AI-Driven Transformation of Higher Vocational Education and AI Literacy Development in China

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ABSTRACT

Artificial intelligence (AI) is transforming vocational education by reshaping educational objectives, teaching approaches, and competency requirements. As AI technologies become increasingly integrated into industrial and professional contexts, higher vocational education needs to develop students' AI literacy to prepare them for future workplaces. This study adopts a conceptual and policy analysis approach to examine AI-driven transformation in China's higher vocational education, focusing on emerging challenges and pathways for AI literacy development.

The findings indicate that AI is promoting changes in curriculum development, teaching innovation, intelligent assessment, and industry–education collaboration. However, effective AI integration remains constrained by challenges related to curriculum adaptation, teacher capability, educational resources, and regional disparities. This study argues that AI literacy should extend beyond basic technology use and include multiple competencies, including understanding AI, applying AI in professional contexts, critically evaluating AI outputs, and using AI responsibly. Furthermore, AI literacy development requires differentiated strategies that consider variations across institutional levels, regions, and academic disciplines. Based on this analysis, the study proposes that AI literacy cultivation should be advanced through curriculum integration, teacher professional development, industry collaboration, and multidimensional assessment mechanisms to support sustainable transformation of higher vocational education.

This study provides theoretical and practical insights into AI-driven vocational education transformation and offers guidance for developing AI literacy frameworks in higher vocational institutions.

Keywords: Artificial Intelligence; Generative Artificial Intelligence; Higher Vocational Education; AI Literacy; Digital Transformation; Educational Policy

INTRODUCTION

Artificial intelligence (AI) has rapidly emerged as a transformative technology that is reshaping economies, industries, and education systems worldwide. Recent advances in generative AI, represented by large language models such as ChatGPT, have significantly enhanced AI's capabilities in content generation, intelligent decision-making, and human–computer interaction. These technological breakthroughs have accelerated the digital transformation of education and fundamentally changed the competencies required for future learning and employment. As AI continues to redefine workplace practices and industrial structures, educational institutions are increasingly expected to prepare learners with the knowledge, skills, and ethical awareness

necessary to thrive in AI-enabled environments.

Among all educational sectors, vocational education is particularly influenced by AI because of its close relationship with industrial development and workforce preparation. AI technologies have enabled vocational institutions to improve teaching effectiveness through personalized learning, intelligent assessment, adaptive curriculum design, and data-driven educational governance. At the same time, AI has shifted vocational education from a traditional knowledge- and skill-oriented model towards a competency-based approach that emphasizes innovation, critical thinking, human–AI collaboration, and lifelong learning. Governments and international organizations, including UNESCO and the Chinese government, have also introduced a series of policies promoting the integration of AI into vocational education while emphasizing responsible and ethical AI use. These initiatives demonstrate that AI has become an essential driver of vocational education reform rather than merely an educational technology.

Despite these opportunities, AI also presents considerable challenges for vocational education. The rapid evolution of AI technologies has accelerated industrial transformation, altered occupational structures, and created increasing demand for new competencies. Existing vocational education systems often struggle to keep pace with technological change because of outdated curricula, insufficient teaching resources, inconsistent educational policies, and inadequate preparation of teachers and students. Furthermore, concerns regarding technological unemployment, digital inequality, algorithmic bias, data security, and ethical governance have made it increasingly difficult for vocational institutions to balance technological innovation with educational responsibility.

These challenges are particularly evident in China's higher vocational education system. Although China has actively promoted AI through national strategies and vocational education reforms, structural limitations remain in curriculum development, talent cultivation, educational resources, institutional coordination, and AI competency development. Consequently, strengthening students' AI-related competencies has become a critical priority for vocational education. This review therefore examines the role of generative AI in vocational education, the impact of AI on vocational education, the structural challenges faced by China's higher vocational education system, and the national policy framework for AI literacy. Collectively, these perspectives provide a theoretical foundation for understanding why AI literacy has become an essential educational objective for higher vocational students in the AI era.

The Role of Generative AI in Vocational Education Transformation

Artificial intelligence (AI) has become a transformative technology driving digital transformation across various sectors, including education. Among recent AI advances, generative AI, represented by ChatGPT, has attracted widespread attention because of its ability to generate human-like content and support complex cognitive tasks. With the rapid development of generative artificial intelligence technologies represented by ChatGPT, AI has become an important driving force behind the digital transformation of vocational education. Generative AI functions not only as a technological tool in educational settings but also as a transformative force that is reshaping the organizational structure, governance logic, and teaching models of vocational education (Ye & Wu, 2024). In September 2023, the United Nations Educational, Scientific and Cultural Organization (UNESCO) released its first global Guidance for Generative AI in Education and Research (hereafter referred to as the Guidance). The document reaffirmed a human-centred approach and called on governments and relevant institutions to adopt appropriate measures in response to the development of generative AI (Chu et al., 2024). The Guidance indicated that education systems are shifting from an isolated model of educational resource provision towards a more interconnected model of “global digital citizenship” education. Open educational resource organizations, such as the Digital Cooperation Organization, have played an important role in promoting educational equity, facilitating the co-construction and sharing of resources, and transforming

vocational education. The digital teaching communities established by these organizations can broaden learning pathways for vocational education students from different backgrounds and regions.

In July 2023, seven Chinese government departments, including the National Development and Reform Commission and the Ministry of Education, jointly issued the Interim Measures for the Management of Generative Artificial Intelligence Services. The document supports technological innovation by educational and research institutions in the field of generative AI while regulating the healthy development of the technology(Government of the People's Republic of China, 2023). The extensive integration of AI is, on the one hand, accelerating the emergence of new industries and forms of business and, on the other hand, reshaping the structure and operation of traditional industries. As a result, existing occupational categories and job positions are undergoing profound changes. In March 2023, the British Financial Times, citing a Goldman Sachs report, stated that generative AI could affect approximately 300 million jobs worldwide (Strauss, 2023). In June 2023, McKinsey & Company reported in The Economic Potential of Generative AI that the expected timeline for AI to replace human work had been brought forward by approximately ten years. It further estimated that, between 2030 and 2060, around 50% of occupations could be displaced by AI. For example, the value generated by generative AI is expected to extend across four major areas, customer service, marketing, software, and research and development and could enable the automation of 60% to 70% of current work activities (Wu, 2025).

Han et al. (2025) demonstrated that artificial intelligence reshapes the allocation of labour factors through three main pathways: technological substitution, organizational substitution, and division-of-labour substitution, thereby exerting a profound influence on the employment market. On the one hand, AI can replace certain traditional jobs and directly disrupt employment; on the other hand, it can generate compensatory and new-employment effects by creating emerging occupations and employment opportunities. Therefore, the substitution and job-creation effects of AI operate simultaneously, not only restructuring employment patterns but also creating new possibilities for the long-term expansion of the labour market.

Among these three pathways, technological substitution is particularly prominent. As AI continues to improve its capabilities in data processing, content generation, and autonomous learning, it is increasingly able to perform standardized, repetitive tasks and work that depends on fixed knowledge and skills. This development is reshaping the supply-and-demand structure of the labour market. From the labour supply perspective, advances in large-scale pretrained models have strengthened AI’s ability to handle complex tasks, placing greater competitive pressure on workers whose jobs are largely based on established rules. From the labour demand perspective, the growing maturity of AI applications represented by ChatGPT has enabled them to better meet the increasing demand of individuals and enterprises for intelligent products and services, thereby raising the skill requirements associated with traditional occupations.

For example, generative AI is increasingly undertaking repetitive and process-oriented tasks in industries such as logistics, distribution, and customer service. In consumer markets, it can also analyse users’ historical behaviour and consumption preferences to provide more accurate and personalized recommendations for products and services, further promoting the intelligent transformation of related industries (Han et al., 2025).

Overall, the existing literature suggests that generative AI is becoming a transformative force in vocational education by reshaping educational practices, governance models, talent cultivation, and labour market dynamics. While generative AI provides significant opportunities to enhance personalized learning, improve educational quality, strengthen industry–education integration, and promote workforce adaptability, it also presents substantial challenges related to employment displacement, digital inequality, algorithmic bias, and ethical governance. These opportunities and challenges indicate that vocational education should not only integrate AI technologies into teaching and learning but also cultivate learners' competencies to understand, apply, evaluate, and use AI responsibly. Therefore, developing AI literacy has become a fundamental requirement for preparing

vocational students to participate effectively in an AI-driven society and future workforce.

The Impact of Artificial Intelligence on Vocational Education

Artificial intelligence (AI) has profoundly transformed the development of vocational education. Through intelligent teaching platforms, personalized learning support, and data-driven assessment systems, AI has accelerated the transformation of teaching models, talent cultivation objectives, and evaluation mechanisms in vocational education. At the same time, AI has shifted instructional practices from a teacher-centred approach to a learner-centred paradigm while strengthening the alignment between vocational education and industrial needs, thereby promoting the integration of vocational skills development with the cultivation of innovation capabilities (Hao, 2024).

The advancement of AI has also reshaped the objectives of vocational education, moving beyond traditional vocational skills training towards a more comprehensive model that integrates knowledge, technical competencies, and holistic capabilities. The revised “Vocational Education Law of the People's Republic of China” emphasizes strengthening the alignment between vocational education and industrial development to cultivate high-quality, interdisciplinary technical talents capable of meeting future workforce demands. In this context, AI leverages personalized learning and big data analytics to identify learners' strengths, characteristics, and developmental needs, enabling tailored learning support that not only enhances professional competencies but also fosters innovation, critical thinking, and teamwork skills.

In recent years, supported by continuous national policy initiatives, the application of AI in vocational education has expanded considerably. For example, the “Action Plan for Improving the Quality and Excellence of Vocational Education (2020–2023)” explicitly encourages the integration of emerging technologies, including AI and big data, into vocational institutions to establish intelligent teaching platforms and improve the informatization and digital governance of vocational education.

Before the widespread adoption of AI, vocational education primarily focused on developing professional knowledge and technical skills to meet the competency requirements of conventional occupations. However, with the rapid advancement of AI technologies, intelligent systems have gradually assumed many routine and procedural tasks, while human workers are increasingly expected to undertake higher-order responsibilities involving organization, decision-making, and innovation. As an essential component of the education system, higher vocational education must respond proactively to evolving labour market demands and regional economic development (Liang, 2024). Meanwhile, the emergence of a new wave of "technological unemployment" driven by AI (Kaplan, 2016) is reshaping higher vocational education by transforming occupational structures, job content, and competency requirements (Wu, 2025).

Chi and Jiang (2025) argued that AI has overcome the traditional limitations of time, space, and human-computer interaction, enabling vocational education to move beyond conventional linear training models and facilitating deeper integration between educational settings and industrial practice. Through intelligent educational resource generation, dynamic analysis of labour market demands, and the construction of virtual-real integrated learning environments, vocational education can better align students' skill development with enterprise needs while promoting teachers' digital competence, improving educational governance, and reforming evaluation systems. Consequently, the labour market is gradually shifting from a static supply-demand matching model towards a dynamic adaptation model. Nevertheless, the rapid development of AI has also introduced challenges, including the digital divide, data security concerns, ethical issues, and legal risks. Therefore, vocational education must establish a comprehensive competency framework encompassing technological understanding, practical application, innovation, and ethical judgment.

Furthermore, as industrial upgrading continues to increase the demand for highly skilled technical professionals,

AI can analyse regional industrial talent needs through deep learning and related technologies, identify skill shortages in key sectors such as advanced manufacturing and modern services, and provide evidence-based support for governments in formulating industry-education integration policies and for vocational institutions in optimizing programme offerings. The value of AI in vocational education extends beyond technological applications to a broader transformation of educational paradigms. Consistent with the human-centred behavioural framework proposed by Zhang (2011), AI contributes to educational innovation across multiple dimensions. At the cognitive level, AI supports the construction of industrial knowledge graphs, enabling students to develop systematic understandings of emerging technologies such as intelligent manufacturing and the Industrial Internet. At the practical level, digital twin and extended reality (XR) technologies reconstruct practical training environments and promote a collaborative education model involving AI tutors, enterprise engineers, and vocational teachers, thereby integrating learning activities with authentic production processes. At the institutional level, government-industry-school collaboration facilitates resource sharing, continuous curriculum renewal, and enterprise-driven teaching reform, ultimately enhancing the alignment between talent cultivation and industrial development (Zhang & Zeng, 2025).

Wang (2025) further suggested that, in vocational education, AI can develop personalized learning pathways based on learners' historical learning data and behavioural characteristics, thereby improving learning efficiency and skill acquisition. Through data analytics, AI also enhances the flexibility and adaptability of curriculum design, enabling vocational programmes to respond more effectively to evolving industrial demands. Moreover, AI can optimize vocational qualification assessment through dynamic evaluation systems, thereby improving the fairness, scientific validity, and transparency of certification processes. By leveraging natural language processing technologies, AI also facilitates more effective cross-cultural communication among learners from diverse cultural backgrounds, strengthening their communication and collaboration skills (Zhang & Dong, 2022).

However, Ye and Wu (2024) argued that the challenges associated with AI should not be overlooked. These include concerns regarding the lack of transparency caused by algorithmic "black-box" systems, the potential marginalization of teachers' professional roles, and biases embedded in AI-generated content. Such challenges place greater demands on technological ethics, digital culture, platform governance, and information security throughout the digital transformation of vocational education. Therefore, while AI serves as a powerful driver of digital transformation, its application in vocational education must be accompanied by appropriate institutional regulation and value-oriented governance to ensure its responsible, ethical, and sustainable development.

Overall, the existing literature indicates that artificial intelligence is fundamentally transforming vocational education by reshaping teaching models, learning environments, curriculum design, educational governance, and talent development. AI not only enhances the alignment between vocational education and industry through personalized learning, intelligent assessment, and data-driven decision-making, but also supports the cultivation of competencies required in an increasingly digital and intelligent workplace. However, the widespread adoption of AI also presents significant challenges, including technological unemployment, digital inequality, algorithmic bias, and ethical concerns. These findings suggest that vocational education should not only integrate AI technologies into teaching and learning but also equip students with the competencies needed to use AI effectively, critically, and responsibly. Consequently, cultivating AI literacy has become an essential objective of vocational education in preparing students for future work and lifelong learning.

Structural Challenges of Chinese Higher Vocational Education in the AI Era

Despite the transformative potential of artificial intelligence and generative AI in advancing vocational education, the effective integration of these technologies remains constrained by existing systemic limitations. While AI has created new opportunities for personalised learning, curriculum innovation, educational governance, and industry–education collaboration, the extent to which these benefits can be realised largely depends on the

readiness of vocational education systems. In China, the rapid advancement of AI has exposed a range of structural weaknesses within higher vocational education, revealing gaps between educational provision and the evolving competency requirements of AI-driven industries.

As artificial intelligence accelerates the reshaping of educational and industrial structures, China's higher vocational education system is confronted with multiple systemic challenges. First, at the level of admissions systems, although the reform of classified examination admissions has moved beyond the traditional "score-only" approach and promoted a transition from "single examination" to "comprehensive evaluation", thereby reinforcing the typological positioning of vocational education, problems such as imperfect institutional design, uneven regional implementation, and the weakening of skills orientation remain prominent (Chen, 2019). At the same time, reforms of vocational education pathways implemented in many provinces continue to be constrained by insufficient overall coordination, weak articulation between stages, disconnection between education and industry, and lagging mechanisms. Issues including unequal resource allocation, fragmented curriculum systems, limited enterprise participation, and inadequate quality assurance jointly undermine the coherence and effectiveness of vocational education reform (Chen & Liu, 2025). These challenges highlight the urgent need for systematic adjustment of the overall structure, governance mechanisms, and operational logic of the higher vocational education system.

At the level of institutional development, China's vocational education system still lags behind developed countries in areas such as infrastructure construction, training conditions, standards systems, enterprise participation, and quality assurance mechanisms (State Council, 2019). These systemic shortcomings directly affect students' access to stable and well-regulated learning support environments, placing higher vocational students in a relatively disadvantaged position within the education system. Lin, and Xiong (2025) point out that vocational education in China generally lacks standardised and systematic curricula, with particularly evident deficiencies in the cultivation of digital literacy and AI literacy. As a result, higher vocational students face structural inequities from the very beginning of their educational trajectories, as their technological cognition and comprehensive literacy required for future industries are insufficiently supported.

In terms of teaching systems and programme development, educational structures formed during the era of the traditional industrial economy can no longer adequately respond to the technological demands of the intelligent era. Li, Liu, and Wang (2023) argue that existing teaching systems, programme structures, and faculty configurations all require reconstruction. New technologies and processes have not been incorporated into classrooms in a timely manner, leaving students underprepared in AI-related knowledge and literacy. This reflects significant lag in higher vocational education with respect to curriculum updating mechanisms, programme structure optimisation, and teacher development systems.

With regard to technological integration, the incorporation of generative artificial intelligence into vocational education teaching systems requires effective alignment with existing educational technologies in order to advance intelligent teaching. However, due to rapid technological iteration and the complexity of resource systems, updates to generative AI resource repositories often lag behind. The authority and curricular relevance of such content remain limited, creating new challenges for knowledge selection, learning resource integration, and learner literacy development (Wang & Hao, 2025).

From the perspective of national talent supply and demand, although China has a large number of skilled workers, the proportion of high-skilled talents remains relatively low. By the end of 2020, among more than 200 million skilled workers nationwide, only about 58 million were classified as high-skilled, accounting for less than one third of the total. This level is insufficient to support the growing demand for composite and innovative talents in intelligent industries (Xie & Shan, 2024). This structural imbalance further exposes the limited adaptability of the higher vocational education system in aligning with industrial trends and building high-quality talent

cultivation systems.

At the student level, the lag in AI education within higher vocational institutions is directly reflected in students' literacy profiles. Research by Hong (2025) shows that only about one third of higher vocational students consciously adhere to ethical norms when using AI tools, and a considerable proportion lack experience in using generative AI. This imbalance in literacy structures reflects deficiencies in curriculum design, resource provision, learning support, and value guidance within the education system, leaving students without systematic safeguards for understanding AI, using AI in a regulated manner, and developing appropriate value orientations.

In sum, the advent of the AI era has exposed multiple structural challenges in China's higher vocational education system, spanning institutional development, teaching systems, resource allocation, and student support. In response to this complex landscape, constructing a clear and systematic AI literacy framework for higher vocational students has become a critical pathway for advancing educational system restructuring. Such a framework not only provides a foundational basis for clarifying cultivation orientations and curricular logic in higher vocational education, but also helps strengthen students' core literacies in technological understanding, tool use, human–machine collaboration, and ethical judgement. In doing so, it enhances the overall adaptability and sustainable development capacity of the education system in the intelligent era.

In summary, China's higher vocational education system is facing multiple structural challenges in the AI era, including limitations in institutional development, curriculum design, educational resources, technological integration, talent cultivation, and student preparedness. These challenges have weakened the system's capacity to respond effectively to the rapidly evolving demands of AI-driven industries. Therefore, it is increasingly important for higher vocational education to strengthen students' AI-related competencies and equip them with the knowledge, skills, and ethical awareness required to adapt to future technological and workplace changes.

In summary, the emergence of the AI era has exposed a series of structural challenges within China's higher vocational education system, including limitations in institutional capacity, curriculum adaptability, technological integration, educational resources, and student competency development. These challenges indicate that the transformation of higher vocational education requires not only technological adoption but also systematic reforms in talent cultivation objectives, curriculum structures, and competency development mechanisms. In particular, the gap between the evolving requirements of AI-driven industries and the existing capabilities of vocational education highlights the urgent need to clarify what competencies students should develop and how these competencies can be systematically cultivated. Against this background, the development of AI literacy has become an essential direction for enhancing the adaptability and sustainability of higher vocational education. Therefore, examining China's emerging policy framework for AI literacy provides an important foundation for understanding the national strategic orientation, competency requirements, and implementation directions of AI literacy development in vocational education.

China's Policy Framework for Artificial Intelligence Literacy

As artificial intelligence becomes a strategic priority in China's educational reform, a series of national policies have been introduced to support the integration of AI into vocational education and guide the cultivation of AI literacy. These policy initiatives span national development strategies, occupational competency standards, and institutional guidelines, providing a systematic policy foundation for AI-enabled vocational education. Against this backdrop, it is essential to examine China's national policy framework in order to understand the developmental orientation and core competencies of AI literacy for higher vocational students. The development of AI literacy in China is closely aligned with the country's broader national strategy. The White Paper on University Students' Artificial Intelligence Literacy (Wu et al., 2024) notes that the advancement of China's AI industry has progressed alongside the country's broader digital transformation. In 2017, the State Council issued

the New Generation Artificial Intelligence Development Plan, which identified five major directions for AI development: big data intelligence, cross-media intelligence, collective intelligence, human–machine hybrid augmented intelligence, and intelligent autonomous systems. The plan further highlighted deep learning, cross-domain integration, human–machine collaboration, open collective intelligence, and autonomous control as defining characteristics of China's new stage of AI development (State Council, 2017).

In terms of vocational education talent standards, the National Occupational Skill Standards for Artificial Intelligence Engineering and Technical Personnel (2021 Edition) were jointly issued by the Ministry of Human Resources and Social Security and the Ministry of Industry and Information Technology. Although this document is institutionally defined as an "occupational competency standard," its content structure clearly extends beyond a narrowly conceived skills-based framework and exhibits a pronounced literacy-oriented orientation.

Guided by the principles of "occupational activities as the focus" and "professional competence as the core," the standard constructs requirements for AI-related occupations across two dimensions: basic requirements and work requirements. The basic requirements encompass professional ethics, foundational knowledge, ethical security, and regulatory compliance, reflecting a systematic emphasis on value awareness, normative understanding, and ethical responsibility. The work requirements, organised hierarchically from entry to advanced levels, specify professional expectations related to algorithm design, model development, system testing, and operation and maintenance consultancy (Ministry of Human Resources and Social Security & Ministry of Industry and Information Technology, 2021). From a literacy perspective, this standard can be substantively synthesised into four core literacy domains, professional ethics literacy, knowledge literacy, technical application literacy, and innovative ethical literacy, thereby providing an important policy reference for the cultivation of artificial intelligence literacy among AI-related talents in China.

At the level of vocational institutions, the Guidelines for the Application of Artificial Intelligence in Vocational Institutions identify AI literacy cultivation as a key direction of vocational education reform and explicitly call for the deep integration of AI technologies with specialised education, with the aim of cultivating technical and skilled talents who possess both AI literacy and occupational competence (Information Technology Teaching Steering Committee of the Ministry of Education, 2023). The guidelines require the inclusion of foundational AI modules in talent cultivation programmes so that students can acquire basic principles, tool usage skills, algorithmic thinking, and ethical awareness, and mandate the incorporation of AI literacy into the system of vocational core competencies. They also propose a tiered cultivation framework spanning "secondary vocational education – higher vocational associate education – vocational bachelor's education", covering three levels: general literacy, professional skills, and industry competence. Specifically, secondary vocational students are expected to master basic concepts and tool usage; higher vocational associate students should understand professional applications and possess the literacy to design AI-assisted solutions; vocational bachelor's students should be capable of constructing AI-enabled innovative business models. In addition, the guidelines emphasise the establishment of a tripartite linkage mechanism among industry, enterprises, and institutions, the development of a dynamic database of skill demands, and the continuous updating of talent cultivation programmes based on the Teaching Standards for Vocational Education Programmes, in order to promote intelligent upgrading of programmes and the development of industry–education integration.

With regard to evaluation systems, the Guidelines for the Application of Artificial Intelligence in Vocational Institutions propose the construction of an AI literacy evaluation system based on dynamic competency maps, along with the development of tiered assessment tools for students at different levels. These tools are intended to enable systematic evaluation across dimensions such as general literacy, professional skills, industry competence, and ethical and security awareness. The guidelines also call for the establishment of a three-tier curriculum system—"general literacy, professional skills, and industry competence" to ensure the systematic cultivation of students' AI literacy (Information Technology Teaching Steering Committee of the Ministry of

Education, 2023).

In addition, the State Council (2025), in the Opinions on Deepening the Implementation of the "Artificial Intelligence Plus" Initiative, explicitly states that AI should be integrated into all elements and throughout the entire process of education and teaching, including curriculum content, teaching approaches, resource development, learning support, and teacher development, so as to advance the overall intelligent transformation of the education system. The document further emphasises a shift in educational approaches from a knowledge transmission orientation towards a literacy-oriented approach, highlighting learners' required literacies in understanding AI, applying AI, and effectively collaborating with AI systems in digital and intelligent environments. This policy direction indicates that AI has become a key driving force for transforming educational evaluation, talent cultivation objectives, and learning modes, providing an institutional foundation and top-level policy support for higher vocational institutions to construct and cultivate students' AI literacy.

Overall, China's AI literacy policy framework has largely taken shape as an interconnected and mutually reinforcing system comprising national planning, occupational standards, and educational guidelines. This framework reflects the strategic importance of AI development at the national level and clarifies pathways for talent cultivation in vocational education. However, these policy arrangements remain primarily at the level of macro design and occupational standards, and there is still a lack of a systematic AI literacy framework specifically tailored to higher vocational students and aligned with their learning characteristics and occupational needs, to guide concrete teaching implementation and capacity development in vocational institutions.

Practical Implementation, Differentiated Development, and Evaluation of AI Literacy in Chinese Higher Vocational Education

Building upon the above discussion, the practical implementation of AI literacy development requires further consideration of institutional contexts, regional conditions, and disciplinary characteristics. Although China has established a national policy framework for artificial intelligence integration in vocational education, the translation of policy objectives into institutional practices remains uneven across different educational contexts. Existing practices indicate that AI literacy cultivation has gradually shifted from policy-oriented planning towards institution-based implementation, involving curriculum reform, professional training, industry collaboration, and competency assessment. In economically developed eastern regions, higher vocational institutions have integrated AI technologies into professional education through cooperation with digital industries and the development of industry-oriented learning scenarios. AI applications have been incorporated into areas such as intelligent manufacturing, digital commerce, and content creation, enabling students to develop practical AI application skills while strengthening responsible AI awareness. In central regions, vocational institutions have explored AI integration based on local industrial characteristics, including AI-supported digital media production, intelligent construction, and technology services. In western regions, where digital infrastructure and industry resources may be relatively limited, institutions have increasingly adopted accessible approaches such as cloud-based AI platforms and online learning resources to expand students' access to AI learning opportunities. These practices demonstrate that AI literacy development should maintain common competency objectives while allowing contextual adaptation according to institutional conditions, regional development, and occupational requirements.

Despite these emerging practices, AI literacy development across Chinese vocational education remains differentiated due to variations in institutional levels, geographical regions, and disciplinary fields. Regarding institutional types, secondary vocational schools mainly emphasize fundamental AI awareness, appropriate tool use, and basic ethical understanding, whereas higher vocational colleges focus more on integrating AI with professional competencies and workplace applications. Vocational undergraduate institutions are expected to cultivate higher-level capabilities related to AI innovation, applied research, and industry-oriented problem

solving. However, the lack of a coherent AI literacy development pathway across educational stages may hinder the continuity between secondary vocational education, higher vocational education, and vocational undergraduate education. Regional differences further influence AI literacy implementation. Eastern coastal regions generally possess stronger digital infrastructure, closer industry partnerships, and richer educational resources, enabling institutions to develop more advanced AI learning environments. In contrast, many institutions in central and western regions continue to face challenges related to limited technological resources, insufficient teacher preparation, and fewer authentic AI application scenarios. In addition, disciplinary characteristics shape the focus of AI literacy cultivation. Engineering programmes tend to emphasize AI technologies, intelligent systems, and industrial applications; business programmes focus more on AI-supported decision-making, data analysis, and digital innovation; while service-oriented disciplines, including healthcare, tourism, and education, require greater attention to human–AI interaction, ethical judgement, and responsible AI use. Therefore, AI literacy development should adopt flexible implementation strategies that integrate universal competency requirements with institution-specific, region-specific, and discipline-specific needs.

To enhance the effectiveness and sustainability of AI literacy cultivation, higher vocational institutions should establish systematic implementation pathways integrating curriculum development, teacher professional development, industry collaboration, and evaluation mechanisms. First, AI literacy development should follow a progressive model across educational levels. Secondary vocational education should focus on basic AI concepts, appropriate tool use, and ethical awareness. Higher vocational education should integrate AI literacy into general education and professional courses through project-based learning, interdisciplinary activities, and authentic workplace tasks. Vocational undergraduate education should further promote AI-enabled innovation, applied research, and industry-oriented solution development. Second, institutions should establish multidimensional assessment systems that move beyond traditional knowledge-based examinations. AI literacy evaluation should incorporate AI knowledge assessment, practical application tasks, project performance, ethical case analysis, and industry feedback to measure students' abilities to understand AI, apply AI, and critically evaluate AI outputs. Finally, long-term evaluation mechanisms should be developed to examine the effectiveness of AI literacy cultivation through continuous monitoring of students' learning outcomes, graduate employment performance, employer satisfaction, and workplace adaptability. Through continuous cycles of implementation, assessment, evaluation, and improvement, higher vocational institutions can develop a sustainable AI literacy ecosystem that supports students' professional development and enhances their capacity to participate responsibly in AI-driven workplaces.

DISCUSSION

Artificial intelligence is driving fundamental changes in the objectives, teaching approaches, and talent development models of higher vocational education. This study suggests that AI should not be viewed merely as a technological tool for improving educational efficiency, but rather as a transformative force reshaping vocational education systems. As AI becomes increasingly integrated into industrial production and professional contexts, higher vocational education needs to move beyond traditional skill-based training towards the development of comprehensive competencies. Students are expected not only to use AI tools but also to understand their capabilities and limitations, critically evaluate AI-generated outputs, and engage in responsible human–AI collaboration. Therefore, AI literacy has become an essential competency for preparing higher vocational students for future workplaces.

The findings further indicate that AI literacy development represents a broader transformation of vocational competency structures. In addition to occupational knowledge and technical skills, future vocational graduates require critical thinking, problem-solving ability, innovation capability, and ethical judgement. However, the integration of AI into vocational education cannot be achieved through technological investment alone. It

requires coordinated reforms in curriculum development, teacher professional development, institutional governance, educational resources, and industry collaboration. Therefore, AI literacy cultivation should be understood as a systematic educational reform rather than simply the introduction of AI-related courses or digital tools.

Furthermore, AI literacy development in Chinese higher vocational education demonstrates significant contextual differences. Variations in institutional levels, regional conditions, and disciplinary characteristics influence how AI literacy can be implemented. Secondary vocational education should primarily focus on fundamental AI awareness, appropriate tool use, and ethical understanding, whereas higher vocational education should emphasize the integration of AI with professional competencies and workplace applications. Vocational undergraduate education should further promote AI-enabled innovation and applied problem-solving capabilities. Similarly, different disciplines require different priorities: engineering programmes may emphasize AI technologies and industrial applications, business programmes may focus on AI-supported decision-making and data analysis, while service-oriented disciplines require greater attention to human–AI interaction and responsible AI use. Therefore, AI literacy development should adopt a flexible framework that maintains common competency goals while allowing adaptation to institutional missions, regional characteristics, and disciplinary needs.

The study also highlights the importance of multi-stakeholder collaboration in advancing AI literacy development. Teachers, students, enterprises, and policymakers play complementary roles in this process. Teachers need to enhance their AI knowledge and pedagogical capabilities to effectively integrate AI into teaching practices. Students should develop the ability to apply and critically evaluate AI through authentic learning experiences. Enterprises can provide valuable occupational contexts and support the alignment between AI literacy development and workplace requirements. Policymakers should establish supportive standards, resources, and governance mechanisms. Therefore, sustainable AI literacy development requires collaboration among educational institutions, industries, and policy systems.

In addition, effective assessment mechanisms are essential for ensuring the quality of AI literacy development. Traditional assessment approaches focusing mainly on knowledge acquisition and technical performance are insufficient for evaluating comprehensive AI literacy. Future assessment systems should incorporate multiple dimensions, including AI knowledge, practical application, critical evaluation, and ethical responsibility. Project-based assessment, case analysis, practical tasks, and industry feedback can provide more comprehensive evidence of students' AI competencies. Moreover, long-term evaluation mechanisms should be developed by examining graduates' employment performance, employer satisfaction, and workplace adaptability, thereby providing continuous feedback for curriculum improvement and institutional development.

Overall, AI provides significant opportunities for enhancing the quality and relevance of higher vocational education while also creating challenges related to educational inequality, technological governance, and ethical responsibility. The future development of vocational education should therefore move beyond AI adoption towards systematic AI literacy cultivation. By establishing competency-based frameworks, implementing context-sensitive strategies, strengthening stakeholder collaboration, and improving evaluation mechanisms, higher vocational institutions can better prepare students to participate effectively, responsibly, and sustainably in AI-enabled workplaces and society.

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