Research

Current Status and Dilemmas of Artificial Intelligence Usage by Vocational College Teachers in Henan: Evidence From Henan Vocational and Technical College

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Abstract

Background and Aim: Artificial intelligence fully empowers the digital transformation of vocational education. The AI literacy and teaching technology adoption level of vocational college teachers directly determine the quality of skills training. Existing domestic empirical studies mostly focus on eastern institutions, lacking micro-quantitative research on the micro-level of public vocational colleges in the central region. This study fills the gap in regional research, identifies the stratification characteristics of vocational college teachers' AI literacy, and quantitatively analyzes the multiple influencing factors that constrain teachers' adoption of AI teaching behaviors. This paper takes Henan Vocational and Technical College as the observation sample, combined with the practical cases of many colleges in Henan Province, and analyzes the real situation of vocational college teachers in AI application. This study aims to explore the cognitive level and current knowledge and skills status of vocational college teachers regarding artificial intelligence technology and analyze the key factors that affect their improvement of AI capabilities.

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Received: 24 June 2026 *Revised: 24 July 2026* *Accepted: 6 August 2026*

Materials and Methods: This study adopted a mixed-methods research design combining questionnaire surveys and focus group interviews. First, to ensure the rigor of research data, participating teachers were selected across diverse majors, teaching years and genders. Henan Vocational and Technical College had a total teaching staff of 800 individuals. Using the Yamane sampling formula with a margin of error controlled within 5%, the calculated required sample size was 267 participants, and a total of 276 valid questionnaires were collected in practice. A self-designed Questionnaire on the Current Status and Dilemmas of Artificial Intelligence Application among Higher Vocational Teachers was adopted in this research. Both its content validity and reliability coefficients exceeded 0.85 after inspection. For the focus group, five participants were recruited, comprising three frontline teachers from the target college covering industrial and business majors, one expert in educational technology, and one specialist in AI educational application. Descriptive statistics including means and standard deviations as well as perceptual grading analysis were applied to analyze questionnaire data. Findings from the focus group discussions were further used to supplement and interpret the quantitative results of the questionnaire.

Keywords: Higher vocational teachers, Artificial intelligence, Application status, Influencing factors

Introduction

Driven by the fast growth of technologies such as the Internet, big data, and cloud computing, artificial intelligence has emerged as a defining technology of the present era, with an impact that reaches across virtually every sector. Education is one area where this impact is especially visible. The adoption of AI is reshaping conventional models of teaching and learning, and it is bringing deep changes to classroom practice, to the way teachers and students relate to one another, and to the underlying philosophy of education itself. As digitalization continues to transform both instructional approaches and the nature of work, it is placing new demands on the professional capabilities of teachers in vocational colleges. Because vocational education is more closely tied to industry than any other form of education, and because it serves as the primary channel for developing a large, highly skilled workforce, it is widely regarded as one of the key areas in which AI is being applied and is expected to have its greatest influence.

Artificial intelligence is ushering vocational college education into a new stage defined by collaboration and interaction between humans and intelligent machines. This shift is forcing vocational colleges to rethink long-established teaching paradigms, and it is speeding up the pace at which their teachers must adapt and develop professionally. Generative AI and large language models, exemplified by tools such as ChatGPT, Doubao, and DeepSeek, draw on an enormous body of codified human knowledge. At the policy level, the recently amended Vocational Education Law of the People's Republic of China affirms that vocational education holds the same standing as general education. Henan Vocational and Technical College, a key public higher vocational college in Henan Province with an engineering focus, offers industrial programs that correspond to the main manufacturing occupations in the region. In terms of the size of its teaching staff and student body and the composition of its programs, the college reflects the typical features of engineering-oriented higher vocational education in central China, which makes it a suitable representative case for regional research.

Reviewing existing literature reveals significant research gaps: current empirical samples are predominantly concentrated in developed eastern regions, while quantitative studies on AI application among teachers at higher vocational colleges in central China

remain scarce. Most research focuses separately on either teacher competencies or institutional hardware resources, lacking integrated analysis that links "attitudes and awareness—practical skills—internal and external environments," and there is insufficient quantitative evidence to substantiate the observed gap between high AI acceptance and low practical proficiency among teachers. Moreover, existing studies rarely differentiate the distinct challenges faced by teachers across different disciplines and teaching experience levels, resulting in generic recommendations that lack specificity and practical applicability within the training and educational contexts of public higher vocational institutions in central China.

To address these research gaps, this study makes three academic contributions: First, it conducts a comprehensive quantitative survey across public engineering-focused higher vocational colleges in central China, enriching empirical data on intelligent literacy among vocational teachers in the Central Plains region and improving the representativeness of regional comparative research samples. Second, it develops a three-tier analytical framework linking "awareness and attitude—knowledge and skills—influencing factors," quantitatively measuring the gap between teachers' cognitive willingness and practical capabilities, thereby clearly illustrating the underlying causes of the "knowledge-practice disconnect." Third, considering the distinctive features of these institutions—high proportion of engineering programs and a dual-teacher (industry-academia) teaching model—it proposes targeted optimization strategies tailored to different professional fields and hierarchical levels (education authorities, institutions, and teachers), addressing the homogenization problem in current policy recommendations. In this context, this study focuses on the current status and challenges of AI application among higher vocational teachers, aiming to deeply analyze the real-world difficulties educators face during technology-enabled education, thus providing theoretical foundations and practical references for promoting the organic integration of artificial intelligence and vocational education.

Research Objectives

1. To explore vocational college teachers’ cognitive level and practical knowledge

and skills regarding artificial intelligence technology

2. To analyze the key factors influencing the improvement of their artificial intelligence capabilities

Research significance

I. Theoretical Significance

1. Enrich the research system of AI education in regional higher vocational colleges Taking Henan Vocational College as a case, it supplements the empirical research on the application of AI by teachers in central region vocational colleges, fills the gap of existing research which mainly focuses on the first-line developed regions and pays insufficient attention to the vocational education group in the Central Plains, and improves the research samples of AI education in different regions of higher vocational colleges.

2. Deepen the theory of digital literacy of vocational education teachers

Combining the educational attribute of vocational skills education in higher vocational colleges, it explores the compatibility logic between artificial intelligence and the development of vocational education teachers, refines the theoretical dimensions of AI application ability, application behavior, and application difficulties of vocational teachers, and enriches the related theories of digital transformation of vocational education teachers.

3. Expand the cross-research on industry-education integration and intelligent vocational education

Connecting with the distinctive characteristics of industry-education integration in higher vocational colleges, it analyzes the application contradictions of artificial intelligence in teaching, training, and school-enterprise collaboration, providing grassroots empirical support for the theories of intelligent vocational education and vocational education informatization.

II. Practical Significance

1. For Henan Vocational College

It precisely sorts out the real situation and existing problems of teachers' use of AI in this school, provides data basis for the school to formulate teacher AI training,

construction of intelligent teaching platforms, and assessment and incentive systems, and promotes the implementation of digitalization in teaching within the school.

2. For similar higher vocational colleges in Henan

It summarizes the common problems and feasible experiences of public higher vocational colleges in the central region, providing reference models and practical ideas for other vocational colleges in the province to carry out teacher AI capability building and promote the reform of smart classrooms.

3. For regional vocational education administrative departments

It provides first-hand research support for the vocational education administrative departments in Henan to formulate policies for the digital development of vocational teachers, coordinate regional intelligent educational resources, and plan teacher training systems, helping the entire province's vocational education achieve digital transformation.

4. For the vocational education teacher group

It clarifies the actual obstacles such as technology, concepts, systems, and environment in AI application, helps teachers break through the barriers in use, guides teachers to reasonably apply artificial intelligence to optimize classroom teaching, training guidance, and teaching research work, and improves teaching efficiency and professional ability.

Literature Review

1. Higher Vocational Teachers and the Application of Artificial Intelligence in Education

Higher vocational teachers refer to professional personnel engaged in educational and teaching work in higher vocational colleges (or higher specialized colleges). Their core task is to cultivate high - quality technical and skilled talents for the front line of production, construction, service, and management. Originally, they were required to possess both the theoretical teaching ability of a "teacher" and the practical skills of an "engineer" (so - called "dual - qualified teachers"). In the era of AI, they have become the implementers of the national educational digitalization strategic action and need to enhance their digital literacy, which encompasses five dimensions: digital awareness,

digital technology knowledge and skills, digital application, digital social responsibility, and professional development.

With the digital transformation and upgrading of industries, the accelerated intelligent transformation of jobs has forced higher vocational dual - qualified teachers to shift from traditional skills teaching to human - machine collaborative intelligent teaching. There is an urgent need to build an AI teaching integration ability system suitable for vocational scenarios. A large-scale survey of 1,637 teachers across Chinese higher vocational colleges identified four distinct AI literacy profiles—exploratory, conceptual, balanced, and innovative—revealing substantial variation in teachers' AI application practices and professional development needs (Li, Yang, et al., 2026).

2. The Application Value and Challenges of Artificial Intelligence in Vocational Education

As an enabling tool, artificial intelligence shows great potential in aspects such as the integration of teaching resources, personalized learning support, and the construction of virtual training scenarios (Wu et al., 2024). In principle, such capabilities could help ease practical challenges commonly faced in higher vocational training, including the high cost of hands-on instruction and the difficulty of quantifying practical-skill assessments.

Overall, educational informatization in China remains at a transitional stage, gradually shifting from simply introducing technology toward integrating it in innovative ways. In practice, many institutions still devote more attention to building digital infrastructure than to making meaningful use of it in everyday classroom teaching.

Wang et al. (2023) proposed an agile governance model for educational AI ethics, emphasizing the need for adaptive oversight mechanisms that can respond to the fast-evolving risks of AI applications in educational settings.

Coupled with the scarcity of AI models exclusive to the vocational field and the fragmentation of professional data, the barriers to the implementation of AI have been further exacerbated. Most existing studies focus on primary and secondary schools or general universities, and there is still a lack of empirical investigations targeting the group of higher vocational teachers, especially the quantitative assessment of teachers' AI basic knowledge and skill levels (Wang et al., 2025).

3. Factors Affecting Teachers' AI Ability Improvement

In this study, teachers' technology acceptance, school organizational atmosphere, training support, and peer collaboration are treated as the key factors influencing the improvement of teachers' digital literacy.

The fact that the school assessment mechanism does not incorporate AI teaching practice and the training content is divorced from the actual situation of higher vocational majors will greatly restrict the long-term improvement of teachers' AI ability. The lack of peer teaching and research exchanges and the absence of an AI teaching community will also lead to a stagnation in ability development (Li, Guan, et al., 2026). Therefore, this study incorporates factors such as individual motivation, school environment, technical support, training opportunities, and peer exchanges into the analysis framework.

Conceptual framework

The conceptual framework constructed in this study centers on teachers' ability to apply AI, and is divided into three levels:

1. Attitude and Awareness Level: This includes teachers' perception of AI opportunities, confidence in enhancing teaching effectiveness, and willingness to actively learn.

2. Knowledge and Skills Level: This encompasses basic AI knowledge, online teaching skills, leveraging AI to support teaching work, organizing training activities, and promoting professional development.

3. Influencing Factors Level: These include personal willingness to actively use AI, self-driven learning, technical anxiety, school's intelligent environment, school's technical support, application atmosphere, peer support and communication, training opportunities, training satisfaction, and resource sufficiency.

The above three levels are interrelated and jointly influence the actual level and development potential of teachers' AI capabilities.

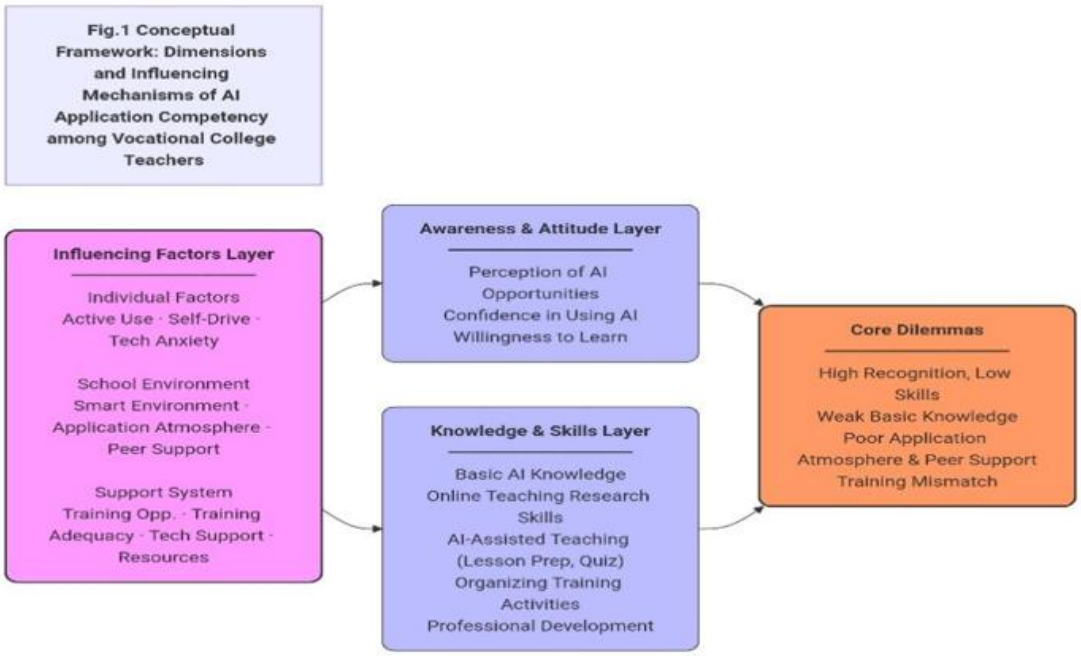


Figure 1 *Conceptual Framework: Model of Influencing Factors on the AI Application Ability of Vocational College Teachers*

Research Methodology

This study adopted a mixed research method combining questionnaire surveys and focus group interviews.

1. Questionnaire Survey

Participants

Participants were teachers from Henan Vocational and Technical College selected via stratified sampling. A total of 276 questionnaires were distributed, and 276 valid responses were retrieved, yielding an effective response rate of 100%. The demographic distribution of participants in terms of age, gender, teaching years, educational background and teaching majors is presented in Table 1.

Research Instrument

A self-designed Questionnaire on the Current Status and Practical Dilemmas of Artificial Intelligence Application among Higher Vocational Teachers was adopted. The scale consisted of four dimensions: basic demographic information of teachers, artificial intelligence awareness (3 items), artificial intelligence knowledge and skills (5 items), and influencing factors (12 items). A five-point Likert scale was applied in this questionnaire, ranging from 1 (strongly disagree) to 5 (strongly agree). Three specialists in educational technology conducted content validity tests, with all IOC values greater than 0.5. The overall reliability coefficient exceeded 0.85, which verified satisfactory reliability and validity of the questionnaire.

Data Collection

Five teachers were invited to complete a pilot test in advance. After wording revisions based on pilot feedback, formal questionnaires were distributed to sampled teachers through the Wenjuan Xing online platform.

Data Analysis

Descriptive statistical analysis was carried out to calculate the mean value and standard deviation (SD) of each item. Per the rating criteria of the five-point Likert scale, perception levels were classified as follows: 4.21–5.00 (excellent), 3.41–4.20 (good), 2.61–3.40 (moderate), 1.81–2.60 (deficient), and 1.00–1.80 (seriously deficient).

To further interpret the current conditions and practical dilemmas of vocational teachers' AI application reflected by quantitative questionnaire data and reduce self-report bias caused by single questionnaire measurement, this study added focus group interviews after quantitative analysis. Qualitative data were adopted to explore underlying causes and provide supplementary explanations for the dilemmas identified in questionnaire results.

2. Focus Group Interview

Participants

The focus group included five participants with both theoretical expertise and frontline teaching experience, consisting of two professional specialists and three full-time

teachers from the target college: one expert in educational technology, one specialist in AI educational application, and three frontline teachers from Henan Vocational and Technical College. The three college teachers were selected through stratified sampling, covering dominant industrial majors and business majors across different teaching years and frequencies of AI usage. They interpreted weaknesses in teachers' AI application combined with real scenarios including lesson preparation, practical training and teaching research. Meanwhile, the two experts analyzed macro causes of these dilemmas from the perspectives of vocational education digital transformation and intelligent teaching resource allocation.

Interview Procedures

A structured interview outline was developed based on the three-tier conceptual framework of this study, focusing on two core themes: the actual status of teachers' AI application and practical application dilemmas. Key interview topics were listed below:

1. Combined with questionnaire findings, analyze teachers' actual cognition and practical skills related to artificial intelligence at the college, and discuss the practical impacts brought by the popularization of generative artificial intelligence on daily vocational teaching.

2. Explore practical obstacles indicated by low-scoring items in the questionnaire, including insufficient basic AI knowledge among teachers, weak classroom practical application ability, inadequate campus atmosphere for intelligent teaching, lack of peer communication channels, disconnection between training content and professional courses, and unbalanced allocation of software and hardware resources. Multiple root causes of these dilemmas were further discussed.

Data Collection

1. Participant recruitment: College teachers were selected from questionnaire respondents via stratified sampling, and experts in educational technology and artificial intelligence were invited. The interview theme was informed in advance to confirm their willingness to participate.

2. Interview outline formulation: Progressive open-ended questions were designed around research themes to cover institutional management, frontline teaching practice and academic theoretical perspectives.

3. Offline focus group implementation: A researcher familiar with this research framework acted as the moderator to balance speaking time between experts and college teachers.

4. Data preservation: Audio recording and written field notes were collected after all participants signed informed consent forms. All original data were filed separately for confidential use.

Data Analysis

1. Audio records and field notes of focus group discussions were transcribed into textual documents as fundamental materials for subsequent analysis.

2. Text data were coded and sorted according to the research objectives of this study to generate qualitative analytical results.

3. Combined with the actual demands of vocational college teachers and suggestions from focus group participants, targeted optimization strategies were proposed on the basis of qualitative findings.

4. Research integration: Results of data analysis, optimization suggestions and concrete implementation paths were compiled into a complete research report with coherent logic and clear structure.

Research Content

The first section of this chapter presents the basic information of participants, including age, gender, teaching experience, and professional titles. The second section outlines the current status and usage patterns of artificial intelligence among vocational college teachers. The third section reports the findings from the focus group discussions. Finally, the chapter concludes with a summary.

1. Basic Information of Participants

Table 1 presents the age, gender, teaching experience, educational background and teaching specialty distribution of 276 participating teachers.

Table 1 Participant Information Table

Options	Frequency	Percentage
Age:		
Under 25 years old	30	10.87%
26-35 years old	65	23.55%
36-45 years old	133	48.19%
Over 46 years old	48	17.39%
Gender:		
male	133	48.19%
female	143	51.81%
Years of teaching:		
1-5 years	75	27.17%
6-10 years	84	30.43%
11-15 years	64	23.19%
More than 16 years	53	19.2%
Education:		
Undergraduate	106	38.41%
Master's	148	53.62%
Doctor	22	7.97%
Teaching specialties:		
Industrial	200	72.46%
Business and Trade	40	14.49%
Pharmaceuticals	16	5.8%
Agriculture	7	2.54%
Others (science and engineering, comprehensive, etc.)	13	4.71%
Total	276	100%

The data shows that the participating teachers are mainly middle-aged ones aged between 36 and 45 (48.19%), with a roughly equal male-to-female ratio. The majority have a master's degree (53.62%), and the majority are teachers with industrial-related majors (72.46%). This is consistent with the engineering-oriented characteristics of Henan Vocational and Technical College.

2. The awareness of artificial intelligence among vocational college teachers

Table 2 shows the teachers' perception of the opportunities, confidence and willingness to learn regarding artificial intelligence.

Table 2: Perception Scale of Vocational College Teachers' Awareness of Artificial Intelligence

Name	Average	Standard deviation	Perception level
I think artificial intelligence technology offers new opportunities for my teaching.	3.775	1.176	More outstanding
I am confident in using AI tools to improve teaching effectiveness.	3.406	1.243	Intermediate
I am willing to take the initiative to learn and understand the functions and roles of smart technologies.	3.764	1.184	More outstanding

The results show that teachers generally recognize the teaching opportunities brought by AI (with an average score of 3.775, rated as "more outstanding"), have a strong desire to learn (with an average score of 3.764, rated as "more outstanding"), but their confidence in using AI to improve teaching effectiveness is at a medium level (with an average score of 3.406, rated as "intermediate"). This indicates that teachers have a positive attitude and awareness, but there is still room for improvement in their confidence.

3. Knowledge and Skills of Vocational College Teachers in Artificial Intelligence

Table 3 presents the self-evaluations of teachers in terms of AI basic knowledge, online teaching skills, teaching applications, training organization, and professional development.

Table 3: Perception Scale of AI Knowledge and Skills of Higher Vocational Teachers

Name	Average	Standard deviation	Perception level
I have some basic knowledge of artificial intelligence.	2.525	1.266	Slightly lacking
I have some online teaching and research skills.	2.736	1.296	Intermediate
I can use artificial intelligence technology to assist in teaching (such as lesson preparation, question setting, etc.).	2.482	1.289	Slightly inadequate

Name	Average	Standard deviation	Perception level
I can use artificial intelligence technology to organize and manage training activities.	2.685	1.259	Intermediate
I was able to use artificial intelligence technology to advance my professional development.	2.989	1.263	Intermediate

The data shows that the basic knowledge of AI for teachers (with a mean score of 2.525 and a rating of "slightly insufficient") and the ability to utilize AI to assist in teaching (with a mean score of 2.482 and a rating of "slightly insufficient") are both at a relatively low level. The skills in online teaching, organizing training activities, and promoting professional development are at the "intermediate" level, but the mean scores for all of them have not exceeded 3.0. This indicates that the AI skills of vocational college teachers are overall weak, especially lacking basic knowledge and direct teaching application abilities.

4. Factors Affecting the Enhancement of Vocational College Teachers' Ability in Artificial Intelligence

Table 4 measured the aspects including individual active use, learning drive, technical anxiety, school environment, technical support, application atmosphere, peer support, training opportunities, and resource sufficiency.

Table 4: Perception Scale of Factors Affecting the Enhancement of Vocational College Teachers' Ability in Artificial Intelligence

Name	Average	Standard deviation	Perception level
I will take the initiative to use artificial intelligence technology in education and teaching.	3.156	1.274	Intermediate
My desire for self-directed learning and professional development drives me to actively learn and apply artificial intelligence technology.	3.656	1.191	More outstanding
I'm worried that the development of AI technology is outpacing my ability to learn.	2.844	1.242	Intermediate

Name	Average	Standard deviation	Perception level
The level of development of the intelligent education environment at my school is very important for the improvement of my AI literacy.	2.710	1.228	Intermediate
My school can provide me with a good experience of smart technology application.	2.851	1.240	Intermediate
The school has a good atmosphere for the application of smart technologies.	2.594	1.319	Slightly lacking
In the application of AI in teaching, I can feel the support and communication from my peers.	2.761	1.242	Intermediate
I think communication with peers is very important for me to enhance my artificial intelligence capabilities.	2.562	1.242	Slightly inadequate

From a personal perspective, teachers have a strong drive for self-directed learning (with an average score of 3.656, rated as "more outstanding"), are at a medium level in actively using AI technologies (with an average score of 3.156), and have a moderate level of technical anxiety (with an average score of 2.844). From the school environment aspect, the score for the intelligent application atmosphere (with an average of 2.594, rated as "slightly insufficient") and the importance perception of peer communication (with an average of 2.562, rated as "slightly insufficient") is relatively low, indicating that the soft environment of the school needs improvement. From the support system perspective, teachers generally recognize that school technical support can help with the use of AI tools (with an average score of 3.543, rated as "more outstanding"), the resource sufficiency evaluation is at a medium level (with an average of 3.370), but the training satisfaction is only at a medium-low level (with an average of 2.649). Overall, teachers feel that the school's technical support is relatively positive, but the application atmosphere, peer collaboration, and training relevance still need to be strengthened.

Focus Group

To systematically analyze the challenges and current status of vocational college teachers in using artificial intelligence (AI), we organized a focus group discussion, bringing

together teacher representatives from various disciplines, educational technology experts, and industry professionals for in-depth dialogue. The discussion outline is as follows:

Question 1: Based on your professional experience, please share the actual attitudes of vocational college teachers toward AI-enabled teaching today. Why does the gap exist between high recognition of AI's value and weak practical application skills?

Ms. Z: Frontline teachers clearly understand that AI can simplify lesson planning, automatically generate exercises, and create teaching materials, ultimately reducing repetitive tasks over time. Therefore, most recognize AI's educational value and are willing to explore new tools. However, our daily teaching loads are heavy, and we also have multiple responsibilities such as lab instruction, student management, and project applications. We lack continuous blocks of time to systematically learn AI fundamentals, prompt engineering, or hands-on tool usage. As a result, we only scratch the surface—despite wanting to learn, we don't have time to deepen our understanding, making it difficult to effectively integrate AI into classrooms.

Ms. W: Many teachers only see the superficial benefits of AI but fail to understand its limitations within specific disciplinary contexts. For example, in psychology courses, directly generating case studies with AI could lead to ethical or value-based distortions. Teachers fear making mistakes or introducing risks into their teaching, so even if they're motivated to learn, they consciously avoid applying AI in practice. This creates a disconnect between mental acceptance and actual implementation.

Mr. Z: Most commercially available large models are general-purpose and focused on humanities content. There are very few vertical AI tools tailored to vocational training and technical instruction. Even when teachers are willing to try, they often cannot find tools that match their specific courses. Thus, their subjective support for AI fails to translate into real classroom practices.

Question 2: What are the intrinsic motivations driving vocational college teachers to proactively learn AI tools? What factors undermine the sustainability of their self-directed learning?

Mr. L: The main drivers fall into two categories: younger teachers are motivated by the need to meet digital teaching evaluation requirements or participate in teaching competitions; older teachers aim to reduce repetitive workloads and enhance classroom engagement. However, sustained self-learning is difficult due to three key issues: first, there is no corresponding assessment or incentive system—success or failure in learning makes little difference; second, when encountering technical problems, teachers must rely on trial and error, lacking immediate access to expert support; third, fragmented short-form video tutorials lack structure, leading to frequent abandonment of self-study efforts.

Ms. Z: Many teachers around me give up after just a short period of self-study. Online tutorials vary widely in difficulty and quality, with insufficient step-by-step learning resources. Novice teachers struggle to understand technical jargon, which leads to frustration and eventually discourages them from continuing.

Question 3: From both teaching and technological perspectives, what are the core barriers preventing vocational college teachers from successfully applying AI in fundamental areas such as AI basics, lesson preparation, test creation, and practical training guidance?

Mr. Z: First, foundational knowledge barriers: most teachers do not understand how large language models work, how to design effective prompts, or how to verify AI-generated content. They can only input simple commands to generate text and lack the ability to precisely control output quality. Second, application barriers: while basic text generation is possible for lesson planning and test creation, teachers cannot design AI-powered virtual hands-on tasks aligned with vocational skill training, nor implement personalized, tiered instruction.

Ms. W: For humanities teachers, the main barrier lies in AI content ethics and review. For engineering teachers, the challenge stems from the lack of industry-specific AI models compatible with specialized equipment and manufacturing processes. General-purpose tools cannot be integrated into practical training curricula, so AI remains limited to theoretical lesson preparation and cannot support hands-on instruction.

Question 4: Are there differences in the difficulty for teachers from different fields (such as industry, commerce, medicine, agriculture, etc.) to use AI tools? If so, in what aspects?

Mr. L: The differences are very obvious. As per the sample of this questionnaire: Engineering teachers in the industry field have more exposure to digital equipment and can learn AI tools more quickly, but they lack industrial-specific AI resources; Teachers in the commerce field can proficiently use general AI tools, but they cannot combine e-commerce training to build intelligent simulation scenarios; Teachers in the medicine and agriculture fields have extremely scarce AI tools that are not suitable for their fields, and there are almost no dedicated models. The difficulty for teachers to apply AI is the highest. This survey shows that 72.46% of the teachers are from the industry field, and the sample represents the situation well. The AI predicaments of teachers in the commerce, medicine, and agriculture fields need further research with expanded samples.

Question 5: Currently, higher vocational colleges have basically equipped their hardware and software resources, but the implementation effect of AI by teachers is not good. Where is the disconnect between technical support, hardware resources and actual teaching needs?

Mr. Z: When colleges purchase hardware and general AI platforms, they only consider the basic performance of the equipment and do not customize and develop them based on the teaching needs of each field. The functions of the platforms are highly homogeneous; Secondly, the technical support personnel in the schools are mostly information operation personnel who do not understand the professional teaching content. When teachers propose AI transformation needs for professional scenarios, the technicians cannot provide suitable solutions and can only solve basic faults such as login and lag, and there is a lack of technical support at the professional teaching level.

Question 6: The satisfaction with the existing AI training in the school is generally low. What are the core deficiencies of the existing training? What kind of training format and content can be adapted to the needs of higher vocational teachers?

Ms. Z: The existing training is mostly one-time offline lectures, which only talk about the AI development concept and have almost no practical exercises. After the training, teachers still cannot use it; The training does not differentiate between fields or age groups

and is taught uniformly, and teachers with zero foundation cannot keep up, while young teachers find the content superficial and lack stratified training.

Mr. Z: The ideal training model should be stratified and categorized: The basic layer is for teachers with zero foundation, explaining the basic operations of AI, simple methods for lesson planning and question setting; The intermediate layer conducts vertical AI training for industrial, commerce, and medicine fields; At the same time, it should be combined with on-site practical guidance by enterprise engineers and adopt a long-term training model of "theory + classroom practice + one-on-one after-class consultation" instead of short-term concentrated lectures.

Question 7: The atmosphere of intelligent application in the school is weak, and there is a lack of peer communication. From which aspects will this hinder the improvement of teachers' AI capabilities? How can a regular peer communication channel be established?

Ms. W: Without a communication community, teachers can only solve AI usage problems by themselves when encountering difficulties, lacking channels for sharing experiences. Excellent AI teaching cases cannot be disseminated within the school; At the same time, there is no AI teaching demonstration classroom in the school, and teachers cannot see mature implementation cases, lacking models for imitation learning.

Mr. L: The school can establish an internal AI research and teaching workshop, divide learning groups by profession, and hold case sharing meetings every month; Set up an AI teaching achievement evaluation system and include the excellent cases in the school's teaching resource library to create an intelligent teaching atmosphere of mutual assistance and communication.

Question 8: Can enterprises and provincial AI associations cooperate with higher vocational colleges from which angles to make up for the shortage of teachers' practical AI capabilities?

Mr. Z: Enterprises can conduct customized training in the school, jointly develop AI teaching tools adapted to specific fields; Open the enterprise AI training system for teachers to try out in daily teaching.

Mr. L: The provincial AI association can coordinate regional AI teacher public training, establish a cross-school peer communication platform, and jointly with the education department develop a comprehensive learning resource library for AI for higher vocational teachers to break through the barriers between schools and industry.

Conclusion

Based on questionnaire surveys distributed to 276 teachers from Henan Vocational and Technical College and focus group discussions, this study systematically analyzed vocational college teachers' awareness, knowledge and skills regarding artificial intelligence application as well as relevant influencing factors. The primary conclusions were drawn as follows:

1. Vocational college teachers highly recognized the teaching opportunities brought by artificial intelligence and showed strong willingness to learn, yet their confidence in improving teaching outcomes via AI remained at a moderate level.

2. Teachers generally lacked basic AI knowledge and practical teaching application skills, which fell into the "slightly deficient" grade and became the core bottleneck restricting AI-enabled teaching.

3. The campus atmosphere for intelligent technology application and peer communication support was relatively weak, and teachers reported low satisfaction with relevant training, despite high recognition of institutional technical support services.

4. Individual self-directed learning served as a positive facilitator, yet such motivation had not been effectively converted into active AI practice in teaching.

In summary, the key to improving vocational teachers' AI application competence lies not in raising their awareness, but in delivering systematic training on foundational knowledge and practical skills, fostering a positive campus atmosphere for AI adoption, and establishing peer collaboration communities.

Discussion

This study identifies a prominent attitude-ability disconnect among teachers at central engineering-focused higher vocational colleges: teachers hold high recognition of AI's instructional value yet lack practical AI application capabilities. This phenomenon can be theoretically interpreted via UNESCO's 2024 AI Competency Framework for Teachers and the TPACK (Technological Pedagogical Content Knowledge) framework.

1. Comparative Analysis Based on UNESCO's AI Competency Framework for Teachers

UNESCO's 2024 framework establishes a three-stage progressive standard—Acquisition, Deepening, Creation—covering five core dimensions: human-centered educational philosophy, AI ethics, technical operation, integrated teaching design, and sustainable professional development (Miao & Cukurova, 2024). Survey data show that teachers scored above 3.76 on AI awareness and autonomous learning willingness, satisfying the basic Acquisition tier and reflecting general recognition of human-AI collaborative teaching. Nevertheless, teachers scored merely 2.525 on foundational AI knowledge and 2.482 on AI-integrated curriculum design, falling into the "slightly insufficient" level and failing to reach the Deepening tier.

Focus group interviews further reveal that institutional training lacks systematic modules of AI ethics and industry-compliant AI application. Colleges also fail to build supporting mechanisms for teachers to conduct research and project development with AI tools, creating a clear gap between institutional practice and the advanced ethical and professional development requirements stipulated by UNESCO's framework. Taken together, the survey and focus group findings suggest that limited institutional support, rather than a lack of teacher motivation, is the main barrier preventing teachers from progressing beyond the Acquisition tier. This finding highlights this study's contribution to filling the empirical research gap on AI literacy among vocational teachers in central China.

2. Interpretation of the Attitude-Ability Disconnect via the TPACK Framework

The TPACK theory argues that effective technology integration in teaching relies on the deep synergy of three core knowledge bases: Technological Knowledge (TK), Content Knowledge (CK), and Pedagogical Knowledge (PK) (Mishra & Koehler, 2006). The vocational education-oriented AI-TPACK extended model further distinguishes general generative AI skills

from industry-specific practical training content (Chen, 2025). The competency deficiencies observed in this sample can be decomposed into three structural weaknesses:

First, insufficient foundational TK. Most teachers only master basic dialogue operations of large language models without systematic training in prompt engineering and AI output verification, forming a fundamental barrier to instructional integration.

Second, mismatched TCK (Technological Content Knowledge). 72.46% of respondents taught industrial majors, yet vertical AI tools tailored for mechanical and manufacturing training remain scarce; specialized AI resources for business, medicine and agriculture majors are nearly unavailable, making it impossible to align disciplinary content with intelligent technology.

Third, inadequate TPK (Technological Pedagogical Knowledge). Existing institutional training prioritizes conceptual lectures rather than hands-on pedagogy training for AI-supported differentiated practical training and skill assessment. Teachers can only generate basic text materials via AI and cannot reconstruct practical training teaching paradigms.

The focus group findings indicate that the homogenized training mode at the case college, which does not differentiate between majors or experience levels, further widens the gap in teachers' technological integration capabilities.

3. Comparisons with Prior Research and Study Limitations

Global empirical studies on teacher AI literacy universally confirm the attitude-ability disconnect as a shared challenge amid educational digital transformation (Tlili et al., 2023). Teachers from eastern Chinese higher vocational colleges score significantly higher on foundational AI knowledge than the sample in this research (Wu et al., 2024), a disparity driven by unequal regional supply of AI training and school-enterprise industry resources. Most existing empirical studies adopting UNESCO's framework and TPACK focus on primary, secondary and general undergraduate education; this study targets engineering higher vocational colleges with practical training as the core mission, differentiates AI application barriers across majors, and enriches localized empirical evidence for the two theories within vocational education.

Two limitations exist in this research: first, samples are recruited from a single college with an overrepresentation of industrial major teachers, limiting cross-major representativeness. Second, self-reported Likert scale data may carry social desirability bias. Future research should

expand multi-region, multi-type vocational college samples and combine classroom observation and instructional artifact evaluation for longitudinal analysis.

4. Theoretical Implications

The three-layer analytical framework constructed in this study (Attitude & Awareness — Knowledge & Skills — Influencing Factors) realizes localized adaptation of the two core theories. The attitude layer corresponds to the human-centered educational cognition dimension of UNESCO's framework; The knowledge-skill layer covers TK, CK, PK and their intersecting integrative competencies defined by TPACK; the influencing factor layer explains external environmental constraints that prevent teachers from achieving advanced AI literacy standards.

The predicament of AI capacity development among central vocational college teachers stems from two overlapping issues: incomplete localization implementation of UNESCO's global AI literacy standards, and structural deficiencies in the three core TPACK knowledge bases. This dual theoretical foundation provides credible theoretical support for targeted optimization strategies for educational authorities, colleges and individual teachers.

Suggestion

Suggestions for Educational Administrative Authorities

1. Formulate a unified regional graded industrial standard for vocational college teachers' artificial intelligence application competence

Based on the industrial structure of vocational education in Henan Province, classify majors into categories including industrial manufacturing, business services, medicine and agriculture, and establish a hierarchical assessment indicator system. Four tiered competency thresholds are defined clearly: basic AI cognition, curriculum and practical training integration, teaching ethics, and virtual training development. This standard shall be incorporated as mandatory references for teachers' annual performance appraisal and double-qualified teacher accreditation. The policy can address two prominent problems: vocational teachers lack clear learning objectives for AI literacy improvement, and colleges have no unified benchmark to design targeted training programs.

2. Set up special provincial funds for AI teacher training and establish regular major-specific training support systems

The special fund shall provide annual continuous appropriations rather than one-off short-term grants to build a sustainable long-term training system. Given the college's high proportion of industrial majors and the shortage of AI teaching resources for liberal arts majors such as business administration, customized practical training programs shall be launched by major categories. Provincial offline practical training tours and regular online live courses shall be held each semester, with AI engineers from relevant enterprises invited to deliver on-campus lectures to make up for the shortage of internal professional trainers.

3. Coordinate a shared provincial pool of intelligent teaching hardware and software resources and build a long-term resource-sharing mechanism

Integrate regional AI practical training platforms for industrial simulation and curriculum generation tools, and open these resources to all public vocational colleges across Henan Province. Profession-specific AI models for vocational education shall be updated regularly to ease long-term difficulties including high independent procurement costs and insufficient professional software resources for individual colleges.

Suggestions for Vocational Colleges

1. Establish a long-term tiered cyclic AI training system to replace scattered one-off lectures

Colleges shall abandon fragmented short-term theoretical lectures and launch a sustainable semester-based rotating training system consisting of three types of courses: basic courses, advanced courses and practical training integration courses. Basic courses focus on fundamental AI knowledge and general tool operation; advanced courses provide hands-on training in lesson preparation, test design and online teaching research; practical training courses offer specialized programs for industrial majors covering virtual simulation and digital industry-education integration. All training activities adopt a credit system, and earned credits will be recorded into teachers' continuing education files to realize annual cyclic implementation. This targeted training model solves the core problems of insufficient basic AI knowledge and weak practical teaching skills among vocational teachers.

2. Build a permanent campus AI teaching research community to create a sustainable peer communication and mutual assistance platform

An interdisciplinary community for AI teaching practice shall be founded, with fixed weekly small-scale seminars and monthly college-wide sharing sessions on AI teaching outcomes, as well as permanent online communication channels. Members shall be divided into groups by majors such as industrial technology and business administration to collect authentic cases of AI-aided lesson preparation and practical guidance regularly. Demonstration classes of excellent AI teaching practices and one-on-one mentoring schemes shall be carried out. Institutionally, this measure addresses the weak campus atmosphere for intelligent teaching and inadequate peer communication support reflected in questionnaire data, forming a stable collaborative teaching research community.

3. Construct a long-term incentive system for AI teaching practice to optimize the campus atmosphere of intelligent technology application

Teachers' AI teaching practice, intelligent curriculum development and participation in community research activities shall be included in evaluation indicators for teaching assessment, merit selection and class-hour subsidies. An annual excellent intelligent teaching achievement award shall be set up, and outstanding teachers' practical cases shall be publicized within the college regularly. The long-term positive incentive mechanism can raise teachers' willingness to apply artificial intelligence actively and break the transformation barrier between learning motivation and practical classroom application.

4. Build a long-term service system for hardware & software upgrade and exclusive technical support

Colleges shall upgrade campus AI teaching hardware and professional software iteratively each year and hire full-time intelligent technology maintenance staff to open permanent online and offline consultation channels. One-on-one adaptive technical guidance shall be provided to meet differentiated demands of industrial practical training and liberal arts curriculum teaching. The long-term, timely and precise technical support can resolve practical pain points including inadequate teaching resources and unsolved technical obstacles in AI operation.

Suggestions for Individual Teachers

1. Develop a phased long-term self-study plan in accordance with provincial graded AI competency standards

Referring to the hierarchical competency indicators issued by educational authorities, teachers shall make semester-based learning schedules relying on open courses on the National Smart Education Platform and vocational AI online courses. Progressive learning helps teachers make up for deficiencies in theoretical AI knowledge and avoid fragmented and aimless casual learning.

2. Apply AI tools in low-threshold daily scenarios consistently to form a long-term habit of AI-integrated teaching

Teachers shall take lesson preparation, test bank compilation, practical courseware production and online teaching research as fixed daily application scenarios. They shall improve at least one teaching link with artificial intelligence every week, and gradually expand AI application to virtual training design and individualized learning situation analysis. Continuous practical experience can steadily improve teachers' overall AI teaching competence.

3. Join the campus AI teaching research community and engage in long-term peer collaborative communication

Teachers shall take part in weekly group seminars and monthly achievement sharing events regularly, share personal teaching obstacles and practical AI cases within the community to relieve technical anxiety. They may consult outstanding campus AI practitioners to build a regular mutual learning mode and obtain continuous peer experience support via the research community.

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