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Heterogeneity in Nursing Students' Artificial Intelligence Literacy: A Study of Self-Efficacy, Attitudes Toward Technology, and Ethical Concerns Based on Latent Profile Analysis

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Research Article

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Abstract

Background

Artificial intelligence (AI) is rapidly transforming healthcare, particularly in clinical decision support, patient monitoring, and personalized care. As future frontline healthcare providers, nursing students' AI literacy is crucial for their professional development and the delivery of high-quality, safe patient care in intelligent healthcare environments. However, previous studies have primarily adopted variable-centered approaches, often overlooking the heterogeneous nature of AI literacy among nursing students. There is limited evidence regarding the latent profiles of AI literacy and its associated factors, especially in resource-limited regions such as Inner Mongolia. This study aimed to identify latent classes of AI literacy among nursing students and explore influencing factors, providing empirical support for stratified AI education in nursing programs.

Methods

A convenience sample of 522 nursing students from a university in eastern Inner Mongolia was recruited in December 2025. Data were collected using a general demographic questionnaire, the Artificial Intelligence Literacy Scale for Chinese College Students (AILS-CCS), the Artificial Intelligence Self-Efficacy Scale (AISE), and the Attitude Scale towards the Use of Artificial Intelligence Technologies in Nursing (ASUAITIN). Latent profile analysis (LPA) was used to identify subgroups, followed by one-way analysis and multinomial logistic regression to examine associated factors.

Results

Three distinct latent classes emerged: low-level foundational weakness group (42.25%), medium-level development group (42.41%), and high-level comprehensive development group (15.34%). Multinomial logistic regression indicated that AI self-efficacy, attitudes toward AI technologies in nursing, and concern about AI ethical issues were independent predictors of class membership (all $P < 0.05$).

Conclusions

Nursing students demonstrate significant heterogeneity in AI literacy. Educators should prioritize AI ethical awareness, self-efficacy, and positive technology attitudes. Implementing tailored, stratified interventions according to students' literacy profiles is recommended to enhance their professional competence in AI-enhanced healthcare settings.

Research Background

With the rapid development of digital technology, artificial intelligence (AI) is being increasingly applied in clinical decision support, diagnostic processes, patient monitoring, and personalized treatment plans[1][2][3], playing a significant role in the field of healthcare. It has significantly improved the efficiency and accuracy of patient care decisions, reduced the workload of healthcare professionals, and optimized clinical workflows[4][5] .While this transformation presents significant opportunities for clinical practice, it also brings numerous complex challenges[6]. China has elevated the development of artificial intelligence to a national strategy and aims to achieve major research and innovation breakthroughs by 2030[7] .The "Healthy China 2030" Outline emphasizes the central role of technology in healthcare reform and proposes a new direction of "prevention first," with the development of artificial intelligence serving as a key driver of this transformation[8]. In the field of nursing education, artificial intelligence also

demonstrates immense value, not only enhancing learning outcomes but also improving the time and cost efficiency of teaching and promoting widespread access to high-quality educational resources[9] .However, promoting equitable AI education for undergraduate nursing students in developing countries with relatively underdeveloped education systems remains a common challenge facing nursing education[10]. In this context, nursing students—as a vital reserve of future healthcare professionals—possess AI literacy that not only influences their individual career development but also directly impacts the quality of healthcare services and patient safety. AI literacy is an interdisciplinary competency that integrates knowledge from multiple fields, including computer science, psychology, sociology, and philosophy[11] .In 2023, UNESCO incorporated AI literacy into its framework of core competencies, defining it as the ability to critically evaluate AI technologies, collaborate effectively with AI, and apply AI tools appropriately in various contexts[12][13]. Previous studies have shown that students in nursing and related fields have a high level of understanding of AI and, to a certain extent, recognize its value in nursing practice[14](.However, the effective use of AI depends not only on technological accessibility but also on the users' level of literacy, including technical understanding, practical application skills, and ethical judgment. Currently, there remains a lack of systematic identification of the structure of AI literacy among nursing students and analysis of its influencing factors from the perspective of individual heterogeneity. Previous studies have mostly adopted variable-oriented methods, analyzing AI literacy as a single continuous variable and overlooking the potential heterogeneous structures that may exist among different student groups.In fact, different students may exhibit distinct combinations of characteristics regarding AI cognition, usage skills, and attitudes, and such differences are difficult to fully reveal through traditional statistical methods. Latent Profile Analysis (LPA), as an individual-centered analytical method, can identify latent categorical structures based on continuous variables, thereby revealing heterogeneous characteristics within a group[16] .However, there remains a relative lack of latent profile studies on the AI literacy of nursing students in the Inner Mongolia region. Therefore, this study innovatively combines the Chinese College Students' AI Literacy Scale, the AI Self-Efficacy Scale, and the Attitudes Toward AI Technology in Nursing Scale to systematically explore the latent profile characteristics of AI literacy among nursing students in Inner Mongolia and to analyze the influence of self-efficacy and attitudes toward technology on different literacy categories.This integrated perspective not only helps reveal the heterogeneous structure of nursing students' AI literacy but also provides empirical evidence for nursing educators to develop stratified and targeted intervention strategies, thereby promoting the adaptive development of nursing education in Inner Mongolia and other remote regions in the era of intelligent technology.

1. Methods

1.1 Study Participants

A convenience sampling method was employed to recruit students from the School of Nursing at Inner Mongolia Minzu University in December 2025. Students meeting the inclusion criteria voluntarily participated in this survey. Inclusion criteria: 1) Undergraduate and graduate students in the School of Nursing at the university;2) Nursing students who provided informed consent for this study; Exclusion criteria: 1) Students who have already graduated from the School of Nursing; 2) Nursing students on leave of absence or on leave; Based on the sample size calculation formula: n = (Zα/2σ/δ), with **α = 0.05, σ = 8.50, and δ = 1.0,** the sample size must be at least 10 times the number of variables.This study involves 23 variables. Considering a 20% dropout rate, the estimated sample size required is at least 153 cases; this study meets this requirement. This study has been approved by the Ethics Committee for Medicine and Life Sciences at Inner Mongolia Minzu University (No.: NMD-RT-2025-12-14).

1.2 Survey Instruments

1.2.1 Demographic Questionnaire

This questionnaire was developed by the researchers based on a review of the literature and discussions within the research team. It consists of two sections: basic information (gender, grade level, and hometown) and AI tool usage.

1.2.2 Chinese College Students' Artificial Intelligence Literacy Scale

The Artificial Intelligence Literacy Scale for Chinese College Students (, AILS-CCS) was developed by Ma Shuai and Chen Zhenzhen in 2024[17] . This tool is of great significance for assessing and training the AI literacy of college students in China and other developing countries around the world.The scale comprises 15 items across four dimensions: Cognition (4 items), Usage (3 items), Evaluation (4 items), and Ethics (4 items). Each item uses a 5-point Likert scale, ranging from "Strongly Disagree" to "Strongly Agree" (scored 1–5, respectively), with a total score ranging from 15 to 75. A higher score indicates a higher level of AI literacy. **The composite reliability for** each dimension of the scale **was greater than 0.70**0, indicating good reliability. The correlation coefficients between all factors and other factors were all less than the square root of their respective average variances (AVE), indicating that the scale possesses good discriminant validity. In this study, the Cronbach's α coefficient for the scale was 0.974.

1.2.3 Artificial Intelligence Self-Efficacy Scale

The Artificial Intelligence Self-Efficacy Scale (AISE) was developed by Wang Yuyin and Zhuang Yuwei in 2023[18] to measure an individual's perceived self-efficacy in using AI products. The scale consists of 22 items across four dimensions:Assistance (7 items), Anthropomorphic Interaction (5 items), Comfort with AI (6 items), and Technical Skills (4 items). Each item uses a 7-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree," scored from 1 to 7. The total score ranges from 22 to 154, with a higher score indicating greater artificial intelligence self-efficacy.The scale's overall Cronbach's α coefficient is 0.958; in this study, the Cronbach's α coefficient for this scale was 0.981.

1.2.4 Attitude Scale Toward the Use of Artificial Intelligence Technologies in Nursing

The Attitude Scale Toward the Use of Artificial Intelligence Technologies in Nursing (ASUAITIN) was initially developed by Yilmaz et al. in 2024 through a review of relevant literature and expert consultations [19] , with the aim of assessing clinical nurses' attitudes toward the application of AI technologies. The scale comprises two dimensions: negative attitudes (6 items) and positive attitudes (9 items).A 5-point Likert scale was used, ranging from "Strongly Disagree" to "Strongly Agree" and scored from 1 to 5, respectively. The total score ranges from 15 to 75, with higher scores indicating a more positive attitude. Li Chuang et al. conducted the Chinese adaptation of the ASUAITIN[20] ; the scale's Cronbach's α coefficient was 0.845, while the Cronbach's α coefficient in this study was 0.955.

1. 3. Data Collection and Quality Control Methods

In this study, an electronic questionnaire was created using the Wenjuanxing platform. After obtaining the respondent's consent, a link was generated and sent to the participants. Before answering, the purpose of the study was explained to the participants, who were required to read the informed consent form and click "Agree" before proceeding to the formal questionnaire interface. All questionnaire items were mandatory, and the questionnaire could only be submitted after it was fully completed.To prevent duplicate submissions, the system was configured to allow only one response per account or IP address. To ensure questionnaire quality, responses with completion times under 2 minutes or answers exhibiting obvious patterns were excluded.

1. 4. Statistical Methods

Using the mean scores (continuous variables) of the items across the four dimensions of the Artificial Intelligence Literacy Scale for Chinese College Students as manifest variables, latent profile analysis was conducted using Mplus

8.3 software. The data model was initially established with one category, and the number of categories was gradually increased until the model with the best fit indices was identified as the final model. Model evaluation metrics: The lower the values for the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and sample-corrected Bayesian Information Criterion (aBIC), the better the model fit; Model fit indicators: The Lo-Mendell-Rubin likelihood ratio test (LMRT) and the bootstrap likelihood ratio test (BLRT). *A p-value* < 0.05 indicates that the k-category model is significantly superior to the k-1-category model;The closer the information entropy (Entropy) is to 1, the more accurate the classification; a value of ≥0.8 indicates a classification accuracy rate exceeding 90%.

Statistical analysis was performed using SPSS 31.0 software. Quantitative data following a normal distribution were presented as mean and standard deviation; quantitative data not following a normal distribution were presented as median and quartiles; and categorical and ordinal data were presented as frequency and percentage. The chi-square test or the Kruskal-Wallis H test was used to compare the general characteristics and scale scores among different student groups to identify statistically significant variables.With the LpA classification results as the dependent variable and the variables found to be statistically significant in the univariate analysis as independent variables, a multivariate logistic regression analysis was conducted. Since the number of latent categories was greater than 2 and the parallel lines test yielded a p-value < 0.05, an unordered multiclass logistic regression analysis was used to examine the factors influencing artificial intelligence literacy in the school's School of Nursing, with a significance level of α = 0.05.

2. Results

2.1 Demographic Characteristics of the Study Participants

A total of 539 questionnaires were distributed in this study, with 522 valid responses collected, resulting in a valid response rate of 96.85%. Among the 522 nursing students, 102 (19.5%) were male and 420 (80.5%) were female;by academic year, 122 were first-year students (23.4%), 103 were second-year students (19.7%), 154 were third-year students (29.5%), 131 were fourth-year students (25.1%), and 12 were graduate students (2.3%);189 (36.2%) were from urban areas, and 333 (63.8%) were from rural areas; other general characteristics are shown in Table 1.

2.2 Scores on the Chinese College Students' Artificial Intelligence Literacy Scale, Artificial Intelligence Self-Efficacy Scale, and Artificial Intelligence Attitude Scale

The 522 students from the School of Nursing had a total score of 55.00 [45.00, 60.00] on the AI Literacy Scale, with a mean score of 3.5 [3.00,4.00] points; the mean score for items in the usage dimension was 3.67 [3.00, 4.00] points; the mean score for items in the evaluation dimension was 3.75 [3.00, 4.00] points; and the mean score for items in the ethics dimension was 4.00 [3.00, 4.00] points. These results indicate that the overall AI literacy of nursing students is at a slightly above-average level.The total score on the AI Self-Efficacy Scale was 110.00 [92.00, 132.00], indicating an overall moderate level of self-efficacy and strong confidence in their ability to use AI technology to solve problems. The total score on the Attitudes Toward AI Technology Scale was 54.00 [44.00, 56.00], indicating that nursing students generally hold a positive attitude toward the application of AI technology in the nursing field.

2.3 Results of the Latent Profile Analysis of Artificial Intelligence Literacy Among Chinese College Students

A data model was established using the scores on the four dimensions of the Chinese College Students' AI Literacy Scale as manifest variables. As the number of models increased, the AIC, BIC, and aBIC values gradually decreased. The LMRT for a model with four categories was not statistically significant ($p > 0.05$); therefore, the model with three latent categories was selected as the best-fitting model. See Table 1.

Table 1: **Potential Fit Measures for Different Categories of Artificial Intelligence Literacy Models Among Chinese College Students**

Number of Categories	AIC	BIC	aBIC	BLRT (*p*)	LMRT(*p*)	Entropy
1	9663.346	9697.063	9671.670	-	-	-
2	8,543.700	8598.490	8557.227	<0.001	<0.001	0.919
3	7,523.439	7599.302	7542.169	<0.001	<0.001	0.971
4	7,344.441	7,441.377	7368.374	<0.001	>0.05	0.951
5	7179.668	7297.677	7208.803	>0.05	>0.05	-

Note: Based on LMRT, entropy, and theoretical significance, we recommend selecting Category 3 models (entropy = 0.971, LMRT p < 0.001)

2.3 Characteristics of Artificial Intelligence Literacy Categories Among Chinese College Students

A latent profile diagram based on the classification results is shown in Figure 1. All three categories scored highest on the evaluation and ethics dimensions and lowest on the application dimension. Category 1 includes 219 students (42.25%), who scored the lowest across all dimensions, with particularly significant deficiencies in the application dimension. As this group represents a vulnerable segment in terms of AI literacy, it is designated as the “Low-Level, Weak Foundation Group”;Category 2 comprises 223 students (42.41%), with scores in the middle range across all dimensions. These students possess basic AI literacy but have room for improvement in all areas; they are therefore designated as the “Intermediate Level Development Group”; Category 3 comprises 80 students (15.34%), who demonstrate high levels across all four dimensions and possess a certain level of AI literacy; they are therefore designated as the “High-Level Comprehensive Development Group.”

2.4 Univariate Analysis of Factors Influencing Different Categories of AI Literacy Among Chinese College Students

This study shows that year of study, whether the institution offers AI courses, level of understanding of AI, students’ overall attitude toward AI, perceptions of the accuracy of AI tools, the extent to which AI assists undergraduate studies, level of concern regarding AI ethical issues, scores on the AI Self-Efficacy Scale, and scores on the Attitude Toward AI Technology in Nursing Scale all had statistical significance ($p < 0.05$). Table 2 is located at the end of the text.

2.5 Multivariate Analysis of Factors Influencing Different Categories of Artificial Intelligence Literacy Among Chinese College Students

Using the three categories of AI literacy among Chinese college students as the dependent variables and the variables found to be statistically significant ($p < 0.05$) in the univariate analysis as independent variables, a multivariate logistic regression analysis was conducted. The coding method is shown in Table (3).Using the “moderate-level development” group as the reference, the AI Self-Efficacy Scale, the AI Technology in Nursing Scale, and the level of concern regarding AI ethical issues were found to be independent predictors of students’ latent AI literacy categories ($p < 0.05$).Table 4 is located at the end of the text.Specifically, higher scores on the AI Self-Efficacy Scale and the Nursing AI Technology Scale were associated with a lower probability of being classified into the “low-level, weak foundation” group and a higher probability of being classified into the “high-level, well-rounded” group. Furthermore, students who expressed a high level of concern regarding AI ethical issues were more likely to be classified into the “high-level, well-rounded” group.

Table 3: Coding of Independent Variables

Variable Name	Coding
Grade	Freshman = 1; Sophomore = 2; Junior = 3; Senior = 4; Graduate Student = 5
AI Courses Offered by the University	Yes = 0; No = 1
Level of Familiarity with AI	Very little knowledge = 1; Some knowledge = 2; Fairly knowledgeable = 3
Overall Attitude Toward AI	Positive = 1; Negative = 2; Neutral = 3;
Perception of AI Accuracy	Completely reliable = 1; Mostly reliable = 2; Mostly inaccurate = 3;
Level of Help with Academic Work	Not helpful at all = 1; Somewhat helpful = 2; Quite helpful = 3
AI Ethical Concerns	Low concern = 1; High concern = 2; Moderate concern = 3
AI Self-Efficacy	Raw Score Entry
Attitudes Toward AI Technology	Raw Score Entry

3. Discussion

3.1 Current Status and Characteristics of AI Literacy Among Nursing Students

The latent profile analysis in this study revealed significant heterogeneity in the AI literacy of undergraduate nursing students, who can be classified into a low-level group with weak foundations (42.25%), a moderate-level group showing development (42.41%), and a high-level group with comprehensive development (15.34%).Overall, students in all groups scored higher on the cognitive, evaluation, and ethical dimensions, while scores on the application dimension were generally lower. In particular, the low-level group with weak foundations scored lower than the other groups on all dimensions and performed the worst on the application dimension.This indicates that although students have a certain grasp of basic AI concepts, risk awareness, and ethical standards, they exhibit significant deficiencies in practical operation and application skills. This situation may stem from the fact that nursing education curricula are predominantly theory-based and lack hands-on AI training integrated with clinical scenarios, resulting in students who understand the theory but cannot apply it.It is worth noting that there is currently a wide range of medical AI tools available for application in nursing education and practice, including intelligent documentation tools (Dragon Medical, DeepScribe AI), clinical decision support tools (Ada, iFlytek Xiaoyi), medical imaging assistance tools (Tencent MiYing, SenseTime SenseCare), patient safety monitoring platforms (Care.ai), and nursing-specific learning software (NurseAI Tutor).These tools cover multiple aspects—including nursing assessment, clinical decision-making, condition monitoring, nursing documentation, and educational training—providing a solid technological foundation for scenario-based teaching in nursing education. However, because most students lack systematic exposure and practical training, their understanding of these tools' functions and their ability to apply them are limited. As a result, their AI literacy remains largely at the cognitive level and is difficult to translate into practical application skills. Furthermore, emerging technologies such as generative AI have only gradually entered educational practice in recent years, leaving students with a lack of long-term, systematic learning opportunities; this gap is particularly pronounced in regions where educational resources are relatively underdeveloped. Researchers have pointed out that, in the face of this challenge, it is necessary to increase targeted investment, improve infrastructure, and implement comprehensive and systematic training programs to help educators actively embrace AI technology, thereby enhancing the overall quality and effectiveness of nursing education[21] .At the same time, a high proportion of the participants in this study were

undergraduate students, and since practical skills typically require the support of clinical practice and technical guidance, the overall scores in the “application” dimension were relatively low. In response to this situation, educators should implement tiered educational strategies. For students in the low-level group with weak foundational knowledge, instruction should begin with basic courses and ethical knowledge, combined with clinical case studies and hands-on training in AI tools, to gradually improve their application skills.Students in the intermediate development group can improve their operational proficiency through intensive training in the use of scenario-based AI tools in nursing and problem-solving skills. Students in the high-level, well-rounded development group can engage in training on AI-assisted data analysis and nursing research design, aligned with research needs, to foster the development of their application and innovation capabilities. Through systematic, tiered educational interventions, the gap in AI literacy among nursing students at different levels can be narrowed, thereby enhancing their comprehensive adaptability and professional competence in intelligent healthcare environments.

3.2 Factors Influencing AI Literacy Among Nursing Students

1. Level of Attention to AI Ethical Issues

The results of this study indicate that the level of attention paid to AI ethics is one of the key factors influencing the potential categories of AI literacy among nursing students. Using the intermediate-level development group as a reference, a comparison between the low-level group with weak foundations and the intermediate-level development group revealed that a high level of attention to AI ethics, relative to a moderate level, significantly reduced the likelihood of students being classified into the low-level group with weak foundations. however, the difference between the high-level group and the moderate-level group did not reach a consistently significant level, suggesting that its effect may vary across different stages.This suggests that a higher level of ethical concern regarding AI helps prevent students from falling into the lower AI literacy category; however, relying solely on ethical concern is insufficient to promote students’ advancement to a high level of AI literacy. Further improvement in AI literacy may require the combined influence of multiple factors, such as AI self-efficacy, attitudes toward technology, and practical experience. This result may be related to the intrinsic characteristics of AI literacy.AI literacy encompasses not only technical knowledge and application skills but also emphasizes the ability to understand and evaluate ethical issues such as data security, privacy protection, algorithmic bias, and social responsibility. Students with higher levels of ethical concern typically possess a more comprehensive understanding of AI technology; while recognizing its advantages, they are also aware of potential risks. Consequently, they are more inclined to use AI tools in a prudent and responsible manner, avoiding blind reliance on technology, thereby reducing the risk of their AI literacy remaining at a low level.In contrast, students with lower levels of ethical concern may focus more on the conveniences offered by AI and lack sufficient awareness of ethical risks and technical limitations, thereby hindering the comprehensive development of their AI literacy. In recent years, generative AI tools such as DeepSeek, Doubao, and Qianwen have rapidly gained widespread adoption, and college students have become a key user group for AI technology. However, while these tools offer convenience, they also present ethical challenges such as academic integrity issues and data privacy breaches.Existing research indicates that a foundation of ethical knowledge is essential for individuals to form ethical judgments and engage in ethical practices[22]. Therefore, while nursing educators cultivate students’ AI application skills, they should place even greater emphasis on developing their ethical literacy, focusing on fostering the ability to critically evaluate AI outputs and guiding them to cross-verify AI-generated information against reliable, evidence-based clinical resources[23] .It is recommended that AI ethics education be incorporated into the nursing curriculum, as this will not only help nursing students fully leverage artificial intelligence to enhance their professional competencies but also assist them in developing risk awareness, standardizing their use of the technology, and reducing safety hazards resulting from improper use[24] .Teaching methods such as case studies, scenario simulations, and ethical discussions can also guide students to correctly understand the value and limitations of AI, cultivate their ability to identify risks, develop critical

thinking, and foster a sense of responsibility. This helps students maintain academic integrity and adhere to professional ethical standards while making reasonable use of AI to improve their learning and work efficiency.

2. AI Self-Efficacy

This study found that AI self-efficacy is a significant predictor of the latent categories of AI literacy among nursing students. Using the moderate-level development group as a reference, the higher the AI self-efficacy score, the greater the likelihood that students would be classified into the high-level comprehensive development group while the likelihood of being classified in the low-level, underdeveloped group was lower. This suggests that AI self-efficacy is an important protective factor in promoting the development of students' AI literacy.This result may stem from the fact that students with high self-efficacy are confident in their ability to complete AI-related tasks; they are more willing to actively engage with new technologies and challenges, and are able to persist in their learning when encountering difficulties, thereby effectively enhancing their AI literacy. Conversely, students with lower self-efficacy are prone to experiencing technology anxiety and a fear of difficulty, resulting in insufficient learning engagement, which limits their skill development.Existing research also shows that nursing students' AI self-efficacy is positively correlated with their learning engagement[25], supporting the findings of this study. This suggests that students with higher self-efficacy are often able to proactively utilize generative AI tools for self-directed learning, information retrieval, and problem-solving, continuously accumulating successful experiences through ongoing practice, thereby creating a virtuous cycle.In response to this phenomenon, nursing educators can draw upon Bandura's self-efficacy theory to create more opportunities for students to experience success through tiered hands-on training, case demonstrations, peer learning, and timely feedback, thereby gradually enhancing their AI self-efficacy and overall literacy. Furthermore, existing research has confirmed that AI literacy can significantly enhance an individual's level of self-efficacy,Nursing students who are proficient in AI applications can not only efficiently process complex data and engage in interdisciplinary team collaboration but also propose innovative solutions to clinical nursing problems and demonstrate their professional competence and career development potential with greater confidence[26] .At the same time, research by Lambert et al. indicates that teaching hospitals, due to their abundant resources and diverse AI application scenarios, have healthcare professionals who are more receptive to AI technology[27]. Therefore, during the clinical practice phase, priority should be given to teaching hospitals with well-developed IT infrastructure and a wide range of AI application scenarios. Additionally, these hospitals should be staffed with clinical instructors who have experience in AI applications and are capable of providing standardized guidance, ensuring that students receive proper demonstrations and effective guidance in real-world settings, thereby further enhancing their AI literacy and self-efficacy.

3. Attitudes Toward Artificial Intelligence Technology

The results of this study indicate that attitudes toward AI technology in the nursing field are also an important factor influencing the potential categories of students' AI literacy. Using the "moderate-level development" group as a reference, the higher the AI technology attitude score, the higher the likelihood that students would be classified into the "high-level comprehensive development" group and the lower the likelihood of being classified into the low-level group with weak foundations, suggesting that a positive attitude toward AI technology helps promote the development of students' AI literacy. This result may be related to the Theory of Technology Acceptance.A positive attitude toward technology enhances an individual's acceptance of and willingness to use technology, reduces anxiety and resistance toward new technologies, and makes them more willing to proactively engage with and learn about AI-related knowledge[28]. In the context of nursing education, students with a positive attitude toward AI are more likely to embrace AI-enabled learning models and actively explore the application of AI tools in nursing education, clinical decision-making, and research, thereby continuously improving their AI literacy.Conversely, if students harbor concerns,

resistance, or distrust toward AI, they may reduce their opportunities for engagement with the technology, thereby limiting their professional development. As AI technology gradually integrates into the healthcare industry, clinical decision support systems, smart nursing devices, predictive analytics systems, and generative AI tools are continuously expanding the scope of nursing practice. However, existing research indicates that while nursing students generally hold a positive attitude toward AI, their understanding of specific application scenarios and usage methods remains insufficient.A cross-sectional study of nursing professionals in China found that only 57% of respondents had a basic understanding of AI, 64.7% knew very little about its specific applications in nursing, and 13.4% had no understanding at all of AI in nursing[29] .In this study, 53.3% of nursing students held a positive attitude toward AI, 28.2% had a high level of understanding, 58% had a moderate level of understanding, and 13.8% had a low level of understanding. This indicates that merely holding a positive attitude does not necessarily imply a high level of AI literacy. Although the application of AI in the healthcare field is becoming increasingly widespread, its integration into nursing education has not yet received sufficient attention[30]. Although nursing professionals generally recognize the value of AI technology, their understanding of AI-related knowledge and its applications in nursing remains limited. This suggests that translating a positive attitude toward the technology into actual competence still requires support from systematic knowledge acquisition and practical training. Research by Amin et al. confirms that systematic professional training, through structured learning and timely feedback, can significantly enhance nurses' confidence in applying AI; in contrast, the effectiveness of self-directed learning alone is less than ideal[31] .Therefore, nursing educators should actively foster a supportive AI learning environment by cultivating a positive mindset, enhancing students' understanding of AI, and helping them recognize its capabilities and limitations. This will enable students to use AI effectively and ethically in clinical decision-making, research, and patient care, while alleviating related concerns. At the same time, efforts should be made to strengthen AI competency development among faculty, promptly update teaching content, and help students establish accurate technical understanding and a positive attitude toward AI application, thereby further promoting the enhancement of AI literacy.

4. Conclusion

Based on latent profile analysis, this study found significant heterogeneity in nursing students' AI literacy, which can be categorized into three profile types: the low-development group, the moderate-development group, and the high-level, comprehensively developed group. Factors influencing students' AI literacy include AI self-efficacy, attitudes toward AI technology, and the degree of ethical concern regarding AI. Ethical concern regarding AI primarily manifests as a reduced likelihood of students falling into the low AI literacy category, but does not significantly increase their likelihood of falling into the high AI literacy category.Future AI education in nursing should **implement tiered, categorized**, **and targeted intervention** strategies: for the low-level group, reinforce training in basic AI applications; for the moderate-level group, strengthen scenario-based practical instruction in nursing; and for the high-level group, expand training in AI-assisted nursing research capabilities. Additionally, it is recommended that **AI ethics education and hands-on AI training** be incorporated into the nursing curriculum to comprehensively enhance nursing students' professional adaptability and ability to apply AI appropriately in intelligent healthcare environments.As this study surveyed only students from the School of Nursing at a single university in Inner Mongolia, certain limitations may exist. Future research should include more institutions from remote regions to help nursing students in these areas achieve high-quality development in the AI era.

Declarations

Ethics approval and consent to participate

This study was approved by the Medical and Life Sciences Ethics Committee of Inner Mongolia Minzu University (Approval No.: NMD-RT-2025-12-14). The study was conducted in accordance with relevant guidelines and regulations and adhered to the ethical principles outlined in the Declaration of Helsinki. Written informed consent was obtained from all participants prior to data collection. Participants were informed that their participation was voluntary and that they could withdraw from the study at any time without any consequences.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author upon reasonable request.

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Authors' contributions

S.X: Conceptualization, methodology, data collection, and writing the original draft.

Z.D and G.Y: Conceptualization and methodology.

ZQ.W and J.H: Data curation and formal analysis.

All authors had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. The corresponding author had final responsibility for the decision to submit for publication. The corresponding author confirms that all listed authors meet authorship criteria and that no other individuals meeting the criteria have been omitted.

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Tables

Table 2:Univariate Analysis of Factors Associated with AI Literacy Latent Classes

Variables	Category	Low-Level, Weak Foundation Group (n=219)	Intermediate Level/Developing Group (n=223)	High-Level, Well-Developed Group (n=80)	Test Statistic	*p*-value
Gender	Male	38 (17.4)	41 (18.4)	23 (28.8)	5.172	0.075
	Female	181 (82.6)	182 (81.6)	57 (71.3)		
Grade	Freshman	66 (30.1)	48 (21.5)	8 (10.0)	11.621	0.010
	Sophomore	41 (18.7)	43 (19.28)	19 (18.4)		
	Junior Year	64 (29.2)	62 (27.8)	28 (35.0)		
	Senior Year	47 (21.5)	62 (27.8)	22 (27.5)		
	Graduate student	1 (0.5)	8 (3.6)	3 (3.8)		
Place of Residence	Urban	74 (33.8)	79 (35.4)	36 (45.0)	0.182	0.913
	Rural	145 (66.2)	144 (64.6)	44 (55.0)		
Have used AI tools	Have used	216 (98.6)	219 (98.2)	79 (98.8)	1.721	0.423
	Never used	3 (1.4)	4 (1.8)	1 (1.2)		
Number of times used per week	0 times	5 (2.3)	9 (4.0)	1 (1.3)	5.589	0.125
	1–10 times	161 (73.5)	155 (69.5)	49 (61.4)		
	>10 times	53 (24.2)	59 (26.5)	30 (37.5)		
Schools offering AI courses	Yes	67 (30.6)	92 (41.3)	40 (50.0)	10.975	0.004
	None	152 (69.4)	131 (58.7)	40 (50.0)		
Would like to offer AI courses	Yes	189 (86.3)	195 (87.4)	69 (86.3)	0.149	0.928
	Do not wish to	30 (13.7)	28 (12.6)	11 (13.8)		
Level of understanding of AI	Very little	30 (13.7)	25 (11.2)	17 (21.3)	13.452	<0.001
	General understanding	151 (68.9)	118 (52.9)	34 (42.5)		
	Fairly familiar	38 (17.3)	80 (35.9)	29 (36.3)		
Overall Perception of AI's Impact	Positive	83 (37.9)	131 (58.7)	64 (80.0)	47.338	<0.001
	Negative	3 (1.4)	2 (0.9)	2 (2.5)		

Variables	Category	Low-Level, Weak Foundation Group (n=219)	Intermediate Level/Developing Group (n=223)	High-Level, Well-Developed Group (n=80)	Test Statistic	*p*-value
	Neutral	133(61)	90(40)	15(19)		
AI Accuracy Assessment	All Reliable	9 (4.1)	7 (3.1)	16 (20.0)	10.006	<0.001
	Mostly reliable	194 (88.6)	205 (91.9)	57 (71.3)		
	Mostly incorrect	16(7.3)	11(5)	7(8.7)		
Level of Help with Studies	Not helpful at all	11 (5)	12 (5.3)	16 (2)	19.047	<0.001
	General	59 (26.9)	29 (13.0)	2 (2.5)		
	Somewhat helpful	149 (68)	182 (82)	62 (77)		
Ethical Concerns	Low concern	61 (27.9)	49 (22)	23 (28.8)	20.123	<0.001
	General	117 (52.4)	77 (34.5)	19 (23.8)		
	High Interest	41 (18.7)	97 (43.5)	38 (47.5)		
AI Self-Efficacy	M (p25, p75)	90.00 [88.00, 105.00]	115.00 [110.00, 131.00]	154.00 [152.00, 154.00]	300.293	<0.001
Nursing AI Attitude	M (p25, p75)	44.00 [44.00, 48.00]	56.00[54.00,56.00]	68.00[68.00,68.00]	378.944	<0.001

Note: χ^2 value; H value;

Table 4Multivariate Logistic Regression of Factors Influencing AI Literacy Latent Classes

Group Comparison	Variable	β	SE	Wald χ^2	OR	95% CI	P-value
Low-level group vs. moderate-level group	Total AI Self-Efficacy Score	-0.046	0.01	21.095	0.955	0.936–0.974	<0.001
	Total Attitude Score Toward AI Technology in Nursing	-0.37	0.037	98.091	0.691	0.642–0.743	<0.001
	AI Ethics Concerns (High vs. Medium)	-0.873	0.402	4.71	0.418	0.190–0.919	0.03
High-level group vs. moderate-level group	Total AI Self-Efficacy Score	0.158	0.037	18.421	1.171	1.090–1.259	<0.001
	Total Attitude Score Toward AI Technology in Nursing	0.521	0.106	24.062	1.683	1.367–2.072	<0.001

Figures

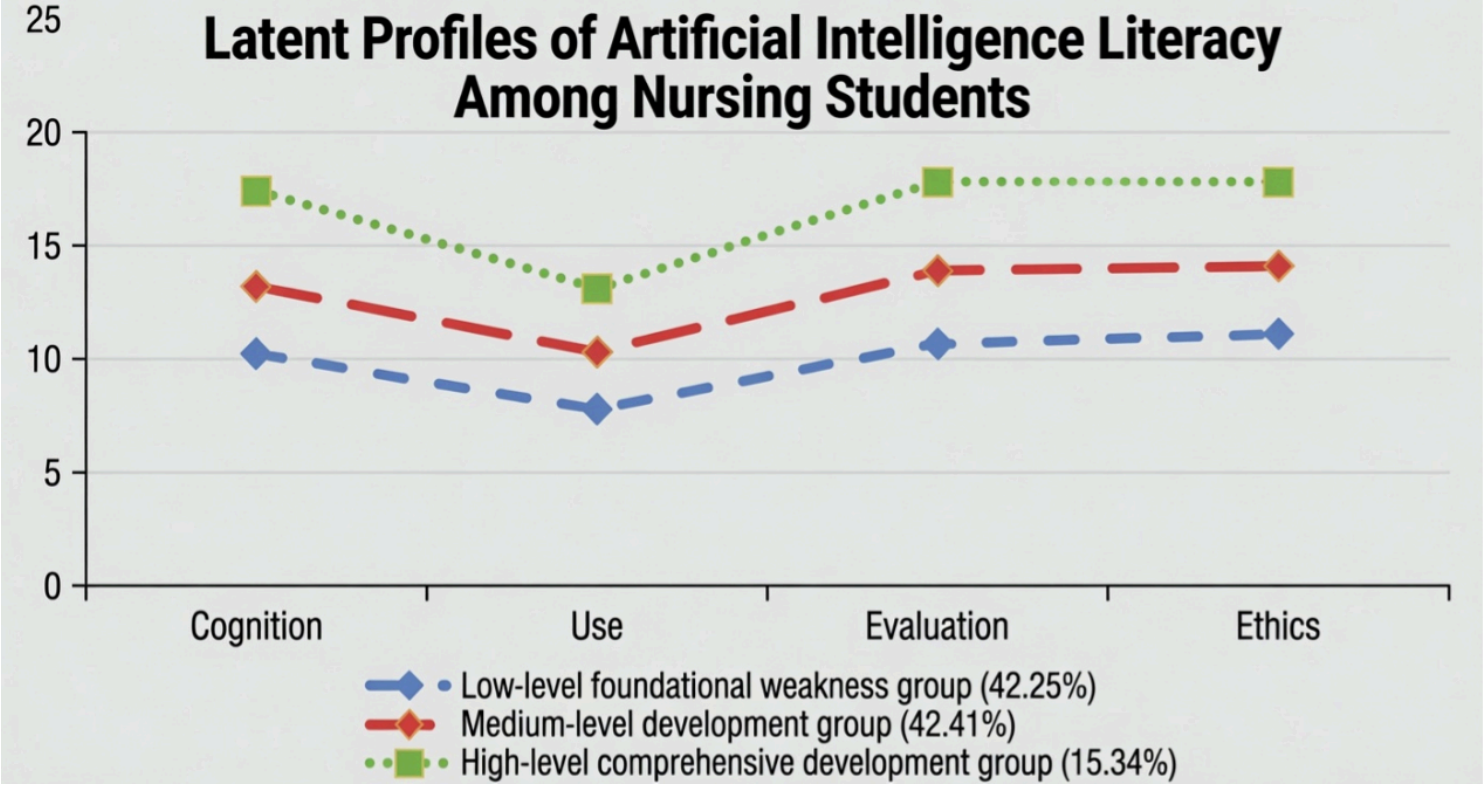


Figure 1

Characteristics of Different Categories of Artificial Intelligence Literacy Among Chinese College Students