



# Analysis of the Current Status and Influencing Factors of Artificial Intelligence Literacy Ability among Nursing Students

Yingying Miao, Qian Zhang, Xin Li, Chen Chen, Jianxin Huang, Chaojin Zhao

College of Nursing, Pingdingshan University, Pingdingshan, China

Email: 20230033@pdsu.edu.cn

**How to cite this paper:** Miao, Y.Y., Zhang, Q., Li, X., Chen, C., Huang, J.X. and Zhao, C.J. (2025) Analysis of the Current Status and Influencing Factors of Artificial Intelligence Literacy Ability among Nursing Students. *Open Access Library Journal*, 12: e14292.

<https://doi.org/10.4236/oalib.1114292>

**Received:** September 16, 2025

**Accepted:** October 14, 2025

**Published:** October 17, 2025

Copyright © 2025 by author(s) and Open Access Library Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

## Abstract

**Objective:** To evaluate the current status of artificial intelligence literacy among nursing students and analyze its influencing factors, in order to provide a scientific basis for integrating AI literacy education into nursing education. **Methods:** A cross-sectional study design was adopted, and a questionnaire was distributed to nursing students in a university in Henan Province through the Wenjuanxing platform from April to May 2025. A total of 337 valid questionnaires were collected. Conduct a survey and analysis of the current situation using the Deep Learning Scale for College Students, the Learning Engagement Scale for College Students, and the Artificial Intelligence Literacy Scale for College Students. **Results:** The overall AI literacy ability of nursing students is at a moderate level ( $95.12 \pm 19.90$ ). Correlation analysis shows that the artificial intelligence literacy ability of college students is significantly positively correlated with their deep learning ( $r = 0.404, P < 0.01$ ) and learning engagement ( $r = 0.307, P < 0.01$ ). The results of multiple factor analysis showed that factors such as grade, family economic status, exposure to AI related courses/training, daily use of AI time, deep learning among college students, and college students' learning engagement had a significant impact on their artificial intelligence literacy ability ( $P < 0.05$ ). **Conclusion:** The AI literacy ability of nursing students needs to be improved. Suggest increasing opportunities for AI practice and integrating AI literacy content into nursing education to encourage deep learning and high engagement, in order to enhance students' AI literacy abilities.

## Subject Areas

Artificial Intelligence

## Keywords

Artificial Intelligence, Nursing Students, Literacy Ability, Influencing Factors, Education

---

## 1. Background

In today's digital age, artificial intelligence (AI) technology is developing at an unprecedented pace. It has profoundly transformed the clinical practice mode of medical care and holds significant potential for revolutionizing nursing education. AI technology matches students' personalized learning needs through adaptive learning platforms [1], creates immersive clinical skills training environments using virtual simulation technology, and proactively identifies students' learning difficulties with predictive analysis models [2]. These advancements provide a strong technical foundation for innovation in nursing education.

Foreign research indicates that nursing students generally have an optimistic attitude towards the application of AI in medical education. They recognize its potential to enhance teaching efficiency and optimize the learning process [3]. Currently, AI literacy has become a key indicator for measuring the quality of nursing services and the level of industry intelligence development. Simm [4] notes that AI literacy in the nursing field involves critical evaluation skills, ethical considerations, and technical proficiency in understanding and applying generative AI technology. This ensures its safe, effective, and responsible use in both educational and clinical settings. Laupichler [5] has confirmed a significant positive correlation between medical students' AI literacy and their positive attitudes towards AI.

Domestic research has highlighted the importance of improving AI literacy among college students in the digital age [6]. While AI-related nursing teaching reforms have been implemented in China [7] [8], the integration of AI knowledge and skills into the curriculum remains in the early stages. Practical teaching conditions also limit students' opportunities to operate intelligent nursing devices and apply AI nursing systems. As a result, the current state of AI literacy among nursing students is not well understood. Exploring the current status and influencing factors of AI literacy among nursing students is crucial for optimizing nursing education content and cultivating high-quality professionals who can meet future medical and nursing needs. This study aims to systematically review the current status and influencing factors of AI literacy among nursing students, providing a theoretical basis for further optimizing nursing education content and developing professional talents suitable for future medical demands.

## 2. Object and Method

### 2.1. Survey Subjects

Using a convenience sampling method, students majoring in nursing in Henan

Province were selected as the research subjects from April to May 2025. Inclusion criteria: 1) Full-time undergraduate students majoring in nursing. 2) Voluntarily participate in this study and sign an informed consent form. Exclusion criteria: 1) Students who are not in school for reasons such as taking a leave of absence or dropping out. 2) Students who have incomplete questionnaire filling or obvious logical errors. This study used G\*Power software for sample size calculation. According to the research objectives and statistical requirements, the expected effect size is set to be moderate (with a correlation coefficient of approximately 0.3), the significance level ( $\alpha$ ) is 0.05, and the test power ( $1 - \beta$ ) is 0.80. The results indicate that a minimum sample size of 258 is required, and a total of 340 cases were distributed in this study, which meets the criteria.

## 2.2. Investigation Tools

### 2.2.1. General Information Survey Form

Including gender, grade level, place of origin, being an only child, being a student leader, family economic status, reasons for choosing a nursing major, exposure to AI related courses/training, and daily AI usage time, there are a total of 9 items. Among them, the daily use of artificial intelligence technology is defined as the total time spent using AI tools for both learning (including assisted queries, translation, and literature reading) and leisure purposes (including interacting with AI chatbots or using AI for image/music generation).

### 2.2.2. Scale of Artificial Intelligence Literacy Ability for College Students

The Artificial Intelligence Literacy Scale for College Students was developed by Zhou [6], focusing on evaluating students' literacy in the field of artificial intelligence, including four dimensions: knowledge, skills, attitudes and values, and ethics, with a total of 25 items. Using a 7-level Likert scale, ranging from "completely disagree" to "completely agree", with scores ranging from 1 to 7, for a total score of 25 to 175. The higher the score, the stronger the AI literacy ability. The reliability of the scale is 0.912, indicating good validity. The confirmatory factor analysis results show that the average variance extracted (AVE) of each factor is greater than 0.45, and the combined reliability (CR) is greater than 0.7. The discriminant validity is acceptable. In this study, the confidence level was 0.968, indicating good reliability of the scale.

### 2.2.3. Deep Learning Scale for College Students

The Deep Learning Scale for College Students was developed by Li [9] to evaluate the deep learning abilities of college students in blended learning environments. It covers four dimensions: motivation, engagement, strategy, and outcomes, with a total of 36 items. Using a 4-point Likert scale, ranging from "completely disagree" to "completely agree", with scores ranging from 1 to 4, for a total score of 36-144. The higher the score, the stronger the deep learning ability. The reliability of the scale is 0.971, with good validity, and all CFA fitting indicators meet the requirements. In this study, the confidence level was 0.980, indicating good reliability.

bility of the scale.

#### **2.2.4. College Student Learning Engagement Scale**

The College Student Learning Engagement Scale was developed by Fang [10] aiming to measure students' level of learning engagement. It covers three dimensions: vitality, dedication, and focus, and includes 17 items. Use a 4-point Likert scale to score, with a total score of 17 - 68. The higher the score, the more engaged the student is in the learning process. The reliability of the scale is 0.951 and the validity is good. Exploratory factor analysis results show that the KMO value is 0.951 and the Bartlett sphericity test value is 3219.67 ( $P < 0.001$ ). The three factors together explain 68.40% of the variance. In this study, the confidence level was 0.969, indicating good reliability of the scale.

### **2.3. Data Collection and Quality Control Methods**

The questionnaire is generated through the "Wenjuanxing" platform, and after generating a QR code and link, it is distributed to the research subjects through the on campus class group notification. Before filling out the questionnaire, the researcher explains the research purpose and confidentiality principles to the research subjects, who voluntarily participate in the survey. Input data separately by two individuals, verify data consistency and logic, and eliminate invalid data. A total of 340 questionnaires were distributed in this study, and 337 valid questionnaires were collected, with an effective response rate of 99.1%. To maximize the representativeness of the sample, we covered nursing students of different grades and classes during the distribution process, and ensured that the questionnaire link remained valid throughout the survey period. Unreturned or invalid questionnaires are mainly due to personal reasons of the research subjects (such as not paying attention to the survey notice due to temporary leave), which did not have a systematic impact on the representativeness of the sample.

### **2.4. Data Analysis**

Statistical analysis was conducted using SPSS 25.0 software. Count data is described using frequency and percentage; The measurement data is described as mean  $\pm$  standard deviation soil. Conduct independent sample t-test, one-way ANOVA, Pearson correlation analysis, and multiple linear regression analysis. Test level  $\alpha = 0.05$ .

## **3. Results**

### **3.1. General Information**

This study collected data from 337 nursing students at Pingdingshan University, including 260 males and 77 females; 86 freshmen, 58 sophomores, 156 juniors, and 37 seniors; 204 urban students and 133 rural students; 94 only children and 243 non only children; There are 53 student cadres and 284 non student cadres, as shown in **Table 1** for specific information.

**Table 1.** General information of college students ( $n = 337$ ).

Project	Grouping	Countdown	Percentage%
gender	male	260	77.15
	female	77	22.85
grade	freshman year	86	25.52
	sophomore year	58	17.21
	junior year	156	46.29
	senior year	37	10.98
place of origin	city	204	60.53
	countryside	133	39.47
Is he/she an only child	yes	94	27.89
	No	243	72.11
Is it a student cadre	yes	53	15.73
	No	284	84.27
Family economic status	poor	60	17.80
	Chinese	111	32.94
	good	105	31.16
	Excellent	61	18.10
Reasons for choosing nursing profession	voluntary	174	51.63
	Parents or others help choose	129	38.28
	adjust	34	10.09
Have you been exposed to AI related courses/training	yes	136	40.36
	No	201	59.64
Daily AI usage time (h)	Basically not used	35	10.39
	<0.5	70	20.77
	0.5 - 1	92	27.30
	1 - 2	81	24.04
	>2	59	17.50

### 3.2. Scores for College Students' Artificial Intelligence Literacy, Deep Learning, and Learning Engagement

The average scores for artificial intelligence literacy ability, deep learning among college students, and college students' learning engagement are  $95.12 \pm 19.90$ ,  $110.55 \pm 18.18$ , and  $72.06 \pm 17.87$ , respectively. The specific scores are shown in **Table 2**.

**Table 2.** Scores for college students' artificial intelligence literacy, deep learning, and learning engagement.

Project	Number of entries	Minimum	Maximum	Average of entries	Standard deviation	Mean
Artificial intelligence literacy ability	25.00	25.00	140.00	95.12	19.90	3.80
AI knowledge	3.00	3.00	21.00	11.24	2.84	3.75
AI skills	8.00	8.00	52.00	30.64	7.20	3.83
AI attitude	6.00	6.00	36.00	22.65	5.04	3.77
AI Ethics	8.00	8.00	49.00	30.59	6.30	3.82
Deep Learning for College Students	36.00	57.00	144.00	110.55	18.18	3.07
motivation	4.00	4.00	16.00	12.53	2.43	3.13
input	6.00	6.00	24.00	17.88	3.81	2.98
strategy	15.00	15.00	60.00	46.19	8.01	3.08
result	11.00	21.00	44.00	33.95	5.52	3.09
College students' engagement in learning	17.00	17.00	119.00	71.60	18.39	4.24
vitality	5.00	5.00	35.00	20.04	5.67	4.03
dedication	6.00	6.00	42.00	25.92	6.55	4.34
focus	5.00	6.00	42.00	25.63	7.14	5.17

### 3.3. Single Factor Analysis of College Students' Artificial Intelligence Literacy Ability

Univariate analysis showed that factors such as grade level, family economic status, reasons for choosing nursing major, exposure to AI related courses/training, and daily AI usage time had statistically significant effects on college students' artificial intelligence literacy ability ( $P < 0.05$ ). The specific scores are shown in **Table 3**.

**Table 3.** Single factor analysis (n = 337).

Project	Grouping	College students' artificial intelligence literacy (Mean $\pm$ Standard Deviation)	T/F	<i>P</i>
gender	male	95.07 $\pm$ 19.95	0.003	0.955
	female	95.29 $\pm$ 19.88		
grade	freshman year	87.05 $\pm$ 19.37	15.184	0.000
	sophomore year	87.28 $\pm$ 20.95		
	junior year	101.13 $\pm$ 18.78		
	senior year	100.81 $\pm$ 12.33		
place of origin	city	97.36 $\pm$ 17.87	0.911	0.341
	countryside	93.66 $\pm$ 21.04		
Is he/she an only child	yes	94.16 $\pm$ 20.92	0.601	0.439
	No	95.49 $\pm$ 19.53		

## Continued

Is it a student cadre	yes	101.19 ± 19.49	0.082	0.775
	No	93.99 ± 19.81		
Family economic status	poor	82.97 ± 21.70	15.445	0.000
	Chinese	98.55 ± 18.93		
	good	92.89 ± 16.21		
	Excellent	104.67 ± 19.29		
Reasons for choosing nursing profession	voluntary	97.83 ± 19.56	5.595	0.004
	Parents or others help choose	98.47 ± 26.77		
	adjust	90.58 ± 17.45		
Have you been exposed to AI related courses/training	yes	105.71 ± 20.70	7.057	0.008
	No	87.96 ± 15.76		
Daily AI usage time (h)	Basically not used	85.46 ± 17.73	13.299	0.000
	<0.5	83.74 ± 17.73		
	0.5 - 1	96.92 ± 17.73		
	1 - 2	101.19 ± 17.73		
	>2	103.20 ± 17.73		

### 3.4. Correlation Analysis of College Students' Artificial Intelligence Literacy, Deep Learning, and Learning Engagement

The correlation analysis results show that there is a significant positive correlation between artificial intelligence literacy and deep learning among college students ( $r = 0.404$ ,  $P < 0.01$ ); There is a significant positive correlation between artificial intelligence literacy ability and college students' learning engagement ( $r = 0.307$ ,  $P < 0.01$ ), The specific scores are shown in **Table 4**.

**Table 4.** Correlation analysis of college students' artificial intelligence literacy ability.

	Artificial intelligence literacy	Artificial intelligence knowledge	Artificial intelligence skills	Attitude towards artificial intelligence	Artificial intelligence ethics	Deep learning for college students	College students' learning engagement
Artificial Intelligence Literacy	1						
Artificial intelligence knowledge	0.848**	1					
Artificial Intelligence Skills	0.956**	0.756**	1				
Attitude towards artificial intelligence	0.915**	0.683**	0.845**	1			
Artificial Intelligence Ethics	0.951**	0.817**	0.859**	0.816**	1		
Deep Learning for College Students	0.404**	0.437**	0.361**	0.392**	0.351**	1	
College students' learning engagement	0.307**	0.254**	0.290**	0.319**	0.268**	0.408**	1

### 3.5. Multi-Factor Analysis of Artificial Intelligence Literacy Ability of College Students

Taking the score of college students' artificial intelligence literacy ability as the dependent variable, the variables with statistical significance in the univariate analysis and those in the correlation analysis were included in the multivariate analysis. The results showed that grade, family economic status, exposure to AI related courses/training, daily use of AI time, and total score depth level input factors had a significant impact on college students' artificial intelligence literacy ability ( $P < 0.05$ ). The VIF of the model is 1.033 - 1.215, with a tolerance of 0.618 - 0.968, and there is no collinearity issue. Entering the regression equation can explain 62.70% of the artificial intelligence literacy ability of college students. See **Table 5, Table 6.**

**Table 5.** Independent variable assignment method.

Independent variable	Assignment instructions
grade	Freshman = 1, sophomore = 2, junior = 3, senior = 4
Family economic status	Poor = 1, Medium 2 = 2, Good = 3, Excellent = 4
Have you been exposed to AI related courses/training	Yes = 1, No = 2
Reasons for choosing nursing profession	Voluntary = 1, Other = 2, Adjustment = 3
Daily AI usage time (h)	Basically not using = 1, < 0.5 = 2, 0.5 - 1 = 3, 1 - 2 = 4, > 2 = 5
Deep Learning for College Students	Substitute the original value into
College students' learning engagement	Substitute the original value into

**Table 6.** Multifactor analysis of artificial intelligence literacy ability of college students.

Variable	$\beta$	SE	$\beta$	t	p	Tolerance	VIF
(Constant)	57.776	9.324		6.196	0.000		
grade	3.294	0.939	0.164	3.509	0.001	0.912	1.096
Family economic status	3.350	0.914	0.166	3.663	0.000	0.968	1.033
Reasons for choosing nursing profession	1.608	1.414	0.054	1.138	0.256	0.881	1.135
Have you been exposed to AI related courses/training	-9.863	2.212	-0.243	-4.459	0.000	0.665	1.503
Daily AI usage time (h)	2.860	0.784	0.178	3.647	0.000	0.831	1.204
Deep Learning for College Students	0.139	0.062	0.127	2.240	0.026	0.618	1.619
College students' learning engagement	0.136	0.053	0.126	2.560	0.011	0.823	1.215

Note:  $R^2 = 0.347$ , adjust  $R^2 = 0.34$ ;  $F = 25.028$ ,  $P < 0.001$ .

## 4. Discussions

### 4.1. Current status of Artificial Intelligence Literacy Ability among Nursing Students

The results of this study show that the overall artificial intelligence literacy ability of nursing students is at a moderate level, with an average total score of 95.12 and

an item mean of 3.80, which is at a moderate level according to the 7-level scoring method. This result is lower than the average value of college students' artificial intelligence literacy ability of 5.588, indicating that there is still room for improvement in the comprehensive ability of nursing students in the field of artificial intelligence. This phenomenon may be related to the fact that the research subjects are in the early stages of development of artificial intelligence related content, insufficient integration, limited practical opportunities, and relatively weak ethical education [11]. Among them, the score of AI skill dimension is relatively high, with an average of 3.83, but still at a moderate level, indicating that students will use some simple operations of AI, but still at a moderate level, and their ability to apply AI technology in practice needs to be improved. The lack of AI practical opportunities in domestic nursing education, such as the application of AI in laboratory courses and clinical internships, limits students' ability to transform theoretical knowledge into practical skills [12]; The lowest score for AI knowledge is 3.75 on average, indicating that students have a relatively weak grasp of AI theoretical knowledge. This phenomenon may be related to the fact that the artificial intelligence related content of the research subject's institution is in the early stages of development, with insufficient integration, limited practical opportunities, and relatively weak ethical education.

## **4.2. Factors Affecting the Artificial Intelligence Literacy of Nursing Students**

### **4.2.1. Grade**

The results of multiple factor analysis show that grade has a significant impact on the artificial intelligence literacy ability of nursing students. The artificial intelligence literacy ability of senior students is significantly higher than that of junior students. This may be related to the fact that senior students have accumulated more professional knowledge and practical experience during the learning process. As students deepen their learning, their understanding and application abilities of artificial intelligence technology gradually increase.

### **4.2.2. Family Economic Status**

The family economic status has a significant impact on the artificial intelligence literacy of nursing students. Students from families with better economic conditions perform better in artificial intelligence literacy abilities. This may be because students from families with better economic conditions can more easily access relevant learning resources, such as attending paid AI training courses, purchasing professional learning software, etc. In addition, students from families with better economic conditions have more opportunities to access and use advanced AI devices and technologies, which are crucial for enhancing their AI literacy abilities.

### **4.2.3. Have You Been Exposed to AI Related Courses/Training**

Whether or not one has been exposed to AI related courses/training has a signifi-

cant impact on the artificial intelligence literacy of nursing students. Students who have been exposed to AI related courses or training perform better in terms of artificial intelligence literacy. This is consistent with the research findings of Laupichler [5], which found that AI related courses and ethics training are key factors in enhancing nursing students' AI literacy. Students who have been exposed to AI related courses or training can acquire more comprehensive AI knowledge and skills, thereby better understanding and applying artificial intelligence technology.

#### **4.2.4. Daily AI Usage Time**

The daily use of AI has a significant impact on the artificial intelligence literacy of nursing students. Students who have been using AI for a longer period of time perform better in terms of artificial intelligence literacy ability. This is consistent with Wang's [13] viewpoint, which states in his developed User AI Capability Measurement Scale that an individual's AI literacy level is significantly positively correlated with the frequency, type, and scope of their use of artificial intelligence technology in daily life. Li's [14] research also shows that users who frequently use generative artificial intelligence have stronger human AI interaction abilities. The stronger the user's performance in dimensions such as information retrieval and analysis, and information evaluation, the stronger the overall AI interaction ability.

#### **4.2.5. Deep Learning for College Students**

Deep learning among college students has a significant impact on the artificial intelligence literacy of nursing students. Students with stronger deep learning abilities perform better in artificial intelligence literacy. Rong's research confirms [15] that introducing virtual reality interaction and artificial intelligence into middle school art education is beneficial for students' deep learning, thereby improving their focus and creativity. Similarly, applying artificial intelligence technology to deep learning in the teaching and learning processes of university teachers and students is also an innovative way to improve teaching quality. Related studies have also shown [16] that teaching reforms empowered by artificial intelligence can effectively improve teaching efficiency, optimize curriculum design, and promote student participation in deep learning.

#### **4.2.6. College Students' Engagement in Learning**

The degree of college students' learning engagement has a significant impact on the artificial intelligence literacy ability of nursing students. This relationship can be explained from the perspective of self-determination theory, that is, when students' basic psychological needs such as autonomy, competence, and belonging are met during the learning process, it will stimulate stronger intrinsic learning motivation and sustained learning engagement behavior, thereby more actively exploring and mastering artificial intelligence related knowledge and skills [17]. Students with higher levels of learning engagement perform better in artificial intelligence literacy abilities. This is consistent with the research results of Zhou

[18], which showed that the application of artificial intelligence in teaching can significantly enhance students' creativity, with learning engagement playing an important mediating role. AI technology improves students' learning engagement by providing personalized support and interactive learning environments, while higher learning engagement further promotes students' active thinking and innovative practices, thereby enhancing creativity.

## 5. Limitation

This study investigated and analyzed the current status and influencing factors of artificial intelligence literacy among nursing students in a certain university. The results show that students' overall AI literacy ability is at a moderate level, with significant influences from factors such as grade, family economic status, exposure to AI related courses/training, daily AI usage time, deep learning among college students, and college students' learning engagement on their AI literacy ability. This study has several limitations. Firstly, the use of a convenience sample from a single university in Henan Province limits the generalizability of the findings and may lack national representativeness. Secondly, reliance solely on self-reported questionnaire data may introduce response bias and restricts an in-depth understanding of the nuances in AI literacy development. The absence of qualitative methods, such as interviews or focus groups, limits the exploration of underlying motivations and contextual factors. Thirdly, although this study identified several influencing factors, it lacks a comprehensive theoretical framework to explain the underlying mechanisms and pathways through which these factors affect AI literacy, which limits the interpretability of the findings. Future research should expand the sample size, combine qualitative research methods, and construct or apply robust theoretical frameworks to better explain the causal relationships and mechanisms behind the influencing factors. Furthermore, it is necessary to expand the analysis of influencing factors to deeply explore the mechanisms of potential factors such as teaching resources and individual differences among students, in order to more comprehensively reveal their impact on the AI literacy ability of nursing students.

## Funding

Artificial Intelligence Teaching Reform Project at Pingdingshan University in 2025 (RGZN201512).

## Conflicts of Interest

The authors declare no conflicts of interest.

## References

- [1] Gupta, N., Khatri, K., Malik, Y., Lakhani, A., Kanwal, A., Aggarwal, S., *et al.* (2024) Exploring Prospects, Hurdles, and Road Ahead for Generative Artificial Intelligence in Orthopedic Education and Training. *BMC Medical Education*, **24**, Article No.

1544. <https://doi.org/10.1186/s12909-024-06592-8>
- [2] Chance, E.A. (2025) The Combined Impact of AI and VR on Interdisciplinary Learning and Patient Safety in Healthcare Education: A Narrative Review. *BMC Medical Education*, **25**, Article No. 1039. <https://doi.org/10.1186/s12909-025-07589-7>
- [3] Duan, S., Liu, C., Rong, T., Zhao, Y. and Liu, B. (2025) Integrating AI in Medical Education: A Comprehensive Study of Medical Students' Attitudes, Concerns, and Behavioral Intentions. *BMC Medical Education*, **25**, Article No. 599. <https://doi.org/10.1186/s12909-025-07177-9>
- [4] Simms, R.C. (2025) Generative Artificial Intelligence (AI) Literacy in Nursing Education: A Crucial Call to Action. *Nurse Education Today*, **146**, Article 106544. <https://doi.org/10.1016/j.nedt.2024.106544>
- [5] Laupichler, M.C., Aster, A., Meyerheim, M., Raupach, T. and Mergen, M. (2024) Medical Students' AI Literacy and Attitudes towards AI: A Cross-Sectional Two-Center Study Using Pre-Validated Assessment Instruments. *BMC Medical Education*, **24**, Article No. 401. <https://doi.org/10.1186/s12909-024-05400-7>
- [6] Zhou, Q., Xu, Y. and Cai, Y. (2024) Multidimensional Analysis of the Current Status and Influencing Factors of Artificial Intelligence Literacy among College Students. *Journal of Library and Information Science*, **41**, 38-48.
- [7] Wu, N., Chen, S., Yu, B., et al. (2025) The Current Situation and Reflection on the Application of Generative Artificial Intelligence Assisted Learning for Vocational Nursing Students. *China Nursing Education*, **22**, 403-409.
- [8] Liu, C., Li, S., Chen, Y., et al. (2025) Application and Practice of Artificial Intelligence in Innovative Teaching of Medical Immunology. *Chinese Journal of Immunology*, **41**, 1324-1327.
- [9] Li, Y.B., Su, D.R., Li, Q.Y., et al. (2018) Development of a Deep Learning Scale for College Students in a Blended Learning Environment. *Research on Electronic Education*, **39**, 94-101.
- [10] Fang, L., Shi, K. and Zhang, F. (2008) A Study on the Reliability and Validity of the Chinese Version of the Learning Engagement Scale. *Chinese Journal of Clinical Psychology*, **16**, 618-620.
- [11] Montejo, L., Fenton, A. and Davis, G. (2024) Artificial Intelligence (AI) Applications in Healthcare and Considerations for Nursing Education. *Nurse Education in Practice*, **80**, Article 104158. <https://doi.org/10.1016/j.nepr.2024.104158>
- [12] Dai, S.Q. (2025) Research on the Reconstruction and Practice of Artificial Intelligence Driven Vocational Education Curriculum System. *Educational Theory and Practice*, **45**, 54-59.
- [13] Wang, B., Rau, P.P. and Yuan, T. (2023) Measuring User Competence in Using Artificial Intelligence: Validity and Reliability of Artificial Intelligence Literacy Scale. *Behaviour & Information Technology*, **42**, 1324-1337. <https://doi.org/10.1080/0144929x.2022.2072768>
- [14] Li, F., Yan, X., Su, H., Shen, R. and Mao, G. (2025) An Assessment of Human-AI Interaction Capability in the Generative AI Era: The Influence of Critical Thinking. *Journal of Intelligence*, **13**, Article 62. <https://doi.org/10.3390/jintelligence13060062>
- [15] Rong, Q., Lian, Q. and Tang, T. (2022) Research on the Influence of AI and VR Technology for Students' Concentration and Creativity. *Frontiers in Psychology*, **13**, Article ID: 767689. <https://doi.org/10.3389/fpsyg.2022.767689>
- [16] Liu, Y., Chen, L. and Yao, Z. (2022) The Application of Artificial Intelligence Assistant to Deep Learning in Teachers' Teaching and Students' Learning Processes. *Frontiers in Psychology*, **13**, Article ID: 767689. <https://doi.org/10.3389/fpsyg.2022.767689>

*tiers in Psychology*, **13**, Article ID: 929175.

<https://doi.org/10.3389/fpsyg.2022.929175>

- [17] Yang, Y., Chen, J. and Zhuang, X. (2025) Self-Determination Theory and the Influence of Social Support, Self-Regulated Learning, and Flow Experience on Student Learning Engagement in Self-Directed E-learning. *Frontiers in Psychology*, **16**, Article ID: 1545980. <https://doi.org/10.3389/fpsyg.2025.1545980>
- [18] Zhou, M. and Peng, S. (2025) The Usage of AI in Teaching and Students' Creativity: The Mediating Role of Learning Engagement and the Moderating Role of AI Literacy. *Behavioral Sciences*, **15**, Article 587. <https://doi.org/10.3390/bs15050587>