population

The target population consisted of undergraduate nursing students registered in accredited nursing colleges in Saudi Arabia during the study period.

Inclusion Criteria

Undergraduate nursing students enrolled in public or private universities in Saudi Arabia.

Students who were able to read and understand English.

Students who voluntarily agreed to participate by providing electronic informed consent.

Students who completed the online questionnaire.

Exclusion Criteria

- Internship nursing students.
- Nursing graduates.
- Participants who submitted incomplete questionnaires.

Sampling Technique

A convenience sampling technique was used to recruit participants from multiple universities throughout Saudi Arabia. The survey link was distributed electronically through official student groups and academic communication platforms to maximize participation from different academic levels.

Sample Size

A total of 396 undergraduate nursing students completed the questionnaire and met the eligibility criteria for inclusion in the final statistical analysis. The achieved sample exceeded the minimum sample size required for the study and provided adequate statistical power for descriptive and inferential analyses.

Survey Administration

The questionnaire was distributed electronically using Google Forms. Participation was voluntary, anonymous, and each participant completed the questionnaire only once. The average completion time was approximately 10–15 minutes.

Study Instrument

Data were collected using a structured self-administered questionnaire developed based on previous literature examining artificial intelligence awareness and readiness among healthcare students.

The questionnaire consisted of three sections:

Tool 1: Demographic characteristics, including age, gender, academic level, university type, previous awareness of AI, formal AI training, previous use of AI-related tools, and self-rated computer skills.

Tool 2: Artificial Intelligence Awareness Scale consisting of 10 items measured using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

Tool 3: Artificial Intelligence Readiness Scale consisting of 12 items measured using the same five-point Likert scale. Higher scores indicated greater readiness toward artificial intelligence.

Validity and Reliability

Content validity of the questionnaire was established through expert review before data collection. Internal consistency reliability was assessed using Cronbach's alpha coefficient. The study instrument demonstrated satisfactory reliability, with Cronbach's alpha values ranging from 0.777 to 0.896.

Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics, including frequencies, percentages, means, and standard deviations, were calculated. Independent t-tests, one-way ANOVA, Tukey HSD post hoc analysis, Pearson correlation, and multiple linear regression analyses were performed. Statistical significance was established at $p < 0.05$.

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board (IRB) of Riyadh Elm University before data collection. Electronic informed consent was obtained from all participants before completing the questionnaire. Participation was voluntary, responses were anonymous, and all collected data were treated confidentially and used solely for research purposes.

Results

Table 1: Reliability Analysis of the Study Instrument (N = 396)

Scale	Number of Items	Frequency (n)
AI Awareness Scale	10	0.777
AI Readiness Scale	12	0.870
Overall Questionnaire	22	0.896

Table 1 presents the reliability analysis of the study instrument using Cronbach's alpha coefficient. The AI Awareness Scale, consisting of 10 items, demonstrated acceptable internal consistency (Cronbach's $\alpha = 0.777$), whereas the AI Readiness Scale, comprising 12 items, demonstrated good internal consistency (Cronbach's $\alpha = 0.870$). The overall questionnaire achieved a Cronbach's

alpha coefficient of 0.896, indicating excellent reliability. Since all Cronbach's alpha values exceeded the recommended threshold of 0.70, the study instrument was considered sufficiently reliable for assessing artificial intelligence awareness and readiness among undergraduate nursing students and was deemed appropriate for subsequent statistical analyses.

Table 2: Demographic Characteristics of the Participants (N = 396)

Variable	Category	Frequency	Percentage (%)
Age	18–20 years	76	19.2
	21–23 years	132	33.3
	24–26 years	109	27.5
	Above 26 years	79	19.9
Gender	Male	185	46.7
	Female	211	53.3
Academic Level	First Year	121	30.6
	Second Year	70	17.7
	Third Year	77	19.4
	Fourth Year	128	32.3
University Type	Public	238	60.1
	Private	158	39.9
Previously Heard About AI	Yes	376	94.9
	No	20	5.1
Formal AI Training	Yes	61	15.4
	No	335	84.6
Used AI-Related Tools	Yes	357	90.2
	No	39	9.8
Self-rated Computer Skills	Poor	2	0.5
	Fair	19	4.8
	Good	215	54.3
	Very Good	118	29.8
	Excellent	42	10.6

Table 2 shows the demographic characteristics of the 396 undergraduate nursing students who participated in the study. The largest proportion of the participants was aged 21–23 years (33.3%, $n = 132$), followed by those aged 24–26 years (27.5%, $n = 109$), while 19.9% ($n = 79$) were older than 26 years and 19.2% ($n = 76$) were aged 18–20 years. Female students constituted 53.3% ($n = 211$) of the study sample, whereas male students represented 46.7% ($n = 185$). Regarding academic level, fourth-year students accounted for the largest proportion (32.3%, $n = 128$), followed by first-year students (30.6%, $n = 121$), third-year students (19.4%, $n = 77$), and second-year students (17.7%, $n = 70$). Most participants were enrolled in public universities (60.1%, $n = 238$), while 39.9% ($n = 158$) attended private universities. Furthermore, 94.9% ($n = 376$) reported that they had previously heard about artificial intelligence, although only 15.4% ($n = 61$) had received formal AI training. The majority of participants (90.2%, $n = 357$) reported previous use of AI-related tools. Regarding self-rated computer skills, more than half of the participants (54.3%, $n = 215$) rated their skills as good, followed by 29.8% ($n = 118$) who reported very good skills and 10.6% ($n = 42$) who reported excellent skills. These findings indicate that the study sample had substantial exposure to digital technologies despite the limited proportion of students who had received formal AI education.

Table 3: Descriptive Statistics of Artificial Intelligence Awareness Scale (N = 396)

S. No	Item	Mean $\pm$ SD	Skewness	Kurtosis	Mean Score (%)
1	I understand the basic concept of artificial intelligence.	3.85 $\pm$ 0.70	-0.924	2.175	77.07
2	I am aware of AI applications in healthcare.	3.82 $\pm$ 0.67	-1.505	4.271	76.31
3	AI can improve diagnostic accuracy.	2.57 $\pm$ 0.87	1.132	0.573	51.46
4	AI can enhance patient safety.	2.75 $\pm$ 0.85	0.728	0.362	55.00
5	AI can reduce medical errors.	3.18 $\pm$ 0.74	0.071	0.543	63.64
6	AI is currently used in Saudi healthcare institutions.	3.77 $\pm$ 0.73	-0.757	1.750	75.40
7	Nurses should understand AI technologies.	3.90 $\pm$ 0.60	-1.164	4.409	77.98
8	AI knowledge is important for future nursing practice.	3.94 $\pm$ 0.64	-1.172	4.315	78.74
9	AI will significantly impact the nursing profession.	2.58 $\pm$ 0.99	0.691	-0.210	51.57
10	AI education should be included in nursing curricula.	3.93 $\pm$ 0.69	-1.406	4.813	78.54

Overall AI Awareness Score

Overall Mean $\pm$ SD	Mean Score (%)
3.43 $\pm$ 0.44	68.57%

As shown in Table 3, the overall mean score of the Artificial Intelligence (AI) Awareness Scale among undergraduate nursing students was 3.43 $\pm$ 0.44, corresponding to a mean score of 68.57%, indicating a moderate level of AI awareness. The highest mean scores were recorded for the statements “AI knowledge is important for future nursing practice” (Mean = 3.94 $\pm$ 0.64; Mean Score = 78.74%), “AI education should be included in nursing curricula” (Mean = 3.93 $\pm$ 0.69; Mean Score = 78.54%), and “Nurses should understand AI technologies” (Mean = 3.90 $\pm$ 0.60; Mean Score = 77.98%), demonstrating that most participants

recognized the importance of AI knowledge and education for future nursing practice. Participants also showed good awareness of the basic concepts of AI and its applications in healthcare. However, comparatively lower mean scores were observed for the statements “AI can improve diagnostic accuracy” (Mean = 2.57 $\pm$ 0.87; Mean Score = 51.46%) and “AI will significantly impact the nursing profession” (Mean = 2.58 $\pm$ 0.99; Mean Score = 51.57%), indicating a lower level of confidence regarding the practical and future implications of AI in nursing. Overall, these findings suggest that undergraduate nursing students have a moderate level of AI awareness, highlighting the need to strengthen AI-related education and provide greater practical exposure to support the effective integration of AI into nursing education and clinical practice.

Table 4: Descriptive Statistics of Artificial Intelligence Readiness Scale (N = 396)

S. No	Item	Mean	SD	Skewness	Kurtosis	Mean Score (%)
1	I feel prepared to use AI technologies in clinical practice.	3.907	0.685	-0.875	2.637	78.13
2	I am confident in learning AI-related skills.	3.987	0.699	-0.922	2.478	79.75
3	I am willing to attend AI training programs.	4.040	0.772	-0.634	0.801	80.81
4	I am open to integrating AI tools in patient care.	3.705	0.653	-0.270	0.439	74.09
5	I believe I can adapt to AI-based systems in hospitals.	3.699	0.775	-0.013	-0.156	73.99
6	I feel comfortable using digital health technologies.	3.598	0.670	-0.440	1.269	71.97
7	I am ready to work in AI-supported healthcare environments.	3.977	0.654	-1.125	4.089	79.55
8	I am interested in further education about AI.	3.639	0.725	-0.052	0.399	72.78
9	I believe AI will make my future work easier.	4.088	0.725	-0.736	1.544	81.77
10	I am motivated to improve my technological competencies.	3.990	0.652	-0.761	2.387	79.80
11	I feel capable of understanding AI-based clinical decisions.	4.010	0.595	-0.944	4.083	80.20
12	I am ready to collaborate with AI-driven systems in nursing care.	4.472	0.781	-1.625	2.854	89.44

As shown in Table 4, undergraduate nursing students demonstrated a high level of readiness to adopt and utilize artificial intelligence (AI) technologies in future nursing practice, with all items achieving mean score percentages above 70%. The highest mean score was reported for the statement “I am ready to collaborate with AI-driven systems in nursing care” (Mean = 4.472, SD = 0.781; Mean Score = 89.44%), followed by “I believe AI will make my future work easier” (Mean = 4.088, SD = 0.725; Mean Score = 81.77%) and “I am willing to attend AI training programs” (Mean = 4.040, SD = 0.772; Mean Score = 80.81%). These findings reflect a high level of acceptance of AI and a positive willingness among nursing students to integrate AI technologies into future clinical practice.

Furthermore, participants reported high confidence in learning AI-related skills (Mean = 3.987, SD = 0.699; Mean Score = 79.75%) and strong motivation to enhance their

technological competencies (Mean = 3.990, SD = 0.652; Mean Score = 79.80%). In contrast, the lowest mean scores were observed for “I feel comfortable using digital health technologies” (Mean = 3.598, SD = 0.670; Mean Score = 71.97%) and “I am interested in further education about AI” (Mean = 3.639, SD = 0.725; Mean Score = 72.78%); however, both items still indicated a high level of readiness. In addition, the skewness values ranged from -1.625 to -0.013, while the kurtosis values ranged from -0.156 to 4.089, indicating an acceptable distribution of responses and supporting the use of parametric statistical analyses. Overall, the findings demonstrate that undergraduate nursing students possess a strong level of readiness to embrace artificial intelligence and exhibit positive attitudes toward its adoption, continuous learning, and future integration into nursing education and healthcare practice.

Table 5: Overall Scores of Artificial Intelligence Awareness and Readiness (N = 396)

Scale	No. of Items	Mean $\pm$ SD	Mean Score (%)	Level
Artificial Intelligence Awareness	10	3.43 $\pm$ 0.44	68.57	Moderate
Artificial Intelligence Readiness	12	3.93 $\pm$ 0.45	78.52	High

The findings in Table 5 indicate that the overall scores of the Artificial Intelligence (AI) Awareness and Artificial Intelligence Readiness scales differed among undergraduate nursing students. The overall mean score for the AI Awareness Scale was 3.43 $\pm$ 0.44, corresponding to a mean score percentage of 68.57%, indicating a moderate level of AI awareness. This finding suggests that although nursing students possess a reasonable understanding of artificial intelligence and recognize its importance in healthcare, additional educational efforts are needed to improve their knowledge of its clinical applications and practical implementation.

In contrast, the AI Readiness Scale achieved an overall mean score of 3.93 $\pm$ 0.45, corresponding to a mean score percentage of 78.52%, indicating a high level of readiness. Participants demonstrated positive attitudes toward adopting AI technologies, expressed confidence in acquiring AI-related competencies, and showed a strong willingness to integrate AI into future nursing practice.

Furthermore, the readiness score exceeded the awareness score, indicating that nursing students were more prepared and motivated to adopt artificial intelligence than their current level of knowledge alone might suggest. These findings emphasize the importance of strengthening AI-related educational content within undergraduate nursing curricula while maintaining students' high level of readiness through practical training and continuous exposure to AI applications in healthcare settings.

Table 6: Comparison of AI Awareness by Demographic Characteristics (N = 396)

Variable	Category	Mean $\pm$ SD	Test	p-value
Gender	Male	3.41 $\pm$ 0.31	t = -0.973	0.331
	Female	3.45 $\pm$ 0.52		
Age	18–20 years	3.33 $\pm$ 0.29	F = 2.027	0.110
	21–23 years	3.44 $\pm$ 0.36		
	24–26 years	3.44 $\pm$ 0.30		
	Above 26 years	3.49 $\pm$ 0.73		
Academic Level	First Year	3.31 $\pm$ 0.43	F = 4.120	0.007*
	Second Year	3.49 $\pm$ 0.34		
	Third Year	3.47 $\pm$ 0.42		
	Fourth Year	3.48 $\pm$ 0.49		
University Type	Public	3.45 $\pm$ 0.42	t = -1.231	0.219
	Private	3.39 $\pm$ 0.46		
Previously Heard About AI	Yes	3.43 $\pm$ 0.39	t = -0.349	0.731
	No	3.36 $\pm$ 0.99		
Formal AI Training	Yes	3.40 $\pm$ 0.34	t = 1.709	0.092
	No	3.57 $\pm$ 0.75		
Used AI-Related Tools	Yes	3.44 $\pm$ 0.40	t = -1.113	0.272
	No	3.32 $\pm$ 0.66		
Self-rated Computer Skills	Poor	4.17 $\pm$ 0.74	F = 28.192	< 0.001*
	Fair	3.16 $\pm$ 0.35		
	Good	3.30 $\pm$ 0.33		
	Very Good	3.52 $\pm$ 0.42		
	Excellent	3.90 $\pm$ 0.50		

Table 6 compares Artificial Intelligence (AI) awareness scores according to the participants' demographic characteristics. The findings revealed no statistically significant differences in AI awareness according to gender (t = -0.973, p = 0.331), age (F = 2.027, p = 0.110), university type (t = -1.231, p = 0.219), previous knowledge of AI (t = -0.349, p = 0.731), formal AI training (t = 1.709, p = 0.092), or previous use of AI-related tools (t = 1.113, p = 0.272). These findings indicate that these demographic variables were not significantly associated with differences in AI awareness among undergraduate nursing students.

However, academic level was significantly associated with AI awareness (F = 4.120, p = 0.007). Fourth-year students achieved the highest mean awareness score (3.48 $\pm$ 0.49), whereas first-year students had the lowest mean score (3.31 $\pm$ 0.43), suggesting that AI awareness increased as students progressed through the nursing program. Furthermore, self-rated computer skills showed a highly significant association with AI awareness (F = 28.192, p < 0.001). Students who rated their computer skills as excellent achieved the highest mean awareness score (3.90 $\pm$ 0.50), while those with fair computer skills had the lowest mean score (3.16 $\pm$ 0.35). Overall, the findings suggest that academic progression and higher computer proficiency were the primary factors associated with greater AI awareness among undergraduate nursing students.

Table 7: Tukey HSD Post Hoc Test for Academic Level and AI Awareness (N = 396)

Comparison	Mean Difference	95% CI	Adjusted p-value	Significant
First Year vs Fourth Year	0.166	0.025 to 0.307	0.014	Yes
First Year vs Second Year	0.173	0.006 to 0.340	0.039	Yes
First Year vs Third Year	0.156	-0.006 to 0.318	0.064	No
Fourth Year vs Second Year	0.008	-0.158 to 0.173	0.999	No
Fourth Year vs Third Year	-0.010	-0.170 to 0.151	0.999	No
Second Year vs Third Year	-0.017	-0.201 to 0.167	0.995	No

Table 7 compares the post hoc pairwise differences in Artificial Intelligence (AI) awareness scores across academic levels using the Tukey Honestly Significant Difference (HSD) test. The findings revealed that first-year nursing students had significantly lower AI awareness scores than both second-year students (Mean Difference = 0.173, 95% CI = 0.006–0.340, p = 0.039) and fourth-year students (Mean Difference = 0.166, 95% CI = 0.025–0.307, p = 0.014). These results indicate that students in the higher academic years demonstrated greater AI awareness than those in the first year of the nursing program.

No statistically significant differences were observed between first-year and third-year students (p = 0.064), second-year and third-year students (p = 0.995), second-year and fourth-year students (p = 0.999), or third-year and fourth-year students (p = 0.999). These findings suggest that the statistically significant difference identified by the one-way ANOVA was primarily attributable to the comparatively lower AI awareness among first-year students.

Overall, the results indicate that AI awareness tends to improve as students advance through the nursing program, highlighting the positive influence of academic progression on nursing students' understanding of artificial intelligence and its applications in healthcare.

Table 8: Tukey HSD Post Hoc Test for Self-rated Computer Skills and AI Awareness (N = 396)

Comparison	Mean Difference	95% CI	Adjusted p-value	Significant
Excellent vs Fair	-0.744	-1.043 to -0.446	<0.001	Yes
Excellent vs Good	-0.600	-0.779 to -0.422	<0.001	Yes
Excellent vs Poor	0.267	-0.366 to 0.899	0.776	No
Excellent vs Very Good	-0.382	-0.572 to -0.192	<0.001	Yes
Fair vs Good	0.144	-0.115 to 0.404	0.547	No
Fair vs Poor	1.011	0.351 to 1.671	<0.001	Yes
Fair vs Very Good	0.362	0.095 to 0.630	0.002	Yes
Good vs Poor	0.867	0.252 to 1.482	0.001	Yes
Good vs Very Good	0.218	0.097 to 0.339	<0.001	Yes
Poor vs Very Good	-0.649	-1.267 to -0.030	0.034	Yes

Table 8 compares the post hoc pairwise differences in Artificial Intelligence (AI) awareness according to self-rated computer skills using the Tukey Honestly Significant Difference (HSD) test. The findings demonstrated several statistically significant differences among the computer skill groups. Participants with excellent computer skills had significantly higher AI awareness than those with fair (Mean Difference = -0.744, $p < 0.001$), good (Mean Difference = -0.600, $p < 0.001$), and very good computer skills (Mean Difference = -0.382, $p < 0.001$). However, no statistically significant difference was observed between participants with excellent and poor computer skills ($p = 0.776$), which may be attributed to the relatively small number of participants in the poor computer skills category.

Furthermore, participants with very good computer skills demonstrated significantly higher AI awareness than those with fair (Mean Difference = 0.362, $p = 0.002$), good (Mean Difference = 0.218, $p < 0.001$), and poor computer skills (Mean Difference = -0.649, $p = 0.034$). Similarly, students with good computer skills had significantly higher AI awareness than those with poor computer skills (Mean Difference = 0.867, $p = 0.001$). In contrast, no statistically significant difference was found between the fair and good computer skill groups ($p = 0.547$).

Overall, these findings indicate that higher levels of computer competency are associated with greater AI awareness among undergraduate nursing students. This highlights the importance of enhancing digital literacy and computer skills within nursing education to strengthen students' understanding of artificial intelligence and facilitate its effective integration into future healthcare practice.

Table 9: Comparison of AI Readiness by Demographic Characteristics (N = 396)

Variable	Category	Mean $\pm$ SD	Test	P-value
Gender	Male	3.94 $\pm$ 0.35	$t = -0.688$	0.492
	Female	3.91 $\pm$ 0.52		
Age	18–20 years	3.77 $\pm$ 0.42	$F = 6.343$	<0.001
	21–23 years	3.99 $\pm$ 0.34		
	24–26 years	4.01 $\pm$ 0.29		
	Above 26 years	3.85 $\pm$ 0.71		
Academic Level	First Year	3.84 $\pm$ 0.46	$F = 3.264$	0.021
	Second Year	4.04 $\pm$ 0.23		
	Third Year	3.96 $\pm$ 0.46		
	Fourth Year	3.92 $\pm$ 0.51		
University Type	Public	3.94 $\pm$ 0.41	$t = -0.510$	0.611
	Private	3.91 $\pm$ 0.50		
Previously Heard About AI	Yes	3.94 $\pm$ 0.41	$t = -1.476$	0.156
	No	3.64 $\pm$ 0.92		
Formal AI Training	Yes	3.95 $\pm$ 0.38	$t = -1.514$	0.135
	No	3.81 $\pm$ 0.71		
Used AI-Related Tools	Yes	3.97 $\pm$ 0.39	$t = -4.292$	<0.001
	No	3.50 $\pm$ 0.68		
Self-rated Computer Skills	Poor	4.61 $\pm$ 0.38	$F = 20.346$	<0.001
	Fair	3.38 $\pm$ 0.31		
	Good	3.83 $\pm$ 0.38		
	Very Good	4.06 $\pm$ 0.47		
	Excellent	4.19 $\pm$ 0.45		

Table 9 compares Artificial Intelligence (AI) readiness scores according to the participants' demographic characteristics. The findings revealed no statistically significant differences in AI readiness according to gender ($t = -0.688$, $p = 0.492$), university type ($t = -0.510$, $p = 0.611$), previous awareness of AI ($t = -1.476$, $p = 0.156$), or formal AI training ($t = -1.514$, $p = 0.135$). These findings indicate that these demographic variables were not significantly associated with nursing students' readiness to adopt AI technologies.

However, age was significantly associated with AI readiness ($F = 6.343$, $p < 0.001$). Students aged 24–26 years achieved the highest mean readiness score (4.01 ± 0.29), whereas those aged 18–20 years had the lowest mean score (3.77 ± 0.42). Likewise, academic level showed a statistically significant association with AI readiness ($F = 3.264$, $p = 0.021$), with second-year students reporting the highest mean readiness score (4.04 ± 0.23). Furthermore, participants who had previously used AI-related tools demonstrated significantly higher readiness scores (3.97 ± 0.39) than those who had not (3.50 ± 0.68) ($t = -4.292$, $p < 0.001$).

A highly significant association was also observed between self-rated computer skills and AI readiness ($F = 20.346$, $p < 0.001$). AI readiness increased significantly across the computer skill categories. Participants who reported poor computer skills achieved the highest mean readiness score (4.61 ± 0.38), followed by those with excellent (4.19 ± 0.45) and very good (4.06 ± 0.47) computer skills. Overall, the findings suggest that age, academic level, previous experience with AI-related tools, and self-rated computer

skills were important factors associated with undergraduate nursing students' readiness to integrate artificial intelligence into future nursing practice.

Table 10: Tukey HSD Post Hoc Test for Age and AI Readiness (N = 396)

Comparison	Mean Difference	95% CI	Adjusted p-value	Significant
18–20 vs 21–23	0.153	0.032 to 0.274	0.007	Yes
18–20 vs 24–26	0.173	0.047 to 0.299	0.003	Yes
18–20 vs Above 26	0.015	-0.120 to 0.151	0.991	No
21–23 vs 24–26	0.020	-0.089 to 0.129	0.964	No
21–23 vs Above 26	-0.137	-0.257 to -0.018	0.017	Yes
24–26 vs Above 26	-0.157	-0.282 to -0.033	0.007	Yes

Table 10 presents the results of the Tukey Honestly Significant Difference (HSD) post hoc test conducted following the significant one-way ANOVA for age and Artificial Intelligence (AI) readiness. The findings revealed that students aged 18–20 years had significantly lower AI readiness than those aged 21–23 years (Mean Difference = 0.153, 95% CI = 0.032–0.274, $p = 0.007$) and 24–26 years (Mean Difference = 0.173, 95% CI = 0.047–0.299, $p = 0.003$).

Furthermore, participants aged above 26 years demonstrated significantly lower AI readiness than those aged 21–23 years (Mean Difference = -0.137, 95% CI = -0.257 to -0.018, $p = 0.017$) and 24–26 years (Mean Difference = -0.157, 95% CI = -0.282 to -0.033, $p = 0.007$). However, no statistically significant differences were found between students aged 18–20 years and above 26 years ($p = 0.991$) or between the 21–23 years and 24–26 years age groups ($p = 0.964$).

Overall, the findings indicate that AI readiness was highest among students aged 21–26 years, whereas younger students (18–20 years) and older students (above 26 years) demonstrated comparatively lower readiness. These findings suggest that age may play an important role in influencing nursing students' readiness to adopt and utilize artificial intelligence technologies in future clinical practice.

Table 11: Tukey HSD Post Hoc Test for Academic Level and AI Readiness (N = 396)

Comparison	Mean Difference	95% CI	Adjusted p-value	Significant
First Year vs Second Year	0.135	0.007 to 0.264	0.034	Yes
First Year vs Third Year	0.075	-0.049 to 0.200	0.405	No
First Year vs Fourth Year	0.014	-0.095 to 0.122	0.989	No
Second Year vs Third Year	-0.060	-0.201 to 0.081	0.688	No
Second Year vs Fourth Year	0.122	-0.005 to 0.249	0.065	No
Third Year vs Fourth Year	0.062	-0.062 to 0.185	0.569	No

Table 11 presents the results of the Tukey Honestly Significant Difference (HSD) post hoc test conducted following the significant one-way ANOVA for academic level and Artificial Intelligence (AI) readiness. The analysis

revealed that second-year nursing students demonstrated significantly higher AI readiness than first-year students (Mean Difference = 0.135, 95% CI = 0.007–0.264, $p = 0.034$).

No statistically significant differences were identified between first-year and third-year students (Mean Difference = 0.075, $p = 0.405$), first-year and fourth-year students (Mean Difference = 0.014, $p = 0.989$), second-year and third-year students (Mean Difference = -0.060, $p = 0.688$), second-year and fourth-year students (Mean Difference = 0.122, $p = 0.065$), or third-year and fourth-year students (Mean Difference = 0.062, $p = 0.569$).

Overall, the post hoc analysis indicates that the significant difference observed in AI readiness across academic levels was primarily driven by the difference between first-year and second-year students. These findings suggest that nursing students' readiness to adopt artificial intelligence improves during the early stages of the nursing program, while readiness levels remain relatively comparable across the higher academic years.

Table 12: Tukey HSD Post Hoc Test for Self-rated Computer Skills and AI Readiness (N = 396)

Comparison	Mean Difference	95% CI	Adjusted p-value	Significant
Excellent vs Fair	-0.543	-0.788 to -0.298	<0.001	Yes
Excellent vs Good	-0.157	-0.303 to -0.010	0.030	Yes
Excellent vs Poor	0.119	-0.400 to 0.638	0.971	No
Excellent vs Very Good	-0.064	-0.220 to 0.093	0.798	No
Fair vs Good	0.386	0.173 to 0.600	<0.001	Yes
Fair vs Poor	0.662	0.120 to 1.204	0.008	Yes
Fair vs Very Good	0.479	0.260 to 0.699	<0.001	Yes
Good vs Poor	0.276	-0.230 to 0.781	0.566	No
Good vs Very Good	0.093	-0.007 to 0.193	0.080	No
Poor vs Very Good	-0.183	-0.691 to 0.325	0.862	No

Table 12 presents the results of the Tukey Honestly Significant Difference (HSD) post hoc test examining differences in Artificial Intelligence (AI) readiness according to self-rated computer skills. The findings revealed that participants with excellent computer skills demonstrated significantly higher AI readiness than those with fair computer skills (Mean Difference = -0.543, 95% CI = -0.788 to -0.298, $p < 0.001$) and good computer skills (Mean Difference = -0.157, 95% CI = -0.303 to -0.010, $p = 0.030$). However, no statistically significant differences were observed between participants with excellent and poor computer skills ($p = 0.971$) or between those with excellent and very good computer skills ($p = 0.798$).

Furthermore, participants with very good computer skills demonstrated significantly higher AI readiness than those with fair computer skills (Mean Difference = 0.479, 95% CI = 0.260–0.699, $p < 0.001$). Likewise, students with good computer skills showed significantly higher AI readiness than those with fair computer skills (Mean Difference = 0.386, 95% CI = 0.173–0.600, $p < 0.001$). Participants with poor computer skills also demonstrated significantly higher AI readiness than those with fair computer skills (Mean Difference = 0.662, 95% CI = 0.120–1.204, $p = 0.008$). No

statistically significant differences were observed between the good and poor computer skill groups ($p = 0.566$), the good and very good groups ($p = 0.080$), or the poor and very good groups ($p = 0.862$).

Overall, the post hoc analysis indicates that students with stronger computer skills generally demonstrated greater readiness to adopt artificial intelligence in nursing practice, particularly when compared with students reporting fair computer skills. These findings highlight the importance of enhancing digital literacy and computer competency to support nursing students' readiness for AI integration in healthcare.

Table 13: Correlation between AI Awareness and AI Readiness (N = 396)

Variables	AI Awareness	AI Readiness
AI Awareness	1.000	0.685
AI Readiness	0.685	1.000

Correlation Test	p-value	r	Interpretation
Pearson Correlation	< 0.001	0.685	Strong positive correlation

Table 13 presents the Pearson correlation analysis between Artificial Intelligence (AI) awareness and AI readiness among undergraduate nursing students. The analysis demonstrated a strong, positive, and statistically significant correlation between the two variables ($r = 0.685$, $p < 0.001$). This finding indicates that nursing students with higher levels of AI awareness were more likely to demonstrate greater readiness to adopt and utilize AI technologies in future nursing practice.

The positive correlation suggests that increasing students' knowledge and understanding of artificial intelligence may enhance their confidence, motivation, and willingness to integrate AI into nursing practice. Overall, these findings indicate that AI awareness and AI readiness are closely related constructs, emphasizing that educational strategies aimed at improving AI awareness are likely to contribute to higher readiness for implementing AI technologies in healthcare settings.

Table 14: Multiple Linear Regression Analysis of Factors Associated with AI Readiness (N = 396)

Predictor	B	SE	t	p-value
Constant	1.770	0.139	12.720	<0.001
Age	-0.011	0.014	-0.755	0.451
Gender	-0.062	0.031	-1.991	0.047
Academic Level	-0.009	0.014	-0.659	0.510
University Type	0.006	0.031	0.180	0.857
Previous AI Knowledge	-0.026	0.079	-0.331	0.741
Formal AI Training	-0.157	0.049	-3.235	0.001
Use of AI-related Tools	-0.290	0.057	-5.049	<0.001
Self-rated Computer Skills	-0.049	0.015	-3.168	0.002
AI Awareness	0.681	0.037	18.419	<0.001

Model Summary

R ²	Adjusted R ²
0.569	0.559

Table 14 presents the results of the multiple linear regression analysis examining the factors associated with Artificial Intelligence (AI) readiness among undergraduate nursing students. The overall regression model demonstrated good explanatory power, accounting for approximately

56.9% of the variance in AI readiness ($R^2 = 0.569$; Adjusted $R^2 = 0.559$). This indicates that the variables included in the model collectively explained more than half of the variation in nursing students' readiness to adopt AI technologies.

Among all predictors, AI awareness was identified as the strongest independent predictor of AI readiness ($B = 0.681$, $SE = 0.037$, $t = 18.419$, $p < 0.001$). This finding suggests that students with higher levels of AI awareness were significantly more likely to demonstrate greater readiness to integrate AI into future nursing practice. In addition, formal AI training ($B = -0.157$, $p = 0.001$), previous use of AI-related tools ($B = -0.290$, $p < 0.001$), self-rated computer skills ($B = -0.049$, $p = 0.002$), and gender ($B = -0.062$, $p = 0.047$) were also identified as statistically significant independent predictors of AI readiness after controlling for the other variables included in the model.

Conversely, age ($p = 0.451$), academic level ($p = 0.510$), university type ($p = 0.857$), and previous AI knowledge ($p = 0.741$) were not statistically significant independent predictors of AI readiness. Overall, these findings suggest that improving AI awareness, providing structured AI training opportunities, encouraging the practical use of AI-related tools, and strengthening students' computer skills may substantially enhance undergraduate nursing students' readiness to adopt artificial intelligence in future clinical practice.

Discussion

The present study demonstrated that undergraduate nursing students had a moderate level of Artificial Intelligence (AI) awareness and a high level of AI readiness. These findings indicate that although nursing students recognize the importance of AI and express positive attitudes toward its integration into future nursing practice, their knowledge and understanding of AI concepts and clinical applications remain limited. Similar findings have been reported in previous studies, which showed that nursing students generally demonstrate positive attitudes and high readiness toward AI despite having only moderate levels of AI awareness and literacy (O'Connor *et al.*, 2023; Factors influencing student nurses' readiness to adopt artificial intelligence, 2023; Burucu & Türkben Polat, 2025; Boztepe *et al.*, 2025) [7-10].

The findings further revealed that students strongly agreed that AI knowledge is essential for future nursing practice, that AI education should be incorporated into undergraduate nursing curricula, and that nurses should develop competencies related to AI technologies. These results reflect nursing students' recognition of the increasing role of AI in healthcare delivery. The World Health Organization emphasized that healthcare professionals should be adequately prepared to utilize AI technologies safely, ethically, and effectively within healthcare systems (World Health Organization, 2021) [1, 2]. Likewise, the International Council of Nurses highlighted the importance of developing digital competencies among nurses to support high-quality patient care and adapt to rapidly evolving healthcare technologies (International Council of Nurses, 2021) [18].

Despite these positive perceptions, lower awareness scores were observed for AI applications related to diagnostic accuracy and the future impact of AI on the nursing profession. These findings may reflect insufficient exposure to AI applications during undergraduate nursing education and limited opportunities for practical experience. Similar

observations were reported by Buchanan *et al.* (2021), who concluded that nursing education has not yet fully prepared students for AI-supported clinical practice despite the increasing adoption of AI technologies in healthcare [16]. Furthermore, von Gerich *et al.* (2022) emphasized that although AI technologies are rapidly expanding within nursing practice, educational preparation remains insufficient to ensure that future nurses possess the competencies required for effective AI utilization [5].

Another important finding of the present study was that AI readiness exceeded AI awareness, indicating that nursing students were generally more willing to adopt AI technologies than their current level of knowledge might suggest. This finding may be explained by students' confidence in the potential benefits of AI for improving patient care, supporting clinical decision-making, and enhancing healthcare quality. Similar findings were reported among nursing students in Saudi Arabia by Al-Olaimat *et al.* (2025), who found high levels of readiness and acceptance toward AI-based healthcare technologies despite differences in AI knowledge [12]. Likewise, Dawood *et al.* (2025) reported that nursing students demonstrated positive attitudes and strong readiness toward AI integration while emphasizing the importance of strengthening AI education and practical training within undergraduate nursing programs [13].

Overall, the findings suggest that although undergraduate nursing students demonstrate encouraging readiness to adopt AI technologies, additional educational efforts are required to strengthen AI awareness and translate students' positive attitudes into practical competencies. Integrating AI-related content into nursing curricula, providing structured educational activities, and expanding opportunities for practical exposure to AI applications may enhance nursing students' preparedness for future technology-driven healthcare environments. These recommendations are consistent with the ethical frameworks proposed by the European Commission and UNESCO, which emphasize responsible AI implementation through education, competency development, transparency, and continuous professional learning (European Commission, 2019; UNESCO, 2021) [19, 20].

The present study demonstrated that academic level was significantly associated with AI awareness, with fourth-year students demonstrating significantly higher awareness than first-year students. This finding suggests that progression through the nursing program enhances students' exposure to healthcare technologies, evidence-based practice, and clinical experiences, all of which may contribute to improving their understanding of AI and its applications in healthcare. Similar findings have been reported in previous studies, which showed that students in higher academic years generally possess greater AI literacy, readiness, and confidence than junior students (Burucu & Türkben Polat, 2025; Boztepe *et al.*, 2025) [9, 10].

The present study also demonstrated that self-rated computer skills were significantly associated with both AI awareness and AI readiness. Students with stronger computer skills achieved significantly higher scores than those with lower levels of digital competency. These findings highlight the essential role of digital literacy in preparing future nurses to understand and utilize AI technologies effectively. Previous studies have similarly reported that digital competence is one of the most

important determinants of AI readiness and successful AI adoption among nursing students (O'Connor *et al.*, 2023; El Arab *et al.*, 2025) [7, 11].

Another important finding was that students who had previously used AI-related tools demonstrated significantly higher AI readiness than those without previous AI experience. Previous exposure to AI technologies may increase students' confidence, reduce uncertainty, and facilitate the acceptance of AI-supported healthcare systems. Similar findings have been reported in previous studies, which concluded that practical experience with AI applications positively influences nursing students' readiness and acceptance of AI technologies (Al-Olaimat *et al.*, 2025; Dawood *et al.*, 2025) [12, 13].

In contrast, gender, university type, previous AI knowledge, and formal AI training were not significantly associated with AI readiness, while gender, age, university type, previous AI knowledge, formal AI training, and previous use of AI-related tools showed no statistically significant association with AI awareness. These findings suggest that demographic characteristics alone may have a limited influence on students' awareness and readiness compared with educational and technological factors. Similar conclusions have been reported in previous studies, which emphasized that competency development, digital literacy, and educational preparation play a more important role than demographic variables in supporting AI implementation in nursing (Ronquillo *et al.*, 2021; von Gerich *et al.*, 2022) [5, 17].

Overall, the findings indicate that academic progression, digital competency, and practical exposure to AI technologies are important determinants of undergraduate nursing students' awareness of and readiness for AI. These findings support the integration of AI-related education, digital health competencies, and practical AI experiences into undergraduate nursing curricula to better prepare future nurses for technology-driven healthcare environments (World Health Organization, 2021; International Council of Nurses, 2021) [2, 18].

The present study demonstrated a strong positive correlation between Artificial Intelligence (AI) awareness and AI readiness among undergraduate nursing students. This finding indicates that students with higher levels of AI awareness were more likely to demonstrate greater readiness to adopt AI technologies in future nursing practice. The positive association between these two variables suggests that improving students' knowledge and understanding of AI may directly enhance their confidence, acceptance, and willingness to integrate AI into clinical practice. Similar findings have been reported in previous studies, which identified AI literacy as a key factor influencing nursing students' readiness and attitudes toward AI (Boztepe *et al.*, 2025; El Arab *et al.*, 2025) [10, 11].

The multiple linear regression analysis further identified AI awareness as the strongest independent predictor of AI readiness. This finding highlights that increasing nursing students' awareness of AI concepts, clinical applications, and ethical considerations is likely to improve their preparedness for AI integration in healthcare. Previous studies have similarly emphasized that AI education plays a fundamental role in developing nurses who are capable of utilizing AI technologies safely and effectively in clinical practice (O'Connor *et al.*, 2023; Buchanan *et al.*, 2021) [7, 16]. In addition, formal AI training, previous use of AI-related

tools, self-rated computer skills, and gender were identified as significant predictors of AI readiness. These findings suggest that educational preparation, practical exposure to AI technologies, and digital competency contribute substantially to students' readiness to adopt AI in healthcare. Similar findings have been reported in previous studies, which demonstrated that nursing students with greater exposure to AI technologies and stronger digital competencies showed higher readiness and more positive attitudes toward AI implementation (Al-Olaimat *et al.*, 2025; Dawood *et al.*, 2025) [12, 13].

Conversely, age, academic level, university type, and previous AI knowledge were not significant independent predictors of AI readiness after controlling for other variables in the regression model. This finding suggests that educational and technological factors exert a stronger influence on AI readiness than demographic characteristics alone. Similar conclusions have been reported in previous studies, which emphasized that competency development, digital literacy, and educational preparation are more important than demographic characteristics in facilitating AI implementation within nursing practice (Ronquillo *et al.*, 2021; von Gerich *et al.*, 2022) [5, 17].

Overall, the findings of the present study emphasize the importance of strengthening AI awareness, integrating AI-related education into undergraduate nursing curricula, improving digital literacy, and expanding opportunities for practical experience with AI technologies. These strategies may enhance nursing students' readiness to adopt AI while supporting the safe, ethical, and effective implementation of AI in future healthcare environments (World Health Organization, 2021; International Council of Nurses, 2021; European Commission, 2019; UNESCO, 2021) [1, 18, 19, 20].

Conclusion

This study concluded that undergraduate nursing students demonstrated a moderate level of Artificial Intelligence (AI) awareness and a high level of AI readiness. Although the participants recognized the importance of AI and expressed positive attitudes toward its integration into nursing practice, their level of awareness remained lower than their readiness, indicating the need to strengthen AI-related knowledge and practical competencies within undergraduate nursing education.

The findings also demonstrated that academic level, computer skills, previous use of AI-related tools, and AI awareness were important factors associated with students' readiness to adopt AI technologies. Moreover, AI awareness was identified as the strongest predictor of AI readiness, highlighting the critical role of educational preparation in supporting AI integration into nursing practice.

Overall, the study emphasizes the importance of integrating AI concepts, digital health education, and practical AI applications into undergraduate nursing curricula to improve students' awareness, strengthen their readiness, and prepare future nurses for the effective and ethical use of AI technologies in healthcare.

Recommendations

Based on the findings of the present study, the following recommendations are proposed:

1. Integrate Artificial Intelligence (AI) concepts and applications into undergraduate nursing curricula to

improve students' knowledge and competencies regarding AI in healthcare.

2. Develop structured educational and training programs that provide nursing students with practical experience in using AI-supported healthcare technologies.
3. Strengthen digital literacy and computer skills among nursing students to enhance their readiness for AI integration in clinical practice.
4. Encourage nursing faculties to incorporate simulation-based learning and AI-assisted educational tools into teaching and clinical training.
5. Promote collaboration between nursing educators, healthcare institutions, and technology experts to facilitate the effective implementation of AI in nursing education and practice.
6. Conduct further multicenter and longitudinal studies involving nursing students from different universities to evaluate changes in AI awareness, readiness, and competency over time.

Data Availability

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Declaration of Interests

The authors declare that they have no known financial or personal interests that could have appeared to influence the work reported in this study.

Conflict of Interest Statement

The authors declare that there is no conflict of interest regarding the publication of this study.

Acknowledgments

The authors would like to express their sincere appreciation to all undergraduate nursing students who voluntarily participated in this study. The authors also extend their gratitude to the participating universities and faculty members for their support and cooperation during the data collection process. Their valuable contributions made this study possible.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

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