

CURRENT SITUATION AND MANAGEMENT OPTIMIZATION OF ARTIFICIAL INTELLIGENCE LITERACY AMONG ENGINEERING MAJOR TEACHERS FOR VOCATIONAL COLLEGES IN XINZHENG CITY

Sun XUN¹ and Suttipong BOONPHADUNG²

1 Student of Master in Educational Administration, Suan Sunandha Rajabhat University, Thailand; s67561802131@ssru.ac.th

2 Graduate School, Suan Sunandha Rajabhat University, Thailand;
Suttipong.bo@ssru.ac.th

ARTICLE HISTORY

Received: 11 June 2026

Revised: 16 June 2026

Published: 26 June 2026

ABSTRACT

This study examines the current situation and management optimization of artificial intelligence (AI) literacy among engineering major teachers in vocational colleges in Xinzhen City, China. Using a mixed-methods design, data were collected from 230 teachers through a 40-item questionnaire and from 5 experts through semi-structured interviews. Results indicate that teachers demonstrate an overall high level of AI literacy, with professional development motivation and ethical awareness ranking highest, while critical evaluation remains the weakest dimension. A 0.16-point gap between the highest and lowest dimensions indicates a clear structural imbalance. Interview data further identify five management optimization strategies: discipline-tailored training, hands-on integration support, ethical governance frameworks, peer review mechanisms, and sustained professional development systems. These findings suggest that institutional management should shift from generic training to differentiated, need-based support frameworks to foster balanced AI literacy development in vocational engineering education.

Keywords: Artificial Intelligence Literacy, Engineering Teachers, Vocational Colleges, Management Optimization

CITATION INFORMATION: Xun, S., & Boonphadung, S. (2026). Current Situation and Management Optimization of Artificial Intelligence Literacy Among Engineering Major Teachers for Vocational Colleges in Xinzhen City. *Procedia of Multidisciplinary Research*, 4(6), 25.

INTRODUCTION

With the rapid development of generative AI, vocational education has entered an era of intelligent transformation, and AI has become a core driver of teaching innovation and governance modernization (Kamalov et al., 2023). As engineering majors are crucial for cultivating technical talents to support regional manufacturing and intelligent manufacturing in China, it is urgent to integrate AI into teaching practice (Jiang et al., 2024). Teacher AI literacy, as a multi-dimensional professional competency, has become a key indicator of vocational education modernization (Miao & Cukurova, 2024). However, the development of teacher AI literacy faces systemic challenges such as fragmented, overly technical training that is disconnected from real engineering teaching, and a lack of targeted management mechanisms in many vocational colleges (Brandão et al., 2024). For engineering teachers in Xinzheng City, the gap between AI application and professional teaching needs is particularly obvious, while few studies have examined this group from an educational management perspective (Chen & Huang, 2025).

Research Objective:

(1) To study the Current Situation of Artificial Intelligence Literacy among Engineering Major Teachers for Vocational Colleges in Xinzheng City;

(2) To propose the Management Optimization of Artificial Intelligence Literacy among Engineering Major Teachers for Vocational Colleges in Xinzheng City;

By synthesizing interdisciplinary literature, it provides a comprehensive overview for scholars, policymakers, and practitioners seeking to understand the complexities of modern educational administration.

LITERATURE REVIEW

Concept and Dimensions of Teacher AI Literacy

Artificial intelligence literacy has gradually emerged as a foundational competence for individuals to effectively participate in the intelligent society. According to Long & Magerko (2020), AI literacy represents the comprehensive ability to understand the basic principles of AI, properly use AI tools, and conduct critical judgments on AI outputs. For teachers, as frontline practitioners of educational reform, AI literacy is not only a technical capability but also a professional competency that integrates pedagogical reasoning, ethical norms, and instructional decision-making.

Unlike general AI literacy, which focuses on public cognition and daily application, teacher AI literacy highlights the professional characteristics of educational practice (Benedikt et al., 2025). It emphasizes teachers' capability to embed AI into teaching design, implement adaptive instruction, guide students to use AI responsibly, and reflect on the deep impacts of AI on teaching modes and student development. Based on a systematic review of domestic and international theoretical frameworks and measurement studies, the present study defines teacher AI literacy as a multi-dimensional structure consisting of five interrelated components. These include:

knowledge and understanding of AI; AI instructional application and integration competence; ethical awareness and responsible use of AI; critical evaluation and reflective thinking in AI use; professional development and learning competence related to AI.

This framework is supported by typical studies such as Ng et al. (2021) and Ning et al. (2025), which confirm that teacher AI literacy is a comprehensive and professional construct rather than a single technical skill.

Current Situation of Teacher AI Literacy

Existing empirical studies have shown that teachers around the world generally possess a basic level of AI literacy, with most self-rated scores falling within the moderate-to-high range. However, development across different dimensions is notably imbalanced (Traga Philippakos &

Rocconi, 2025). Most teachers have established a preliminary cognitive foundation of AI concepts and functions, but they often lack the ability to integrate AI deeply into teaching and assessment. In terms of ethical awareness, teachers generally maintain a high sense of responsibility regarding data security and academic integrity, yet their ability to critically evaluate AI-generated content, identify biases, and reflect on teaching effects remains relatively weak (Özüdoğru & Durak, 2025).

In addition, individual differences among teachers significantly influence AI literacy. Factors such as age, educational background, disciplinary field, and teaching experience lead to obvious disparities. Younger teachers and those majoring in science and engineering tend to hold more positive attitudes toward AI and demonstrate higher willingness to apply AI tools in teaching (Spathopoulou et al., 2025). In the field of vocational education, engineering teachers face more prominent and distinctive pressures. They are required to integrate AI technologies such as intelligent simulation, data analysis, and intelligent detection into practical training and project-based teaching. Meanwhile, they must strictly guarantee technical accuracy, operational safety, and professional relevance. Despite such demands, many engineering teachers still lack discipline-specific AI teaching resources, targeted training, and institutional support, which restricts the further improvement of their AI literacy (Pekcan, 2024).

METHODS

Population and Sample

This research focuses on engineering major teachers in vocational colleges in Xinzheng City, China (approximately 600 people). Using Krejcie & Morgan (1970) sampling table, 234 teachers were selected as samples; 230 valid questionnaires were recovered, with an effective rate of 98.29%. For interviews, five senior educators with more than five years of management experience were selected via purposive sampling, covering mechanical engineering, electrical automation, mechatronics, and intelligent manufacturing.

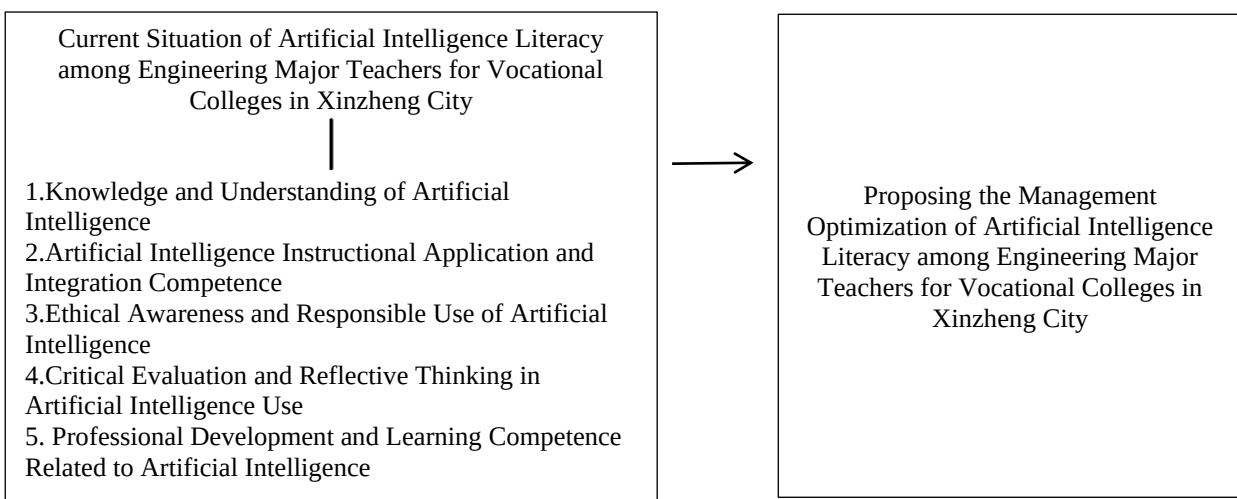
Research Instruments

The questionnaire on the personal status of the respondents, the questionnaire on the level of current situation and management optimization of artificial intelligence literacy among engineering major teachers for vocational colleges in Xinzheng City, and the semi-structured questionnaire for the in-depth interview.

Data Analysis

Quantitative data were analyzed via descriptive statistics (mean, standard deviation) using PSPP. Qualitative interview data were analyzed via content analysis to extract themes and verify quantitative results.

Conceptual framework for research



Demographic Characteristics of Respondents

Among 230 teachers, males accounted for 60% and females 40%; 31–40 years old (41.3%) were the largest group; master's degree holders (54.35%) were the majority; teaching experience was concentrated at 6–10 years (31.3%); majors included mechanical engineering (29.57%), electrical automation (27.83%), mechatronics (24.35%), and intelligent manufacturing (18.26%).

Current Status of AI Literacy

As shown in Table 1, teachers' overall AI literacy was at a high level (mean = 3.72). The ranking of dimensions from high to low: Professional Development and Learning Competence (3.80) > Ethical Awareness and Responsible Use (3.79) > AI Instructional Application and Integration Competence (3.70) > Knowledge and Understanding of AI (3.68) > Critical Evaluation and Reflective Thinking (3.64).

Table 1

Current Situation of Artificial Intelligence Literacy among Engineering Major Teachers for Vocational Colleges in Xinzheng City	n = 230		Interpretation
	$\bar{x}$	S.D.	
Knowledge and Understanding of Artificial Intelligence	3.68	0.91	high level
Artificial Intelligence Instructional Application and Integration Competence	3.70	0.92	high level
Ethical Awareness and Responsible Use of Artificial Intelligence	3.79	0.89	high level
Critical Evaluation and Reflective Thinking in Artificial Intelligence Use	3.64	0.94	high level
Professional Development and Learning Competence Related to Artificial Intelligence	3.80	0.88	high level
Total	3.72	0.91	high level

Dimension-specific findings:

Knowledge and Understanding (3.68): Teachers clearly recognized AI's advantages and limitations (3.74), but lacked ability to distinguish appropriate teaching scenarios (3.58).

Instructional Application (3.70): Strong ability in lesson preparation (3.75), but weak in AI-supported case/project-based teaching (3.62).

Ethical Awareness (3.79): High sense of professional responsibility (3.93) and attention to data privacy (3.82), but insufficient awareness of algorithmic bias.

Critical Evaluation (3.64): Could verify AI content (3.72), but weak in identifying biases (3.60) and guiding students' critical evaluation (3.58).

Professional Development (3.80): Strong willingness to learn (3.84), but lacked institutional support and discipline-specific resources.

Qualitative Interview Results

Interviewees confirmed the quantitative findings and pointed out three core constraints:

Training mismatch: Generic AI training ignores engineering disciplinary characteristics, with low practicality.

Resource shortage: Lack of engineering-oriented AI teaching tools and cases; infrastructure is insufficient.

Mechanism absence: No standardized ethical review, critical evaluation norms, or tiered training systems.

DISCUSSION AND MANAGEMENT OPTIMIZATION STRATEGIES

Discussion

The high overall AI literacy indicates that teachers have positive attitudes and basic capabilities toward AI integration, consistent with national smart education policies (Ministry of Education, 2023). The uneven dimensional development reflects a typical “motivation-ethics ahead, application-critical thinking lag” pattern, consistent with international studies (Traga Philippakos & Rocconi, 2025). The weakness in critical evaluation and disciplinary integration is the core bottleneck, caused by insufficient institutional management and discipline-specific support.

Management Optimization Strategies

(1) Construct Tiered and Discipline-Specific Training System

Establish beginner-intermediate-advanced training modules; develop AI teaching cases for mechanical, electrical, and mechatronics majors; allocate dedicated learning time and build an AI resource library.

(2) Strengthen Engineering-Oriented AI Application Support

Cooperate with local enterprises to develop practical AI tools; launch peer mentorship and teaching demonstration activities; upgrade laboratory infrastructure for AI-integrated practical training.

(3) Improve AI Ethical Governance Mechanism

Formulate engineering-teaching-specific ethical guidelines; establish an AI tool review committee; carry out regular ethical training on data privacy and algorithm bias.

(4) Enhance Critical Evaluation and Reflective Competence

Organize workshops on verifying AI-generated engineering content; build peer review networks for AI teaching materials; incorporate critical evaluation into teacher professional development.

(5) Optimize Institutional Management and Resource Support

Set clear AI literacy development goals; establish annual assessment and incentive mechanisms; promote industry-education integration to enhance training relevance.

CONCLUSION

This study confirms that engineering major teachers in vocational colleges in Xinzheng City have high overall AI literacy, with strengths in professional development willingness and ethical awareness, and weaknesses in critical evaluation and disciplinary integration. The key constraints are mismatched training, insufficient resources, and imperfect management mechanisms. The proposed five-dimensional optimization strategy provides a practical path for vocational colleges to improve teacher AI literacy from an educational management perspective.

Limitations: The sample is limited to Xinzheng City; future research can expand to broader regions and use longitudinal designs to test strategy effectiveness.

REFERENCES

- Benedikt, B., Sandra, S., & Martin, E. (2025). From Gretel to Strudel city: Empowering teachers regarding generative AI for enhanced AI literacy with Collective GPT. *Education Sciences*, 15(2), 206.
- Brandão, A., Pedro, L., & Zagalo, N. (2024). Teacher professional development for a future with generative artificial intelligence: An integrative literature review. *Digital Education Review*, 38, 1–18.
- Cetin, O., & Celen, G. (2025). Investigation of pre-service teachers' artificial intelligence literacy and views on the use of artificial intelligence in education. *Journal of Education in Science, Environment and Health*, 11(4), 285–304.

- Chen, L. T., & Huang, L. (2025). Investigation on the current situation and improvement strategies of higher vocational teachers' AI educational literacy based on the AI-TPACK model. *Vocational and Technical Education*, 8, 69–75.
- Jiang, R., Chen, Y., Peng, Y., Xie, S., & Qu, D. (2024). Opportunities and challenges of AI in vocational education. *International Journal of Learning and Teaching*, 590–596.
- Kamalov, F., Santandreu Calonge, D., & Gurrib, I. (2023). New era of artificial intelligence in education: Towards a sustainable multifaceted revolution. *Sustainability*, 15(16), 12451.
- Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, 30(3), 607–610.
- Liang, X., & Deng, X. (2025). Attribution analysis and bridging paths of the artificial intelligence literacy gap among teachers in higher vocational colleges. *Journal of Nanning Vocational and Technical University*, 33(5), 21–28.
- Long, D., & Magerko, B. (2020). What is AI literacy? Competencies and design considerations. *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*, 1–16.
- Mayrell, D. (2025). Enhancing educator AI literacy for effective use of large language models (Doctoral dissertation). University of Louisiana Monroe.
- Miao, F., & Cukurova, M. (2024). AI competency framework for teachers. UNESCO Publishing.
- Ministry of Education of the People's Republic of China. (2023). China promotes digital transformation of education and development of smart education.
- Ning, Y., Zhang, W., Yao, D., Fang, B., Xu, B., & Wijaya, T. T. (2025). Development and validation of the artificial intelligence literacy scale for teachers (AILST). *Education and Information Technologies*, 30, 17769–17803.
- Ng, D. T. K., Leung, J. K. L., Chu, K. W. S., & Qiao, M. S. (2021). AI literacy: Definition, teaching, evaluation and ethical issues. *Proceedings of the Association for Information Science and Technology*, 58(1), 504–509.
- Özüdoğru, G., & Durak, H. Y. (2025). Conceptualizing pre-service teachers' artificial intelligence readiness and examining its relationship with various variables. *Information Development*, 41(3), 916–932.
- Pekcan, S. G. (2024). K-12 teachers' artificial intelligence literacy: A key driver of AI integration into teaching practices (Master's thesis). Missouri State University.
- Qin, G., Liu, M., Mi, P., & Li, M. (2025). Characteristics, practical dilemmas, and cultivation strategies of vocational education teachers' intelligent literacy from the perspective of generative artificial intelligence. *Vocational Education*, 24(35), 37–43.
- Spathopoulou, F., Pitychoutis, K. M., & Papakonstantinidis, S. (2025). AI and higher education: Understanding faculty roles in teaching, research, and administration. *Contemporary Educational Technology*, 17(4), ep600.
- Traga Philippakos, Z. A., & Rocconi, L. (2025). AI literacy: Elementary and secondary teachers' use of AI-tools, reported confidence, and professional development needs. *Education Sciences*, 15(9), 1186.

Data Availability Statement: The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Conflicts of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's Note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors

and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.



Copyright: © 2026 by the authors. This is a fully open-access article distributed under the terms of the Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0).