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Original Article

Artificial Intelligence Literacy Among Nursing Interns: Current Status and Influencing Factors

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Abstract

Background: With the rapid integration of artificial intelligence (AI) into healthcare and nursing, intelligent nursing has emerged as a major trend in the development of the profession.

Objectives: This study aimed to assess AI literacy among nursing interns and identify its influencing factors.

Methods: A cross-sectional study was conducted between December 2025 and January 2026 using convenience sampling to recruit 250 nursing interns from five tertiary Grade A hospitals in Henan Province, China. Data were collected using a general information questionnaire and the Artificial Intelligence Literacy Survey Scale. Descriptive statistics, independent-samples t-tests, one-way ANOVA, and multiple linear regression were performed using IBM SPSS Statistics version 27.0.

Results: The mean (SD) AI literacy score among nursing interns was 40.20 (9.63). Multiple linear regression showed that willingness to participate in AI training ($\beta = -0.193$, $p = 0.001$) and frequency of AI use ($\beta = -0.354$, $p < 0.001$) were independently associated with AI literacy, explaining 19.9% of its variance (adjusted $R^2 = 0.199$).

Conclusion: Nursing interns demonstrated a moderate to high level of AI literacy. Greater AI use and willingness to participate in AI training were associated with higher AI literacy. Strengthening AI education and encouraging active engagement with AI may help improve AI literacy and better prepare nursing interns for the evolving demands of intelligent nursing practice.

Implications for Nursing and Midwifery Preventive Care

- Enhancing AI literacy may support preventive nursing care by improving preparedness for early risk recognition and responsible AI use.
- Targeted AI education may strengthen AI literacy and better prepare future nurses to apply AI in preventive care and evidence-informed practice.

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Introduction

The rapid advancement of emerging technologies, including artificial intelligence (AI), big data, and the Internet, is driving healthcare's digital transformation.

AI is increasingly being integrated into healthcare across a wide range of applications, including clinical decision support, intelligent nursing systems, patient monitoring, and health management, creating new opportunities to improve the quality and efficiency of healthcare delivery [1]. However, the expanding use of AI also raises important challenges related to algorithmic bias, deepfake-generated misinformation, data privacy, transparency, and ethical accountability, highlighting the need for healthcare professionals to use AI responsibly and critically [2].

AI literacy has therefore become an essential competency for nurses in contemporary healthcare. It extends beyond technical knowledge and operational skills to include the ability to understand AI technologies, critically evaluate AI-generated information, apply AI appropriately in clinical contexts, and recognize the ethical and legal implications of AI use [3].

As future members of the nursing workforce, nursing interns are increasingly exposed to AI technologies during clinical training. However, many have limited experience with AI applications and receive little formal education in AI, which may affect their preparedness to use these technologies effectively and responsibly in clinical practice.

Although AI has been integrated into healthcare systems in many countries and research on AI literacy has expanded accordingly [4], studies in China have primarily focused on registered nurses and postgraduate students [5].

Evidence regarding AI literacy among nursing interns remains limited.

In addition, standardized AI literacy education has not yet been widely incorporated into undergraduate nursing curricula or clinical internship programs.

Given the growing integration of AI into healthcare, strengthening AI literacy may better prepare nursing interns to engage with AI technologies in preventive nursing care and evidence-informed clinical practice.

Objectives

This study aimed to assess the level of artificial intelligence (AI) literacy among nursing interns and identify factors associated with AI literacy. The findings may inform targeted educational strategies to strengthen AI literacy and better prepare nursing interns for the increasing integration of AI technologies into preventive nursing care and clinical practice.

Methods

Study Design

This cross-sectional study used convenience sampling and was conducted among nursing interns undertaking clinical internships at five tertiary Grade A hospitals in Henan Province, China, between December 2025 and January 2026. The participating hospitals included both comprehensive and specialized institutions to increase the diversity of clinical training settings.

Participants and Sampling

Eligible participants were nursing interns who undertook clinical internships at tertiary Grade A hospitals and had completed at least seven months of clinical training. Nursing interns who were not actively engaged in clinical practice or whose internships had been interrupted because of sick leave or other personal reasons were excluded.

We estimated the sample size using a power analysis for multiple linear regression. Based on an anticipated medium effect size ($f^2 = 0.15$), a significance level of 0.05, a statistical power of 80%, and 18 candidate independent variables considered during study planning, the minimum required sample size was 180 participants. To account for potential non-response and incomplete questionnaires, the sample size was inflated by 20% using the formula $180/(1-0.20)$, resulting in a minimum target of 225 participants. A total of 262 questionnaires were distributed, of which 250 were completed and

considered valid for analysis, yielding a valid response rate of 95.42%.

The 18 candidate predictors were identified at the study planning stage based on demographic and AI-related characteristics considered potentially relevant to AI literacy. Because it was not possible to determine in advance which variables would be retained in the final regression model, all 18 candidate predictors were used for the sample size calculation to provide a conservative estimate. Variables significantly associated with AI literacy in the bivariate analyses ($p < 0.05$) were subsequently considered for multivariable model development. Predictor selection was then guided by both statistical screening and conceptual relevance. Among the conceptually related AI-engagement variables, willingness to participate in AI training was retained because of its direct relevance to future educational engagement, while AI use frequency represented actual engagement with AI in practice. The remaining conceptually overlapping variables were not retained to reduce redundancy in the final model. Because this screening and selection process was conducted after data collection and was not pre-specified in a registered protocol, the final predictor selection should be regarded as exploratory and partly data driven.

Measurement Instruments (Validity & Reliability)

Two instruments were used to collect the study data.

General Information Questionnaire

A researcher-developed questionnaire collected participants' demographic and educational characteristics. The questionnaire included items on gender, educational background, Grade, duration of clinical internship, previous formal AI training, interest in AI, perceived impact of AI on nursing practice, willingness to participate in AI training, and frequency of AI use during the previous six months.

Artificial Intelligence Literacy Scale

AI literacy was assessed using the Artificial Intelligence Literacy Scale developed by Wang in 2023 [6]. The scale was designed to evaluate AI literacy in the general population and comprises four dimensions: Awareness, Use, Evaluation, and Ethics. The Awareness dimension assesses individuals' understanding of AI technologies and their overall cognitive awareness of AI applications. The Use dimension evaluates the ability to use AI technologies appropriately. The Evaluation dimension measures the ability to assess AI-generated information critically, select appropriate AI tools, and evaluate their performance in different contexts. The Ethics dimension assesses awareness of ethical responsibilities, potential risks associated with AI use, and adherence to ethical principles.

The scale contains 12 items, with three items in each dimension. Responses are rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), yielding a total score between 12 and 60. Higher scores indicate higher levels of AI literacy.

The original instrument demonstrated acceptable psychometric properties. In the original validation study, the scale underwent a three-step content validation process, and its four-factor structure (Awareness, Use, Evaluation, and Ethics) was supported by confirmatory factor analysis. The scale also showed good internal consistency (overall Cronbach's $\alpha = 0.83$) and adequate criterion-related validity, with AI literacy scores significantly associated with digital literacy, attitudes toward robots, and daily AI use [6]. The scale was originally developed in Chinese and validated in Chinese samples; therefore, the original Chinese version was used in the present study without additional translation or cultural adaptation. In the present study, the overall scale showed excellent internal consistency, with a Cronbach's α of 0.92.

Data Collection Procedure

Data were collected using an anonymous electronic questionnaire administered to nursing interns during their clinical internships at the participating hospitals. Before accessing the questionnaire, participants were provided with information describing the study objectives, participation requirements, confidentiality measures, and the voluntary nature of participation. Completion of the questionnaire indicated informed consent to participate.

The electronic questionnaire was created and administered using the Wenjuanxing (Questionnaire Star) online survey platform. To prevent duplicate submissions, the survey was configured to allow only one submission from each IP address and device. We identified and excluded repeated submissions from the same IP address or device during data cleaning.

To improve data completeness, all questionnaire items were set as mandatory, and the electronic survey system generated automatic prompts when responses were incomplete. A total of 262 questionnaires were returned. After excluding incomplete or invalid responses, 250 questionnaires were included in the final analysis, corresponding to a valid response rate of 95.42%.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 27.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics summarized participants' demographic characteristics and AI literacy scores. Continuous variables are presented as means and standard deviations (SD), whereas categorical variables are reported as frequencies and percentages.

Independent-samples t tests and one-way analysis of variance (ANOVA) compared AI literacy scores across participant characteristics, as appropriate. Variables showing significant associations in the bivariate analyses were considered during multivariable model development. Predictor selection for the multivariable model was based on both conceptual relevance and statistical criteria. Variables significantly associated with AI literacy in the bivariate analyses ($p < 0.05$) were initially considered as candidate predictors. This screening step was performed after data collection and was not pre-specified in a registered protocol; therefore, the retained predictors should be interpreted as exploratory. Among these variables, interest in AI, perceived impact of AI on nursing practice, formal AI training, and willingness to participate in AI training represented closely related aspects of engagement with AI. To avoid redundancy among conceptually overlapping variables, we selected willingness to participate in AI training and AI use frequency for inclusion in the final model. Collinearity diagnostics indicated no evidence of multicollinearity among the retained predictors (all variance inflation factor values < 1.2). Multiple linear regression analysis was performed to identify factors independently associated with AI literacy. The dependent variable was the total AI literacy score. Before model fitting, the assumptions of multiple linear regression, including normality of residuals, independence of errors (Durbin–Watson statistic), and multicollinearity (variance inflation factor [VIF]), were evaluated. Categorical variables were coded before analysis, and the final regression model was fitted using the enter method with the selected predictors entered simultaneously. Statistical significance was defined as a two-tailed $p < 0.05$.

Result

General Characteristics of the Study Participants

Of the 250 nursing interns included in the study, 42 (16.80%) were male, and 208 (83.20%) were female. Participants ranged in age from 19 to 25 years [mean (SD) = 21.80 (1.50)]. Regarding educational background, 40 (16.00%) had a junior college diploma, 204 (81.60%) were undergraduate students, and 6 (2.40%) were postgraduate students. The distribution of academic grade included 25 sophomores (10.00%), 121 juniors (48.40%), 86 seniors (34.40%), and 18 fifth-year students (7.20%). Clinical internship duration ranged from 7 to 12 months, with a mean (SD) of 9.20 (1.80).

AI Literacy Scores Among Nursing Interns

The mean AI literacy score was 40.20 (SD = 9.63), corresponding to 67.0% of the maximum possible score. Across the four dimensions, mean scores ranged from 9.91 (SD = 2.86) to 10.14 (SD = 2.69), corresponding to scoring rates of 66.07% to 67.60% [Table 1].

Comparison of AI Literacy Scores According to Participant Characteristics. Bivariate analyses showed that educational background, interest in artificial intelligence, perceived impact of AI on nursing practice, formal AI training, willingness to participate in AI training, and AI use frequency during the previous six months were significantly associated with AI literacy scores ($p < 0.05$). AI

literacy was not significantly associated with gender. Differences across academic grades were also non-significant (all $p > 0.05$) and are therefore not tabulated. Table 2 presents detailed results.

Multivariable Analysis of Factors Associated with AI Literacy

Multiple linear regression analysis was performed to identify factors independently associated with AI literacy. The final model included willingness to participate in AI training and AI use frequency during the previous six months as independent variables. The model was statistically significant ($F(2, 247) = 31.899$, $p < 0.001$) and explained 19.9% of the variance in AI literacy scores (adjusted $R^2 = 0.199$). Both willingness to participate in AI training ($\beta = -0.193$, $p = 0.001$) and AI use frequency ($\beta = -0.354$, $p < 0.001$) were independently associated with AI literacy [Table 3].

Table 1. AI Literacy Scores Across Dimensions Among Nursing Interns (N = 250)

Dimension	Items	Possible Score Range	Mean (SD)	Scoring Rate (%)
Awareness	3	3–15	10.12 (2.72)	67.47
Use	3	3–15	10.14 (2.69)	67.60
Evaluation	3	3–15	9.91 (2.86)	66.07
Ethics	3	3–15	10.04 (2.75)	66.93

Note. Higher scores indicate higher levels of AI literacy. AI = Artificial Intelligence.

Table 2. Comparison of AI Literacy Scores According to Participant Characteristics (N = 250)

Characteristic	Category	n (%)	Mean (SD)	Test Statistic	*p*	Effect Size
Gender	Male	42 (16.80)	40.05	t = −0.11	0.913	$d = 0.02$
	Female	208 (83.20)	40.24			
Educational background	Junior college	40 (16.00)	36.42	F = 4.05	0.013	$\eta^2 = 0.03$
	Undergraduate	204 (81.60)	40.84			
	Postgraduate	6 (2.40)	43.83			
Interest in AI	Yes	170 (68.00)	41.61	t = 3.44	< 0.001	$d = 0.47$
	No	80 (32.00)	37.21			
Perceived impact of AI on nursing practice	Yes	213 (85.20)	41.18	t = 3.97	< 0.001	$d = 0.71$
	No	37 (14.80)	34.57			
Received formal AI training	Yes	112 (44.80)	47.28	t = 13.95	< 0.001	$d = 1.77$
	No	138 (55.20)	34.46			
Willingness to participate in AI training	Yes	189 (75.60)	41.86	t = 5.01	< 0.001	$d = 0.74$
	No	61 (24.40)	35.07			
AI use frequency (past 6 months)	Daily	41 (16.40)	46.95	F = 17.46	< 0.001	$\eta^2 = 0.18$
	At least once a week	91 (36.40)	42.08			
	At least once a month	71 (28.40)	37.41			
	Occasionally	47 (18.80)	34.91			

Note. Data are presented as mean (SD) unless otherwise indicated. Independent-samples t tests were used for two-group comparisons, and one-way ANOVA was used for variables with three or more categories. AI = artificial intelligence. Cohen's *d* was reported as the effect size for two-group comparisons, and η^2 for variables with three or more categories. For educational background, Levene's test and a Kruskal–Wallis *H* sensitivity analysis were performed because of the small postgraduate group (n = 6); results were consistent with the ANOVA findings but interpret comparisons involving this subgroup with caution. For educational background, Welch's robust test was applied because Levene's test indicated unequal variances; accordingly, the reported F and *p* values may differ from those obtained with the classical one-way ANOVA. The p value reported for interest in AI in the previous version was a transcription error and has been corrected.

Table 3. Multivariable Linear Regression Analysis of Factors Associated with AI Literacy Among Nursing Interns (N = 250)

Predictor	*B*	*SE*	*β*	t	*p*	95% CI	VIF
Intercept	54.277	1.921	—	28.257	< 0.001	[50.49, 58.06]	—
Willingness to participate in AI training (No vs. Yes*)	−4.324	1.336	−0.193	−3.235	0.001	[−6.95, −1.70]	1.108
AI use frequency (higher score = less frequent use)	−3.483	0.588	−0.354	−5.927	< 0.001	[−4.64, −2.33]	1.095

Note. $R^2 = .205$; adjusted $R^2 = .199$; $F(2, 247) = 31.899$, $p < 0.001$. CI = confidence interval; VIF = variance inflation factor. *Reference category. Willingness to participate in AI training was dummy coded as Yes = 0 and No = 1, with "Yes" as the reference category. Thus, the regression coefficient represents the difference in AI literacy scores between unwilling and willing participants. AI use frequency was coded ordinally as 1 = daily, 2 = at least once a week, 3 = at least once a month, and 4 = occasionally. Higher scores indicate less frequent AI use; therefore, the negative coefficient indicates that more frequent AI use was associated with higher AI literacy scores. Although formal AI training was significantly associated with AI literacy in the bivariate analysis (Table 2), it was not retained in the final multivariable model because it was conceptually overlapping with willingness to participate in AI training and AI use frequency.

Discussion

This cross-sectional study examined the level of artificial intelligence (AI) literacy among nursing interns and identified factors associated with AI literacy. The findings indicated that nursing interns demonstrated a moderate to high level of AI literacy, with the lowest scores observed in the evaluation dimension. In addition, AI use frequency and

willingness to actively participate in AI training were independently associated with AI literacy, explaining approximately 20% of the variance in literacy scores. These findings suggest that both practical engagement with AI technologies and learners' willingness to participate in AI-related education may play an important role in developing AI literacy among nursing interns.

Although the overall AI literacy of nursing interns was moderate to high, it appeared to be lower than levels reported in previous studies involving clinical nurses [7]. However, this comparison should be interpreted cautiously, as differences in study populations, clinical experience, and measurement contexts may influence AI literacy scores [8]. The lower scores observed among nursing interns may reflect their relatively limited opportunities to apply AI knowledge in clinical practice, although this cross-sectional study cannot confirm that explanation.

One possible explanation relates to the characteristics of the assessment instrument. The AI Literacy Scale places considerable emphasis on applying and evaluating AI in clinical contexts [9]. Several items require respondents to judge the appropriateness of AI-assisted clinical applications, evaluate AI-generated information, or recognize ethical issues encountered during clinical practice. These competencies are typically strengthened through repeated exposure to clinical decision-making and practical use of AI technologies [10]. Although nursing interns may have acquired foundational knowledge of AI during their academic education, they generally have fewer opportunities to apply it in real clinical settings. Consequently, they may experience greater difficulty when evaluating AI-supported clinical information or interpreting AI-generated recommendations.

Consistent with this explanation, the evaluation dimension showed the lowest score among the four dimensions of AI literacy. This finding may indicate that nursing interns have greater difficulty critically appraising AI-generated information than understanding basic AI concepts, using AI tools, or recognizing ethical considerations. Because critical evaluation is essential for the safe and appropriate integration of AI into clinical practice, greater emphasis on developing evaluative competencies during undergraduate nursing education may help bridge the gap between theoretical knowledge and clinical application.

The present study demonstrated that AI use frequency was independently associated with AI literacy. Nursing interns who reported more frequent use of AI tools achieved higher AI literacy scores, a finding consistent with previous research among perioperative nurses in Turkey [11]. Although awareness of AI technologies has increased in healthcare settings, previous evidence suggests that awareness alone may not be sufficient to support the development of AI literacy. Instead, regular engagement with AI applications may strengthen knowledge, improve operational skills, and increase familiarity with the appropriate use of AI technologies.

One possible explanation is that repeated exposure to AI tools allows nursing interns to apply the theoretical knowledge acquired during their academic education to practical learning activities. Interns who use AI more frequently for information retrieval, literature searching, or learning support may gradually become more familiar with AI applications and more confident in interpreting AI-generated information [12, 13]. However, because this study is cross-sectional, the direction of this association cannot be established. It is also possible that nursing interns with higher AI literacy may be more inclined to use AI technologies during their learning and clinical training.

Similarly, willingness to participate in AI training was independently associated with AI literacy. Nursing interns who expressed greater willingness to engage in AI-related training demonstrated higher AI literacy scores than those who were less willing to participate. This finding is consistent with previous studies emphasizing the importance of active learning and self-directed professional development in acquiring new competencies [14, 15]. Interns who actively seek learning opportunities may be more motivated to develop AI-related knowledge and strengthen the critical thinking skills needed to use AI technologies appropriately.

Taken together, these findings suggest that practical engagement with AI technologies and active participation in educational activities may both contribute to developing AI literacy among nursing interns. Therefore, nursing education programs may benefit from complementing theoretical instruction with supervised opportunities to use AI technologies in educational and clinical learning environments [16].

Such approaches may help nursing interns strengthen both their technical competence and their ability to critically evaluate AI-generated information before applying it in clinical practice [17, 18].

The findings of this study have several implications for nursing education and clinical practice. As AI technologies become increasingly integrated into healthcare, AI literacy may help nursing interns use AI-assisted tools appropriately, critically interpret AI-generated information, and recognize the ethical considerations associated with AI applications. These competencies can facilitate evidence-informed clinical decision-making and promote the appropriate use of AI in nursing practice.

From the perspective of preventive nursing care, improving AI literacy may help nursing interns recognize potential clinical risks at an earlier stage and support timely nursing interventions when AI-assisted technologies are available. Likewise, greater familiarity with AI applications may contribute to safer use of AI-supported systems by encouraging appropriate interpretation of AI outputs and adherence to ethical principles during clinical practice. Although the present study did not directly examine these potential benefits, they highlight the importance of preparing future nurses to use AI technologies responsibly in increasingly digital healthcare environments.

The present findings also suggest that AI education should extend beyond theoretical instruction. Integrating supervised practical experience with AI technologies into undergraduate nursing curricula and clinical internship programs may provide nursing interns opportunities to strengthen both technical competence and critical evaluation skills. Such educational approaches may better prepare future nurses to adapt to the continued integration of AI into healthcare practice [19].

Several limitations should be considered when interpreting this study's findings. First, the study used convenience sampling and recruited participants from a limited number of tertiary hospitals within a single geographic region, which may limit the generalizability of the findings. Second, the cross-sectional design does not permit conclusions regarding causal relationships between the identified factors and AI literacy.

Third, data were collected using self-reported questionnaires and may therefore be subject to recall and social desirability bias.

Finally, because most participants were undergraduate nursing interns, the findings may not be generalizable to nursing students with different educational backgrounds. Future studies using longitudinal designs and more diverse samples are warranted to examine further the development of AI literacy throughout nursing education and early clinical practice. In addition, although the candidate predictors were specified during study planning, the final regression model was selected after data collection through bivariate screening and conceptual judgement.

This approach may have excluded potentially relevant variables and may introduce the possibility of data-driven selection.

Therefore, the multivariable findings should be interpreted as exploratory and should be confirmed in future studies using pre-specified predictor selection strategies.

Nursing interns demonstrated a moderate to high level of AI literacy, and both AI use frequency and willingness to participate in AI training were independently associated with AI literacy.

These findings highlight the potential value of combining structured educational programs with practical learning opportunities to support the development of AI literacy among future nurses.

Conclusion

Nursing interns demonstrated a moderate to high level of artificial intelligence (AI) literacy, although the evaluation dimension showed the lowest

performance and may require greater educational attention. More frequent AI use and willingness to participate in AI training were independently associated with higher AI literacy. These findings suggest that nursing educators and clinical preceptors should incorporate structured, practice-oriented AI training into undergraduate nursing education and clinical internships to support AI literacy development and prepare future nurses for increasingly digital healthcare environments.

Ethical Considerations

This study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Pingdingshan University (approval number: PDSU20250317). All participants were fully informed about the study purpose, procedures, and their rights to confidentiality and voluntary withdrawal. Because data were collected using an anonymous online questionnaire, completion of the questionnaire was taken as informed consent; electronic informed consent was therefore obtained from all participants before they accessed the survey items.

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Conflict of Interest

The authors declare no conflict of interest.

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Authors' Contributions

Conceptualization: C. Zhao, F. Wang
Methodology: F. Wang, C. Zhao
Formal Analysis: C. Zhao
Investigation: C. Zhao, S. Ma
Data Curation: C. Zhao, S. Ma
Writing – Original Draft: C. Zhao
Writing – Review & Editing: F. Wang, S. Ma
Project Administration: F. Wang
All authors read and approved the final manuscript and agree to be accountable for all aspects of the work.

Artificial Intelligence Utilization

During the preparation of this work, the authors used AI-assisted tools (ChatGPT, OpenAI; GPT-4o) for literature retrieval, preliminary data organization, and language polishing. All AI-generated content was critically reviewed, revised, and validated by the authors, who take full responsibility for the accuracy, integrity, and originality of the final manuscript. No AI tools were used for data analysis or interpretation of results.

Data Availability Statement

Data are available upon reasonable request.

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