Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Nursing Undergraduate Teachers' Cognition Of AI-Driven Teacher-Student Education al Co-Creation: A Cross-Sectional Study

Huixin Shan
Zhengzhou University
Chenmeng Li
Beijing Normal-Hong Kong Baptist University
Yinxia Dou
Zhengzhou Health College
Qiming Liao
Zhengzhou Health College
Shuwei Sun
Zhengzhou University
Xiao Yang
Zhengzhou University
Xiaofan Wang
Zhengzhou University
Meili Wang
Zhengzhou Health College
Chunhui Zhang
zhangchunhui0617@163.com
Zhengzhou University
Wenna Wang
Zhengzhou University

Research Article

Keywords: Artificial Intelligence, Education, Nursing, Cooperative Behavior, Teachers, Cognition, Literacy, Psychological Well-Being

Posted Date: November 25th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11421611/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

Background

Artificial intelligence (AI) is reshaping nursing education, and AI-driven teacher-student co-creation has emerged as a promising approach to cultivate human-AI collaboration competencies. Teachers, as designers and facilitators, play a pivotal role; their cognition, attitudes, and practices determine the effectiveness of co-creation.

Ethical Dimension:

This study was performed in accordance with the principles of the Declaration of Helsinki. The study was approved by the Ethics Committee of Zhengzhou University (No. ZZUIRB2025-56).

Methods

From January to February 2026, 232 teachers from nursing colleges in Henan Province, China, were recruited via convenience sampling. Data were collected using a general demographic questionnaire, a self-developed Cognition of AI-Driven Teacher-Student Educational Co-Creation Questionnaire, the Artificial Intelligence Literacy Scale(AILS), and the Flourishing Scale(FS). Descriptive statistics, t-tests, ANOVA, Pearson correlation, and multiple linear regression were used.

Results

The mean total cognition score was 116.38(SD = 13.90). Cognition positively correlated with flourishing ($r = 0.380$, $p < 0.01$) and AI literacy ($r = 0.402$, $p < 0.01$). AI literacy ($\beta = 0.285$) and flourishing ($\beta = 0.241$) were independent positive factors. The model explained 21.6% of the variance (adjusted $R^2 = 0.205$, $F = 6.947$).

Conclusion

Nursing undergraduate teachers showed favourable overall cognition, yet cognitive understanding and practical engagement lagged behind attitudes. AI literacy and flourishing are key modifiable associated factors. Multifaceted interventions—structured AI literacy training, psychological resource cultivation, and institutional support—are needed to strengthen cognitive foundations and bridge the gap between positive attitudes and sustained co-creation practices in nursing education.

1.Introduction

The deep integration of artificial intelligence (AI) into education is reshaping the landscape of nursing education[1], catalysing a paradigm shift from traditional skill-based training toward the cultivation of innovative nursing talent capable of navigating increasingly complex healthcare environments. The core educational goal now centres on developing intelligent nursing professionals who possess human-AI collaboration capabilities, interdisciplinary thinking, and the ability to leverage AI to address complex clinical problems[2]. However, conventional nursing teaching models exhibit notable deficiencies in adapting to this new era. These models remain predominantly teacher-centred, emphasising unidirectional knowledge transmission and basic technical skill training—approaches that fall short of meeting the evolving demands of the AI-driven healthcare landscape[3].

Contemporary nursing students demonstrate strong willingness to use AI tools and express urgent needs for personalised, interactive, and immersive learning experiences[4]. Against this backdrop, the dual-subject teaching philosophy—which equally values both teachers and students as active participants—has gradually gained traction. AI-driven teacher-student educational co-creation has become an important pathway for operationalising this philosophy[5]. Different from teachers' individual adoption of AI teaching tools, AI-driven co-creation in nursing education is defined as a continuous process in which AI technologies serve as empowering tools, and nursing teachers, students, and other stakeholders collaboratively and equitably participate in instructional design, resource development, learning assessment, and educational governance. It encompasses multiple domains, including curriculum content co-creation, personalised learning co-creation, and research and professional development co-creation[5].

Existing studies have mostly focused on nursing educators' attitudes, barriers and perceived benefits of general AI application. Empirical evidence specifically targeting teachers' cognition-attitude-practice toward AI-empowered teacher-student co-creation remains limited. Moreover, few studies have incorporated positive psychological resources such as flourishing as potential associated factors.

Within this co-creation framework, teachers function as designers, facilitators, and enablers of teaching activities, positioning them as the central agents in teacher-student educational co-creation. Their cognitive level, receptive attitudes, and practical competencies directly determine the depth and effectiveness of co-creation implementation[6]. Therefore, this study investigated the current status of cognition regarding AI-driven teacher-student educational co-creation among nursing undergraduate teachers and analysed its influencing factors, with the aim of providing theoretical support for promoting co-creation practices in nursing education and facilitating the digital transformation of the discipline.

2. Methods

2.1 Design

This study used a cross-sectional correlational design to investigate the current status of cognition regarding AI-driven teacher-student educational co-creation among nursing undergraduate teachers and

analyse its associated factors. This manuscript adheres to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement for reporting observational research.

2.2Participants

Using a convenience sampling method, we recruited nursing faculty from public undergraduate nursing colleges in Henan Province, China, between January and February 2026. Inclusion criteria were: (a) having taught undergraduate nursing courses for at least one year; and (b) providing informed consent and voluntarily participating in the survey. Exclusion criteria were: concurrent participation in other intervention or evaluation studies related to AI-driven co-creation cognition. Based on the rule of thumb requiring 5–10 times the number of variables[7], with 21 independent variables in total and accounting for 20% anticipated invalid responses, the required sample size was estimated to range from 126 to 252. A total of 232 valid responses were ultimately obtained.

2.3Measures

2.3.1General Demographic Questionnaire

This questionnaire collected information on gender, age, type of institution, teaching experience, professional title, highest educational degree, professional background, type of main courses taught, years of clinical practice, commonly used co-creation tools, frequency of co-creation, student participation methods, and types of co-creation projects.

2.3.2Cognition of AI-Driven Teacher-Student Educational Co-Creation Questionnaire for Nursing Undergraduate Teachers

This instrument was self-developed by the research team under the guidance of Community of Practice theory and the Theory of Planned Behavior. The Theory of Planned Behavior informed the three-domain framework: cognition (beliefs and understanding), attitudes (affective evaluation), and practices (behavioural tendency). Community of Practice theory guided the development of items reflecting interactive collaboration between teachers and students in AI-enabled educational scenarios. Its development involved literature review, interviews, and a Delphi expert consultation process. The final questionnaire comprised 26 items across three dimensions: cognition (11 items), attitudes (8 items), and practices (7 items). The overall Cronbach's α coefficient was 0.935, with subscale coefficients of 0.880 (cognition), 0.957 (attitudes), and 0.934 (practices). The content validity index (S-CVI) was 0.895. Exploratory factor analysis was performed to examine the structural validity of the scale. The KMO value was 0.897, and Bartlett's test of sphericity yielded X^2=2920.465, df = 325, $p < 0.001$, indicating that the sample data were suitable for factor analysis. Given the limited sample size in this study and ceiling effects observed in several items (most respondents selected high scores), single-item indicators were associated with substantial random error. Referring to the item parceling strategy proposed by Little et al., items within each dimension were aggregated into 3 parcel indicators based on the theoretical

connotation of each dimension. This approach reduced the number of parameters to be estimated and improved the stability of model estimation. Confirmatory factor analysis showed that X^2 = 72.8, df = 23, X^2/df = 3.17, CFI = 0.959, TLI = 0.936, RMSEA = 0.137. The CFI and TLI of the model met the criteria for good fit, while the RMSEA was relatively high. This discrepancy was mainly attributed to the small sample size of the study. The model was judged to have acceptable fit comprehensively.

The cognition dimension measures teachers' understanding of the connotation of co-creation and the value of AI; the attitude dimension assesses their acceptance and willingness to support co-creation practices; and the practice dimension captures their actual co-creation behaviours in teaching. Each item was rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree), with total scores ranging from 26 to 130. Higher scores indicated higher cognitive levels. The cut-off values for categorisation were derived in an exploratory manner. First, theoretical quartile points (25%, 50%, 75%) were calculated according to the theoretical total-score range of the questionnaire. Considering the skewed distribution of observed scores in the present sample, these theoretical thresholds were adjusted to fit the actual score distribution and rounded to integers. The final categorisation was defined as: low level < 32; moderate level 32-97; high level > 98. These cut-offs are sample-specific and exploratory, and should not be treated as standardised norm-referenced thresholds for application to external populations.

2.3.3Artificial Intelligence Literacy Scale (AILS)

The AILS was developed by Wang et al.[8] in China in 2023, based on an AI literacy framework. It comprises four dimensions—awareness, usage, evaluation, and ethics—each containing 3 items. Items are rated on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree), with total scores ranging from 12 to 84. Higher scores indicate higher levels of AI literacy. The overall Cronbach's α coefficient for this scale was 0.736.

2.3.4Flourishing Scale (FS)

The FS was originally developed by Diener et al.[9] and translated into Chinese by Lai Qiaozhen[10]. It consists of 8 items covering meaning, self-acceptance, relationships, helping others, engagement, competence, optimism about the future, and respect from others. Each item is rated on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). Higher scores indicate higher levels of flourishing. The item mean score is used as the evaluation criterion: <4(low), 4–<5(moderate), 5–<6(relatively high), and ≥ 6(high). The overall Cronbach's α coefficient for this scale was 0.935.

2.4Data Collection

Data were collected via an online questionnaire. An anonymous survey was conducted using the WJX (Questionnaire Star) platform. The QR code was distributed to teachers for voluntary completion. Upon receipt, two researchers independently reviewed the quality of responses on the same day, cross-checked and cleaned the data, and manually excluded invalid questionnaires based on the following criteria: (1) identical responses or obvious patterned answering; (2) logical contradictions in responses or incorrect answers to trap questions; and (3) completion time too short (< 150seconds). A

total of 245 questionnaires were returned, of which 232 were valid, yielding an effective response rate of 94.7%.

2.5Data Analysis

Data were analysed using IBM SPSS Statistics version 27.0. Continuous variables were described as mean ± standard deviation, and categorical variables as frequencies and percentages. Differences in general demographic characteristics were examined using independent-samples T tests and one-way analysis of variance. Multiple linear regression was performed to identify the associations between influencing factors and each dimension, and hierarchical regression was used to examine the effects of each variable on the dependent variable. The significance level was set at $\alpha = 0.05$ (two-tailed).

3.Results

3.1General Characteristics of Participants

A total of 232 participants were included in the final analysis. Their general demographic characteristics are presented in Table 1.

Table 1
General characteristics of participating nursing teachers (N = 232)

Variable	Category	N	%	*F/t*	P
Gender	Male	5	2.2	5.736	< 0.05
	Female	227	97.8		
Age	< 31	21	9.1	0.305	0.874
	31–40	140	60.3		
	41–50	59	25.4		
	> 50	12	5.1		
Type of institution	985university	1	0.4	0.582	0.676
	211university	61	26.3		
	Regular undergraduate university	170	73.3		
Teaching experience	< 11	115	49.6	1.245	0.293
	11–20	89	38.4		
	21–30	22	9.5		
	31–40	3	1.3		
	> 40	3	1.3		
Professional title	Junior	31	13.4	0.319	0.811
	Intermediate	138	59.5		
	Associate senior	48	20.7		
	Senior	15	6.5		
Highest degree	Bachelor	165	71.1	2.419	0.091
	Master	45	19.4		
	Doctorate	22	9.5		
Frequency of co-creation activities	Never	41	17.7	0.169	0.954
	Very rarely	90	38.8		
	Occasionally	76	32.8		
	Frequently	21	9.1		
	Very frequently	4	1.7		

Variable	Category	N	%	*F/t*	P
Years of clinical practice	< 11	40	17.2	0.566	0.687
	11–20	158	68.1		
	21–30	28	12.1		
	31–40	5	2.2		
	> 40	1	0.4		

3.2Univariate Analysis of Teachers' Cognition

Univariate analysis indicated a statistically significant difference in cognition scores by gender ($p < 0.05$). However, this association disappeared after adjusting for other variables in multiple linear regression ($p = 0.120$). Given the extremely small number of male participants (n = 5), this gender-related finding should be interpreted cautiously.

3.3Overall Cognition, Attitudes, and Practices

Table 2 shows scores across each dimension of the self-developed questionnaire and the two standardized scales.

Table 2
Scores of the Study Instruments and Subscales

Dimension and Total Score	Item	Score (mean ± SD)
Questionnaire on Cognitive Status	Cognition	50.39 ± 5.61
	Attitudes	36.97 ± 4.45
	Practices	29.01 ± 6.22
	Total	116.38 ± 13.90
Artificial Intelligence Literacy Scale	Awareness	14.06 ± 3.44
	Utilization	15.02 ± 2.83
	Assessment	16.62 ± 2.43
	Ethics	15.64 ± 2.98
	Total	61.34 ± 10.40
Flourishing Scale	Total	48.75 ± 7.76

3.4 Correlation Analyses

Table 3 shows pearson correlation analyses revealed that the total cognition score was significantly and positively correlated with both AI literacy total score ($r = 0.402$, $p < 0.01$) and flourishing total score ($r =$

0.380, $p < 0.01$). The correlation matrix is presented below.

Table 3
correlation analysis

Variable	Co-creation cognition total	AI literacy total	Flourishing total
Co-creation cognition total	1		
AI literacy total	0.402***	1	
Flourishing total	0.380***	0.455***	1

3.5 Multiple Linear Regression Analysis

Table 4 shows that taking the cognition total score as the dependent variable, variables with statistical significance ($p < 0.05$) in univariate analyses and correlation analyses were entered as independent variables into the multiple linear regression model.

Table 4
Multiple linear regression analysis of factors associated with teachers' cognition

Variable	B SE		*t*	*P*	*VIF*
(Constant)	52.53	13.41	3.92	< 0.001	
Gender	8.998	5.759	1.563	0.120	1.056
Age	2.078	2.092	0.993	0.322	3.302
Type of institution	-0.142	1.176	-0.121	0.904	1.150
Teaching experience	-0.290	1.391	-0.208	0.835	1.888
Professional title	-0.494	1.799	-0.275	0.784	2.729
Highest degree	-2.380	1.459	-1.631	0.104	1.370
Frequency of co-creation activities	0.552	0.946	0.583	0.561	1.183
Years of clinical practice	0.078	1.511	0.051	0.959	1.725
AI literacy total score	0.393	0.088	4.345	< 0.001	1.373
Flourishing total score	0.432	0.119	3.623	< 0.001	1.287

R^2=0.239, adjusted R^2 = 0.205, F = 6.947, $P < 0.001$.

4.Discussion

4.1Overall Cognition: Favourable but with Gaps in Practice

Among the 232 nursing undergraduate teachers, scores across the cognition, attitude, practice, and total dimensions were all at relatively high levels, consistent with findings from Alabbad et al.[11]. The total cognition score was 116.38 (SD 13.90). Among the subscales, the attitude dimension scored highest, whereas the cognition and practice dimensions were comparatively lower. This pattern indicates that while nursing teachers hold positive attitudes and strong intentions toward AI-driven teacher-student educational co-creation, their understanding of its core connotations and practical implementation remains superficial. Furthermore, many teachers have not translated their positive attitudes into consistent behavioural engagement; although some have developed co-creation competencies, a substantial proportion remain at the theoretical awareness level without actual application, reflecting considerable inter-individual variability.

The favourable attitudes are likely attributable to teachers' recognition of the overarching trend of digital transformation in education and the alignment of co-creation with the collaborative ethos of nursing education. The relatively lower cognition scores may stem from a superficial understanding of the core tenets and role definitions in AI-driven nursing education co-creation, compounded by a lack of systematic training[6]. The lowest scores in the practice dimension are plausibly influenced by multiple real-world constraints: limited depth of cognitive understanding, insufficient institutional provision of AI teaching resources and platforms, and competing time and energy demands arising from the triple responsibilities of teaching, research, and clinical practice[12], as well as inadequate hands-on AI operational skills. These findings align with those of Abutaima et al.[13].

Based on these findings, we recommend that nursing institutions develop tailored support systems that address actual teaching needs. On one hand, institutions should establish AI teaching tool platforms and co-creation practice platforms that offer application resources specifically aligned with undergraduate nursing teaching contexts[14]. On the other hand, they should increase practice-oriented training and hands-on opportunities, guiding teachers to deeply integrate AI technologies with nursing teaching co-creation, thereby progressively enhancing both cognitive depth and practical capabilities, ultimately facilitating the effective implementation of AI-driven teacher-student educational co-creation in undergraduate nursing education.

4.2AI Literacy as a Key Correlate of Cognition

Our analysis demonstrated a significant positive correlation between AI literacy and teachers' cognition, with AI literacy emerging as a significant positive correlate of cognitive levels[15]. The Technology Acceptance Model and the three-dimensional AI literacy theoretical framework posit that perceived ease of use and perceived usefulness of a technology are critical antecedents influencing technology acceptance (cognitive level)[16]. AI literacy, as a comprehensive capacity for mastering AI technologies and employing AI tools, forms the foundation for teachers' understanding and acceptance of AI-driven nursing education co-creation[17].

We reason that nursing teachers with higher AI literacy are better able to clearly recognise the technological advantages, application scenarios, and practical value of AI in teacher-student co-creation, thus developing a more scientifically grounded understanding. Conversely, those with lower AI literacy may harbour cognitive biases about AI technologies[18], hindering accurate comprehension of the connotations and implications of AI-driven co-creation. However, as Kim et al.[19] noted, cognition is a multifaceted outcome shaped by AI literacy, professional beliefs, ethical awareness, and other factors. Therefore, while enhancing AI literacy is essential, training programmes should simultaneously attend to AI awareness, hands-on training, evaluative skills, and ethical considerations, avoiding the limitations of single-domain approaches.

4.3Flourishing as an Independent Psychological Correlate of Cognition

Our findings further revealed that flourishing level was significantly positively correlated with cognition and remained a significant independent correlate even after accounting for AI literacy. This underscores flourishing as an important psychological resource uniquely contributing to teachers' cognition[20–21]. Flourishing, conceptualised as a positive psychological state encompassing mental energy, positive affect, and self-efficacy, serves as an intrinsic motivational force that enables teachers to generate positive cognitions and behaviours when confronting educational reforms. Positive emotions facilitate cognitive expansion by enhancing cognitive flexibility and fulfilling psychological needs.

Nursing education is currently navigating a critical phase of digital and intelligent transformation[2]. AI-driven teacher-student educational co-creation fundamentally disrupts the conventional teaching model, imposing heightened demands on teachers' educational philosophies, teaching competencies, and psychological adaptability. Teachers equipped with ample psychological resources, low technostress, and strong self-efficacy are more inclined to proactively explore AI applications in nursing teaching and deeply grasp the reformative implications of AI-driven co-creation, thereby forming comprehensive and positive perceptions. In contrast, those with lower flourishing levels may experience anxiety, resistance, or a wait-and-see attitude when facing transformative pressures, limiting their ability to embrace novel teaching models and develop a holistic, scientific understanding of AI-driven co-creation[2].

To further enhance teachers' cognition and facilitate the intelligent transformation of nursing education, we recommend that institutions incorporate positive psychological cultivation into routine teachers development programmes[22]. Specific strategies may include deploying AI-powered psychological support chatbots, delivering mindfulness-based cognitive interventions[23], and establishing teachers psychological support platforms tailored to the realities of nursing education. These initiatives can help alleviate anxiety related to educational transformation, enhance mental energy and resilience[2], and build a robust psychological foundation for teachers to actively embrace and understand AI-driven teacher-student educational co-creation.

4.4Strategies to Enhance Cognitive Levels

As a core engine of digital transformation in education, AI is reshaping the teaching-learning ecosystem. The critical factor in empowering nursing education co-creation with AI lies in enhancing cognition among nursing teachers. Our regression model only explained 20.5% of total variance, indicating that many other individual- and organisational-level factors remain unexplained, such as institutional support, departmental atmosphere, teachers' technostress and workload. Although overall cognition is favourable, practice levels require strengthening, and AI literacy and flourishing are key modifiable associated factors identified in this study. The underlying reasons include teachers reliance on traditional teaching paradigms and perceived risks of new technologies[24], as well as insufficient alignment between institutional support systems, technological functionalities, and teaching tasks. The AI-TPACK integration framework[25] also suggests that only when technological knowledge, pedagogical knowledge, and content knowledge are jointly applied in authentic contexts can AI become an integral part of teachers' professional competencies.

Accordingly, we propose the following multi-pronged strategies grounded in our empirical results. First, teachers mindsets should be shifted through teaching seminars, demonstration class observations, and sharing of exemplary teaching cases[26], helping teachers recognise AI's contemporary role and incorporate AI into teaching, thereby reducing dependence on conventional methods and alleviating technophobia. Second, a tiered, classified, and phased flexible training system should be designed according to diverse teachers needs and characteristics[27]: ladder-shaped training based on teaching experience and AI literacy levels, targeting differentiated goals of "basic use," "skillful use," and "creative use," while tailoring content for different teaching roles (e.g., theoretical courses, clinical practicum, and humanities nursing). This progressive approach accommodates individual differences and professional development demands, consolidating cognitive foundations and enhancing co-creation participation capacities. Third, attention should be paid to nurturing flourishing and providing positive psychological guidance[28], using positive incentives to elevate flourishing and create a supportive AI-driven co-creation climate. Starting with simple scenarios to accumulate mastery experiences, respecting teachers' individual adaptation paces, and establishing platforms for achievement display and experience sharing can enhance professional fulfilment and self-efficacy, motivating teachers to actively embrace, explore, and participate in AI educational co-creation. Fourth, institutions should offer open and customisable AI tool platforms rather than rigid solutions[29], preserving space for teacher innovation. In terms of teaching policies, differentiated support mechanisms should be established—granting greater autonomy to teachers with high AI literacy, while providing phased support to those with low AI literacy before gradually withdrawing it. Finally, a "small-step, fast-iteration" practice model[30] should be implemented across nursing classrooms and clinical practica, guiding teachers to begin with simple teaching resource co-creation and progressively advance to curriculum co-construction and research co-creation, thereby deepening cognition through practice and promoting the routine, standardised development of AI-driven teacher-student educational co-creation.

5.Limitations

This study has several limitations. First, the sample was drawn exclusively from nursing undergraduate institutions in Henan Province, China, limiting generalisability. Second, the gender distribution was severely imbalanced (97.8% female), which may have affected the detection of gender-related effects. Third, the regression model explained only 21.6% of the variance in cognition scores (adjusted R^2=0.205), suggesting that other important factors—such as regional culture, educational policies, technological readiness, ethical concerns, and departmental support—warrant further investigation. Future multi-centre studies with larger and more diverse samples across different economic regions, along with longitudinal designs to capture the dynamic trajectories of teachers' cognition, are recommended to further elucidate these determinants and inform evidence-based interventions.

6.Conclusions

Nursing undergraduate teachers demonstrated favourable overall cognition toward AI-driven teacher-student educational co-creation, yet cognitive understanding and practical engagement remained relatively weaker. AI literacy and flourishing were identified as key associated factors of teachers' cognition. Targeted AI literacy training and psychological support interventions are needed to enhance cognitive levels and thereby improve the quality of AI-driven educational co-creation.

Ethical Dimension

This study was performed in accordance with the principles of the Declaration of Helsinki. The study was approved by the Ethics Committee of Zhengzhou University (No. ZZUIRB2025-56). All participants were informed of the study's purpose and content. Personal information obtained in this study was anonymized and kept strictly confidential. Completion and submission of the online questionnaire constituted voluntary informed consent for participants. Participants were made aware that they could withdraw from the study at any time.

Declarations

Ethical Dimension

This study was performed in accordance with the principles of the Declaration of Helsinki. The study was approved by the Ethics Committee of Zhengzhou University (No. ZZUIRB2025-56). All participants were informed of the study's purpose and content. Personal information obtained in this study was anonymized and kept strictly confidential. Completion and submission of the online questionnaire constituted voluntary informed consent for participants. Participants were made aware that they could withdraw from the study at any time.

Declaration of competing interest

The authors have no conflicts to declare.

Data availability

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

Funding

This work was supported by the Higher Education Teaching Reform Project of Henan Province for the year 2024(Grant No. 2024SJGLX0910), Department of Education of Henan Province, China.

This work was supported by the 2025 Zhengzhou University Education and Teaching Reform Research and Practice Project[Grant No. 2025ZZUJGXM280].

Authorship contribution statement

Huixin Shan: Writing-review & editing, Writing-original draft, Data analysis, Conceptualization. Chenmeng Li: Writing-original draft, Data curation, Data analysis. Yinxia Dou: Writing-original draft, Resources, Data curation. Qiming Liao: Writing-original draft, Resources, Data curation. Shuwei Sun: Writing-original draft, Data analysis, Data curation. Xiao Yang: Writing-original draft, Data analysis, Methodology. Xiaofan Wang: Writing-original draft, Supervision. Meili Wang: Writing-original draft, contributed data. Chunhui Zhang: Writing-original draft, Writing-review&editing, Writing-original draft, Validation, Supervision, Resources. Wenna Wang: Writing-original draft, Writing-review&editing, Validation.

Registration statement

This study was not registered in a clinical trial registry because it involved a cross-sectional educational survey of teachers, with no clinical intervention or patient outcome measures.

References

1. Shi YF, Li B, Yu M, et al. The role and reflection of internet healthcare in clinical scientific research. Chinese General Practice Journal. 2025;28(14):1694-1701,1716.
2. Guo RP, Peng SY, He XM, Peng DY, Xu JC. Application of artificial intelligence in nursing education: a scoping review. Chinese Nursing Management. 2025; 25(8): 1217-1223.
3. Zhong WX, Mao XJ, Cheng J, et al. SWOT analysis of the application of generative artificial intelligence to the development of cross-professional communication skills in nursing. Chinese Journal of Nursing Education. 2024; 21(3): 282-288.
4. Lei P, Duo EN, Gao Y, Zhu X. Research on the experience of utilizing artificial intelligence in nursing learning from the perspective of nursing students - a qualitative study. BMC Nurs. 2025 Aug 12;24(1):1062.
5. Laugeland KA, Klippen MIF, Ravik M, Gonzalez MT, Akerjordet K. Exploring co-creation with student nurses in contemporary nursing education: a systematic scoping review. Nurse Education Today.

2025;146:106515.

6. Jiang ZQ, Zhou SX, Guo XL. Teaching emotions of nursing educators empowered by artificial intelligence: value, characteristics and pathways. China Medical Education Technology. 2025; 39(2): 165-169.
7. Sun EH, Gao Y, Ye XC. Translation and validation of the Technology Anxiety Scale in older adults. Chinese Journal of Nursing. 2022; 57(3): 380-384.
8. WANG B,PATRICK RAU P L,YUAN T. Measuring user competence in using artificial intelligence:validity and reliability of artificial intelligence literacy scale[J].Behav Inf Technol, 2023,42(9):1324-1337.
9. Diener E,Wirtz D,Tov W,et al. New well-being mea-sures:short scales to assess flourishing and positive and negative feelings[J].SocIndicRes,2010,97(2):143-156.
10. Lai QZ. Flourishing Status of College Students and Its Application in the Dual-Factor Model of Mental Health[dissertation]. Guangzhou: Southern Medical University; 2017.
11. Alabbad FA, Almeneessier AS, Alshalan MH, Aljarba MN. Knowledge, attitude, and practice of artificial intelligence among doctors and medical students in Saudi Arabia[J]. J Family Med Prim Care, 2025 Apr, 14(4): 1459-1464.
12. Kim SS, De Gagne JC, Hong M, Shin H. Nurse Educators' Perceptions of the Use of Artificial Intelligence: A Qualitative Study. J Nurs Educ. 2025 Jun;64(6):339-345.
13. Abutaima R, Barakat M, Sawan HM, Al Omari SM, Mhaidat NM. Knowledge, attitudes, and practices towards the use of GLP-1 receptor agonists for weight loss among the general population in Jordan; A cross-sectional study. PLoS One. 2024 Dec 5;19(12):e0314407.
14. Dornan M. Every nurse an AI nurse: A framework for integrating artificial intelligence across nursing practice, education, research and policy. Digit Health. 2025 Sep 29;11:205520 76251377939.
15. Saleh ZT, Rababa M, Elshatarat RA, Alharbi M, Alhumaidi BN, Al-Za'areer MS, Jarrad RA, Al Niarat TF, Almagharbeh WT, Al-Sayaghi KM, Fadila DES. Exploring faculty perceptions and concerns regarding artificial intelligence Chatbots in nursing education: potential benefits and limitations. BMC Nurs. 2025 Apr 18;24(1):440.
16. Yim, I. H. Y., & Wegerif, R. (2024). Teachers’ perceptions, attitudes, and acceptance of artificial intelligence (AI) educational learning tools: An exploratory study on AI literacy for young students. Future in Educational Research, 2, Article 4.
17. Majidpanah K, Afra A, Tahery N. Artificial Intelligence from the Perspective of Nursing Professors: Knowledge, Attitudes, Application, Benefits, and Concerns. J Med Edu. 2025;24(1):e165873.
18. Kim SS, De Gagne JC, Hong M, Shin H. Nurse Educators' Perceptions of the Use of Artificial Intelligence: A Qualitative Study. J Nurs Educ. 2025 Jun; 64(6):339-345.
19. Chow, T.S.; To, K. Mindsets Matter: A Mediation Analysis of the Role of a Technological Growth Mindset in Generative Artificial Intelligence Usage in Higher Education. Educ. Sci. 2025, 15, 310.

20. Abou Hashish EA, Alsayed SA, Abdel Razek NMF. Embracing AI in academia: A mixed methods study of nursing students' and educators' perspectives on using ChatGPT. PLoS One. 2025 Jul 17;20(7): e0327981.
21. Filiz, O., Kaya, M.H. & Adiguzel, T. Teachers and AI: Understanding the factors influencing AI integration in K-12 education. Educ Inf Technol 30, 17931–17967 (2025).
22. Casu M, Triscari S, Battiato S, Guarnera L, Caponnetto P. AI Chatbots for Mental Health: A Scoping Review of Effectiveness, Feasibility, and Applications. Applied Sciences. 2024; 14(13):5889.
23. Guo L, Yan D, Yan J, Jiao R. Correlation of academic emotion and hardiness personality of undergraduate nursing students. BMC Nurs. 2024 Feb 21;23(1):134.
24. He SQ, Qi CX. Teachers' perceived risk of project-based learning and its relationship with implementation willingness. Teacher Education Research. 2024; 36(3): 52-59.
25. Yan ZM, Fu JL, Zhu YL, et al. AI-integrated Technological Pedagogical Content Knowledge (AI-TPACK): connotation, teaching practice, and future issues. Journal of Distance Education. 2020; 38(5): 23-34.
26. Feng XY, Xu X, Zhang HK. A new paradigm of instructional design empowered by artificial intelligence. Open Education Research. 2025; 31(3): 63-73.
27. Xiao W, Pian Y, Ma XM. Current status of AI education application and training optimization suggestions for primary and secondary school teachers: an empirical analysis based on large-scale survey data. China Educational Technology. 2025; (10): 114-122.
28. Shen L, Qiu N, Wang Z. Psychological safety and trust as drivers of teachers' continued use of AI tools in classrooms. Sci Rep. 2025 Aug 26; 15(1): 31426.
29. Tao D, Zhang ZH. Construction of a teacher support system for AI-empowered teaching: a case study of MIT Sloan School of Management. Open Education Research. 2025; 31(2): 36-44.
30. Zhan ZH, Zhong CC, Lin ZH, et al. The chain mediating effect of teachers' AI literacy on teaching innovative behavior. China Educational Technology. 2026; (4): 77-85,114.