



Artificial Intelligence Literacy of Teachers in Higher Vocational Colleges: Challenges, Framework, and Enhancement Strategies

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Abstract. With the deep integration of artificial intelligence technology into the educational field, enhancing the AI literacy of teachers in higher vocational colleges has become a key factor in promoting the modernization of vocational education. Based on the background of educational transformation in the AI era, this paper analyzes the current status and challenges of teachers' AI literacy, systematically explores the framework and core components of AI literacy for higher vocational college teachers, and proposes corresponding enhancement strategies and implementation pathways. Research indicates that constructing a six-dimensional literacy framework encompassing awareness and attitude, knowledge and understanding, application and integration, data literacy, innovative thinking, and ethics and safety, combined with a multi-level support system including policy guidance, training mechanisms, practice platforms, and international experience, can effectively promote the comprehensive improvement of AI literacy among higher vocational college teachers. The research results provide theoretical reference and practical guidance for the professional development of teachers in higher vocational colleges.

Keywords: AI literacy; higher vocational teachers; enhancement pathways; human-machine collaboration

1 Introduction

Artificial intelligence technology is penetrating the educational field with unprecedented depth and breadth, reshaping the educational ecosystem, transforming teaching models, and posing new requirements for teachers' professional capabilities. As the main front for cultivating high-quality technical and skilled talents, the AI literacy of higher vocational education teachers is directly related to the quality of talent cultivation and the modernization process of vocational education. The key to AI-empowered education lies with teachers; their level of AI literacy directly determines whether they can harness the intelligent technology revolution to cultivate innovative talents adapted to future society. Therefore, systematically constructing an AI literacy framework for

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higher vocational college teachers and exploring effective enhancement pathways hold significant theoretical and practical value.

Integrating the latest research findings on teachers' AI literacy, this paper systematically explores the enhancement pathways for AI literacy among higher vocational college teachers from multiple dimensions, including definition of connotation, framework construction, current situation analysis, and strategy proposal, providing reference for promoting high-quality development of AI-empowered vocational education.

2 Current Status and Challenges of AI Literacy for Higher Vocational College Teachers

2.1 Related Work

Internationally, various beneficial models have been formed for enhancing teachers' AI literacy, providing rich references for the improvement of teacher literacy in China's higher vocational colleges^[1]. The policy-driven model, represented by Germany and South Korea, provides clear guidance for enhancing teachers' AI literacy through government-led standard setting and policy system improvement^[9]. Germany funds digital infrastructure through government grants, develops educational AI models, and integrates AI into pre-service and in-service teacher training systems. South Korea formulates specific indicators for teachers' AI literacy, covering basic skills, application skills, and professional engagement, supporting teachers through practical manuals and training to enhance their AI literacy.

The National Institute of Education, Singapore, incorporates fundamental AI courses into pre-service training and in-service training stages, cultivating teachers' programming and data analysis skills^[3]. Finland requires schools to teach programming, digital skills, and critical media literacy^[7]. Teachers must not only teach students basic AI knowledge but also guide them in reflecting on technological ethics. UNESCO has created a "Shared Open Educational Resources" database, providing resources such as course evaluations and teaching methods^[4]. The UK's Education Endowment Foundation researches and publishes guidelines on how to effectively use educational technologies, including AI, providing evidence-based guidance for teachers' practice^[12].

2.2 Main Challenges

Insufficient Technical Application Ability.

This insufficiency in application ability is mainly reflected in three aspects: First, deficiency in tool usage skills. many teachers have limited understanding of the functions and usage methods of common AI educational tools, unable to fully leverage the technological potential^[2]. Second, insufficient integration and application ability, even when mastering the use of individual tools, it is difficult to organically integrate multiple tools into the teaching process to form systematic solutions. Third, weak teaching innovation ability. rarely able to utilize AI technology to carry out innovative teaching

models such as project-based learning or inquiry-based learning, making it difficult to achieve a fundamental transformation of teaching paradigms.

The causes of this situation are complex and diverse. Objectively, AI technology iterates rapidly, with tools emerging endlessly, making it hard for teachers to keep up with the pace of technological updates^[5]. Subjectively, teacher training mechanisms are imperfect, with training content often disconnected from actual teaching needs, leading to poor training outcomes. Environmentally, many schools lack necessary technical facilities and support systems, making it difficult for teachers to obtain continuous technical support and practical guidance.

Prominent Ethical and Security Risks.

Ethical risks are mainly manifested at three levels: Data privacy level, when using AI tools, teachers may unintentionally leak students' personal information and learning data, infringing on students' privacy rights^[11]. Algorithmic fairness level, algorithms within educational AI systems may contain biases of the designers, leading to differential treatment of students from different backgrounds and exacerbating educational inequality. Academic integrity level, misuse of AI technology may facilitate academic misconduct, such as using AI to write papers or fabricate research data, undermining academic norms.

Weak Systematic Support System.

The enhancement of AI literacy among higher vocational teachers faces the challenge of a weak systematic support system. Regarding policy support, although relevant documents have been issued at national and local levels, most are macro-level guidance, lacking specific implementation norms and supporting measures^[6]. Many schools have not incorporated AI literacy into teachers' assessment and evaluation systems, resulting in insufficient motivation for teachers to improve. In terms of resource supply, learning resources suitable for the needs of higher vocational teachers are scarce, especially case resources and practical guidance integrated with professional teaching. Regarding platform construction, infrastructure such as personalized learning platforms and cross-domain collaborative teaching research platforms is incomplete, making it difficult for teachers to obtain continuous professional development support.

Furthermore, insufficient integration of industry and education is also a significant issue. With AI technology evolving rapidly, it is difficult for schools alone to keep up with the technological frontier, necessitating close cooperation with enterprises^[10]. However, current school-enterprise cooperation in the AI field mostly remains superficial, failing to form a deep collaborative talent cultivation mechanism. The latest technologies and practical cases from enterprises have not been timely transformed into teaching resources, making it difficult for teachers to access the latest industry developments, which affects the relevance and foresight of AI literacy enhancement^[8].

3 Framework and Connotation of AI Literacy for Higher Vocational Teachers

3.1 Construction of a Six-Dimensional Framework System

This section constructs a six-dimensional framework system for teachers' AI literacy, shows in Table 1. The framework references UNESCO's AI Competency Framework for Teachers and the requirements of China's Ministry of Education's Digital Empowerment for Teacher Development initiative^[4], aiming to provide systematic guidance for cultivating AI literacy among higher vocational college teachers.

Table 1. Six-Dimensional Framework System for Teachers' AI Literacy

Dimension	Core Connotation	Competency Requirements
AI Awareness and Attitude	Understand AI's potential impact on education; maintain an open, rational attitude	Understand AI development trends; adopt a human-machine collaborative mindset; proactively apply AI to optimize teaching.
AI Knowledge and Understanding	Master basic AI concepts, principles, and typical application scenarios	Understand core AI concepts; be familiar with AI application cases in education; establish scientific cognition.
AI Application and Integration Ability	Proficiently use AI tools and integrate them into the entire teaching process	Skillfully operate AI educational tools; seamlessly integrate them into all aspects of instructional design.
Data Literacy and Evidence-Based Decision-Making Ability	Collect and analyze learning data; make teaching decisions based on data	Interpret learning analytics reports; use data to identify teaching issues; adjust teaching strategies.
Innovative and Critical Thinking Ability	Critically evaluate AI tools; creatively design teaching activities	Assess limitations of AI tools; innovate instructional design; cultivate computational and data thinking.
Ethics, Safety, and Social Responsibility	Adhere to AI ethical norms; protect data privacy; prevent algorithmic bias	Follow data privacy regulations; identify algorithmic bias; guide students in responsible AI use.

3.2 Explanation of Connotation

AI Awareness and Attitude is the foundation of literacy, requiring teachers not only to understand the development trends and application prospects of AI technology but also to face technological changes with a positive and rational attitude, overcome technological anxiety, and proactively seek innovative human-machine collaborative teaching models. This dimension is the psychological basis for establishing all other dimensions, determining the intrinsic motivation for teachers to learn and apply AI technology.

AI Knowledge and Understanding is the core of literacy, including basic concepts of AI, working principles, and typical application scenarios in the educational field. Teachers need to understand algorithms of basic principles such as machine learning and neural networks, comprehend the working mechanisms of adaptive learning systems and intelligent assessment tools, laying a solid knowledge foundation for technology application.

AI Application and Integration Ability is the key to practice, requiring teachers to skillfully use various AI educational tools to assist the entire teaching process and organically integrate tools and data into all links of instructional design, implementation, and evaluation, achieving seamless integration of technology and teaching. This dimension emphasizes the shift from tool usage to pedagogical transformation, realizing the educational paradigm shift from "teacher-centered" to "student-centered."

Data Literacy and Evidence-Based Decision-Making Ability is a special requirement in the era of intelligent education. Teachers need to use AI tools to collect, analyze, and interpret student learning data, making teaching interventions and optimizing decisions based on data insights, even designing intelligence tutorial system to tracing the students' development. This requires teachers to master basic data analysis tools and methods, forming a three-stage analysis capability of "description-diagnosis-prediction," enabling data-driven precise teaching.

Innovative and Critical Thinking Ability is the high-level manifestation of literacy, emphasizing that teachers can critically evaluate the applicability and limitations of AI tools and creatively utilize AI to design new teaching activities and assessment methods. This dimension enables teachers to be not only users of technology but also innovators and critics of technology's educational application.

Ethics, Safety, and Social Responsibility is the bottom line of literacy, requiring teachers to adhere to AI ethical norms, data privacy and security regulations, avoid algorithmic bias, protect student data, and guide students in using AI technology responsibly. With the deep application of AI in education, ethical and safety literacy has become an indispensable component of teachers' professional literacy.

These six dimensions support and relate to each other, together forming a complete framework for AI literacy among higher vocational teachers. Awareness and attitude are the premise, knowledge and understanding are the foundation, application and integration are the core, data literacy is the key, innovative thinking is sublimation, and ethics and safety are the safeguard, all unified in the entire process of teachers' professional development.

4 Implementation Strategies Supported by Computer Technology

4.1 Strengthen Policy Guidance and Technical Standard Construction

At the national level, formulate a "Vocational College Teachers' AI Literacy Development Plan". Establish a technical standard system for teachers' AI literacy, including technical capability evaluation indicators such as programming proficiency, AI tool operation, and model development. Implement hierarchical standards for different teacher groups: for information technology professional teachers, require proficiency in AI model training and secondary development; for professional course teachers, focus on evaluating the ability to integrate AI tools with professional teaching; for teachers with weak technical foundations, focus on basic programming and AI tool application capabilities.

4.2 Build a Hierarchical Training System Integrated with Computer Technology

Construct a three-stage hierarchical training system based on the technical growth law of teachers:

Technical foundation stage: Focus on training basic computer skills, including programming languages (Python, SQL), data analysis tools (Pandas, Tableau), and basic AI concepts. Adopt the training mode of "online courses + hands-on workshops", and cooperate with platforms such as Huawei Cloud and Alibaba Cloud to provide free online programming courses. Set up on-campus hands-on workshops to carry out practical training such as data cleaning and simple model training.

Application practice stage: Focus on the integration of computer technology and teaching practice, and carry out special training on educational large model application, intelligent teaching system integration, and data-driven teaching design. For example, training teachers to use vocational education large models to generate courseware, design test questions, and carry out personalized teaching; guiding teachers to use NLP technology to analyze student homework and test papers, and identify common mistakes and learning difficulties.

Innovation and development stage: Focus on cultivating technical innovation and research capabilities, and carry out training on AI tool secondary development, educational AI project research, and computational thinking teaching design. Cooperate with enterprises such as iFlytek and Youbisuan to set up "AI + Professional" training workshops, and guide teachers to develop small AI teaching tools suitable for professional courses based on API interfaces and open source frameworks.

4.3 Create a Technical Practice Platform and Collaborative Mechanism

Build an Intelligent Training Platform Based on Cloud Computing.

Construct a personalized training platform supported by cloud computing and big data, which can automatically generate personalized training paths according to teachers' technical background and development needs. The platform integrates functions such as online programming environment, AI model training sandbox, and teaching case library. Teachers can conduct hands-on practice of programming, model training, and data analysis on the platform without configuring local hardware; the platform can record training processes and learning data in real time, and generate technical capability evaluation reports through data mining algorithms to provide targeted improvement suggestions.

Establish a Cross-Domain Collaborative Research Platform Supported by Knowledge Graphs.

Build a cross-school and cross-regional collaborative research platform using NLP and knowledge graph technology, which can realize the semantic analysis and intelligent matching of teaching resources and research experiences. Teachers can upload their own AI teaching cases and technical application experiences to the platform, and

the platform can automatically recommend similar cases and cooperative partners through knowledge graphs; set up online technical discussion areas and expert consultation channels to provide teachers with real-time technical guidance and experience sharing opportunities.

Deepen School-Enterprise Cooperation and Build a Technical Practice Base.

Cooperate with leading enterprises in the computer and AI fields to build "AI + Professional" industrial colleges and technical practice bases. Introduce enterprise's advanced technologies such as industrial AI models, intelligent production lines, and cloud computing platforms into the campus, and transform them into teaching resources. Arrange teachers to participate in enterprise technical research and project development, so that teachers can contact the latest technical applications in the industry in a timely manner. Jointly develop training courses with enterprises, and invite enterprise technical experts to teach practical courses such as AI tool development and technical application, so as to improve the pertinence and practicality of training.

4.4 Improve the Data-Driven Evaluation and Sustainable Development Mechanism

Establish a Process-Oriented Technical Capability Evaluation System.

Build a "teacher technical development digital portfolio" based on blockchain technology to record teachers' technical training, teaching practice, project research and other data in a tamper-proof manner. Adopt a combination of process evaluation and result evaluation, and use data mining algorithms to analyze teachers' technical application frequency, training participation, case quality and other data to generate technical capability radar charts. The evaluation indicators include programming proficiency, model application effect, data analysis depth, technical innovation level, etc., so as to comprehensively and objectively evaluate teachers' AI literacy.

Build an Intelligent Continuous Support System.

Develop an intelligent mentor system based on educational large models, which can push personalized learning resources according to teachers' technical weaknesses and development needs. Provide real-time technical consultation and problem-solving services through the system, and answer teachers' questions in programming, model application, and data analysis. Establish an online learning community, encourage teachers to share technical experience, exchange application problems, and form a good atmosphere of collaborative learning and common progress.

Promote the Iteration and Upgrade of Technical Support Resources.

Establish a dynamic update mechanism for technical resources, track the latest developments of computer technologies such as AI and big data, and update training courses, teaching cases, and technical tools in a timely manner. Cooperate with universities and research institutions to carry out research on cutting-edge technologies such

as educational large model customization and intelligent teaching system optimization, and transform research results into practical resources to support teachers' sustainable technical development.

5 Conclusions

This study proposes a framework for AI literacy in higher vocational education faculty, presenting a series of technology-backed implementation strategies through the integration of fundamental computing technologies. Research indicates that the integrated "six-dimensional framework plus technical underpinning" system effectively guides the cultivation of teachers' AI literacy. Moreover, hierarchical technical training, smart practice platform construction, and data-driven evaluation strategies significantly enhance teachers' capabilities in computer technology application and AI pedagogical innovation.

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