Development of a Framework for AI Literacy Among Vocational Students: A Delphi Study

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Abstract: Artificial Intelligence(AI) literacy occupies an increasingly prominent strategic position in talent cultivation and serves as a critical enabler for cultivating high-quality talent in the new era. The study extracted the main AI literacy framework of vocational college students through literature research. Based on this, a questionnaire was designed and 16 experts were selected for three rounds of opinion solicitation using the Delphi study. An AI literacy frame- work for vocational college students was developed, including 5 first-level indicators and 16 second-level indicators. Based on the characteristics of industries, sectors, and academic disciplines, and informed by the literacy framework and student interviews, this study puts forward suggestions for cultivating AI literacy, offering a theoretical basis and practical reference for talent cultivation reform in vocational colleges.

Keywords: AI literacy, vocational students, Delphi method, AI education

1 Introduction

Artificial Intelligence (AI) technologies are rapidly permeating all facets of human life, driving productivity improvements and economic growth while delivering substantial benefits to end users, enterprises and the broader economy [1] .Against this backdrop, every individual will inevitably need to engage with AI and learn to coexist and thrive alongside it [2]. In September 2024, the United Nations Educational, Scientific and Cultural Organization (UNESCO) released the AI Competency Framework for Students, establishing AI literacy as a core competency for citizens in modern society and building a standardized competency system spanning all educational stages—from K-12 and vocational education to higher education. The strategic importance of AI literacy in talent cultivation is increasingly evident, establishing it as a foundational competency for developing high-quality talent in the new era. Vocational students constitute a crucial segment of social productivity and serve as the backbone of a high-quality workforce of technical and skilled professionals. Developing an AI literacy framework tailored for the digital-intelligent era holds profound significance for promoting the cultivation and assessment of AI literacy among vocational college students. While the domestic and

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international academic community has established relatively mature AI literacy frameworks, existing research mostly focuses on K-12 and higher education stages, notably absent is a theoretically grounded, empirically validated framework specifically tailored for vocational education. For this reason, by investigating the existing research results of AI literacy frameworks at home and abroad, combined with the the typological attributes of vocational education and the actual situation of students, this paper initially establishes a set of AI literacy framework for vocational college students, and then uses Delphi method to complete multiple rounds expert consultation, and finally determines a complete framework for vocational college students' artificial intelligence literacy. The contribution of this study lies in that vocational education researchers and practitioners can use these research findings to design research and learning activities related to AI literacy and competencies, thereby offering theoretical insights and guidance for cultivating and enhancing the AI literacy of vocational college students.

2 Literature Review

2.1 International Research

Although the term "AI literacy" lacks a precise definition and has yet to achieve a unified understanding in academia, Long and Ng [3-4] conceptualize AI Literacy as the capacity to understand, utilize, monitor, and critically reflect upon AI applications, without necessarily possessing the technical expertise to develop AI models themselves. Currently, AI literacy is often categorized under the umbrella of information literacy or digital literacy. The latter two focus on the acquisition, evaluation, and utilization of information, whereas AI literacy extends beyond this by emphasizing the understanding and application of AI technologies, along with critical engagement with their associated societal, ethical, and legal implications[5]. Among the foreign research on AI literacy, the representative one is the "AI Competency Framework for Students" proposed by UNESCO in September 2024. It outlines 12 competencies across four dimensions: human-centered mindset, AI ethics, AI technologies and applications, and AI system design, spanning three developmental stages: understanding, applying, and creating[1].

Chiu et al. [6] —in collaboration with senior AI education experts in Hong Kong, China, jointly built an AI literacy system for the K-12 stage. The framework fully considers the non-technical background of the K-12 group, and divides AI literacy into five core dimensions: technical cognition, social influence, ethical norms, collaborative application, and self-reflection. Kim and Lee [7] developed an artificial intelligence literacy test scale for middle school students, in which six domains were designed: social impact, understanding, using AI to execute plans, using AI to solve problems, data literacy, and ethics. Based on analytical research in the field of higher education and adult education, Laupichler [8], drawing on analytical research in the fields of higher education and adult education, tends to endorse Long's perspective that AI literacy refers to a set of competencies enabling individuals to critically evaluate AI technologies, communicate and collaborate effectively with AI, and utilize AI as a tool in online, home, and workplace settings. The study on AI literacy in vocational education specifies that competencies involving the utilization of specialized AI technologies to understand, analyze, judge,

interpret, and evaluate domain-specific data, information, and AI-based content, among other related tasks, can be categorized as vocation-related competencies. For the general workforce, the most critical AI competency requirements center on data and algorithm literacy as well as vocation-related literacy[9].

While tailoring AI literacy education to specific career needs is critical, equally important are transferable, interdisciplinary AI capabilities that support borderless career trajectories, enabling professionals to adapt to changing AI across fields [10]. Another study on vocational education emphasizes that in the era of AI, technological progress should be balanced with the importance of cultivating humanistic literacy. Humanism remains crucial in cultivating emotional intelligence, ethical responsibility and social awareness—skills that are indispensable for navigating the complexities of modern workplaces[11]. The aforementioned studies have offered abundant constructive insights into building an AI literacy framework for vocational college students. In particular, concepts such as humanism, interdisciplinary competencies, and vocation- related competencies proposed in vocational education-focused research provide new perspectives for our subsequent research.

2.2 Research in China

There is a growing consensus in domestic research regarding the first-level indicators of AI literacy. Guo et al. [12] suggested that AI literacy can be summarized as the ability to recognize and understand AI, apply and analyze AI, as well as evaluate and create AI. Zhang et al.[13] proposed that AI knowledge, AI competencies, and AI ethics constitute three interrelated and interdependent dimensions. Zhong et al. [2] developed an AI literacy assessment framework based on three dimensions: AI knowledge, AI affect, and AI thinking. They emphasized that AI literacy construction requires attention not only to its foundation (knowledge) and its higher-order dimensions (thinking, specifically "domain-specific thinking in AI"), but, more importantly, to the affective climate of the process (affect, specifically "domain-specific affect in AI")[2]. A distinctive characteristic compared to the framework proposed by Long and Ng's team abroad is that domestic AI literacy frameworks consistently incorporate higher-order AI competencies, including engineering design capabilities, programming skills, and algorithmic proficiency. Given that the complexity of AI literacy escalates across educational stages [14], and considering that vocational college students in China differ fundamentally from K-12 learners and general university students in their educational objectives, this paper further explores whether this cohort requires advanced AI competencies and, if so, which core competencies should be prioritized.

In summary, studies on AI literacy specifically tailored to vocational college students remains relatively limited both within China and abroad. The construction of an AI literacy framework for vocational college students must be grounded in the practical needs of industries, enterprises and cross-sectoral fields, highlight the distinctive nature and application-oriented orientation of vocational education, and align with the talent cultivation objectives of colleges and the development needs of local economies. The Delphi method, which synthesizes expert judgments through iterative multi-round consultations to achieve consensus, is particularly well-suited for the rigorous construction of

AI literacy framework. Accordingly, this study employs the Delphi method to systematically develop an AI literacy framework for vocational college students, aiming to provide theoretical insights and practical guidance for relevant teaching practices and talent cultivation.

3 Research Design

3.1 Qualitative Literature Review Method

Constructing an AI literacy framework for vocational college students is a complex undertaking, involving the screening and establishment of various levels of dimensions and their corresponding systems. The foremost issue is to determine appropriate first-level indicators. To achieve this, the study employed a qualitative literature review approach to systematically collect, examine, synthesize, and integrate existing research and theoretical frameworks from peer-reviewed articles, conference proceedings, industry publications, and other credible sources. Closely aligned with vocational college talent cultivation programs and informed by the representative perspectives and key issues outlined in the preceding Literature Review, five first-level dimensions were initially identified: AI Knowledge, AI Awareness, AI Thinking, AI Application, and AI Ethics. Building on this foundation, this study integrates the development of the AI discipline and the distinctive nature of vocational education. Leveraging the Students' AI literacy Framework issued by the United Nations Educational, Scientific and Cultural Organization (UNESCO), alongside the research findings of Su [15], Zhang [13], and Chee [9], this study developed the second-level dimensions of the indicators as comprehensively as possible within the scope of current academic cognition. The initial indicator pool was systematically constructed by integrating established AI literacy frameworks with vocational education competency standards, ensuring that each first- and second-level dimension was substantiated by at least two independent, authoritative sources. Indicators were retained for subsequent expert evaluation only if they satisfied both criteria: (1) robust theoretical grounding—evidenced by consistent support across peer-reviewed literature—and (2) contextual relevance—demonstrated through documented alignment with vocational training requirements and industry practice.

In alignment with the distinctive nature of vocational education, the dimension of "AI Knowledge" was categorized into "Foundational AI Knowledge," "Industry-Specific AI Technology Knowledge" and "Occupation-Specific AI Knowledge", as illustrated in Table 1. Based on the research of Su [15] and Chee [9], as well as the vocational education talent training program, the dimension of "AI Application" was divided into "Hands-on Operation of AI Tools for Specific Occupational Posts," "Performance Evaluation of AI Tools," "Human-AI Collaborative Application," "Independent AI Creation," and "AI Skill Transfer".

Table 1. A Preliminary Framework for AI Literacy

First-level	Second-level	The descriptions of second-level indicators
AI Knowledge	Foundational AI Knowledge	Be aware of fundamental AI concepts, development history, and core technology frameworks
	Industry-Specific AI Technology Knowledge	Be aware of AI technologies related to one's professional field
	AI Knowledge for Occupational Posts	Understanding of AI application principles and workflows in target occupational positions
AI Awareness	Vigilance Awareness	Critically identify biases in AI systems within occupational contexts
	Verification awareness	Verify the source, authenticity, and quality of AI-generated content
	Humanistic Awareness	Recognize cultural subjectivity and diversity in AI tools
	Exploration Awareness	Willingness to actively explore and experience new AI products
	Value Awareness	Recognize the value of AI technology for career development
	Risk Prevention Awareness	Maintain awareness of data security and AI risks
AI Thinking	Systems thinking	View research objects as interconnected parts
	Computational Thinking	Apply computer science thinking to solve problems
	Data Thinking	Understand, find, synthesize, interpret and evaluate data
	Programming Thinking	Understand basic programming knowledge
	Critical Thinking	Critically interpret AI feedback and identify AI limitations
	Interdisciplinary Thinking	Integrate disciplinary domain with AI technology
	Logical Thinking	Leverage AI-generated logical reasoning pathways
AI Applications	Hands-on Operation of AI Tools	Proficiently operate AI tools commonly used in specific occupational posts
	Performance Evaluation of AI Tools	Evaluate AI tool performance, accuracy and effectiveness
	Human-AI collaborative	Collaborate with AI systems to accomplish professional tasks
	Application Independent AI Creation	Use AI technology to creatively solve practical problems
	AI Skill Transfer	Apply AI-related knowledge and skills across diverse contexts
AI Ethics	Social responsibility	Ensure equity and fairness, be responsible to others and society
	AI Laws & Regulations	Comply with laws and regulations in AI
	AI Ethical compliance	Comply with ethical norms in AI

3.2 Delphi Method

The Delphi method utilizes an iterative, multi-round consultation process to gradually converge dispersed expert opinions toward consensus, effectively fulfilling its core functions of information feedback and control. Delphi panels typically comprise 10 to

30 experts. This study engaged a panel of 16 experts across three consultation rounds [16]. The first two rounds of questionnaires primarily included two parts. The first part involved experts evaluating and providing revision suggestions for the components of the indicator system at all levels, using a 5-point Likert scale (1 = very unimportant, 2 = unimportant, 3 = important, 4 = relatively important, 5 = very important) for scoring. The second part consisted of experts' self-assessments of their rating basis, covering two dimensions: the basis for rating judgment basis (Ca) and familiarity level (Cs) [17]. The third round focused on final validation of the AI literacy framework and the weighting of indicators at each hierarchical level. Questionnaires were distributed and collected via WeChat, QQ, and email, with data compiled and analyzed using SPSS. Constructing an AI literacy framework for vocational college students intersects multiple domains, including vocational education, industry practice, and AI. To ensure a broad disciplinary and practical representation, the expert panel was strategically formed with 16 members: three industry-related enterprise technical specialists, nine faculty members of vocational education institutions and four researchers in IT, AI, and smart education from academia. The panel composition ensured cross-sector representation with 43.75% female experts and 56.25% male experts, and disciplinary backgrounds covered computer science, AI ethics, vocational pedagogy, and industry-specific domains including Intelligent Manufacturing and digital media, drawn from six regions including Anhui, Jiangxi, Henan, Zhejiang, Shaanxi province, and Shanghai city, all hold distinguished professional qualifications. This consultation process was conducted from January 2, 2026 to March 15, 2026, with the following core implementation stages:

1. Draft expert consultation questionnaires and accompanying explanatory notes;
2. Distribute the first-round expert questionnaires;
3. Collect all first-round questionnaires, organize the collected data, and compile the second-round expert consultation materials;
4. Distribute the second-round expert questionnaires;
5. Collect the second-round questionnaires, synthesize aggregated expert opinions, and draft the third-round expert questionnaires;
6. Distribute the third-round expert questionnaires, and collect valid responses until the experts reached a final consensus. In this study, the effective recovery rate of the questionnaires was all above 95% with no case of missing items, indicating that the experts' participation enthusiasm was high and the results of the expert consultation were reliable.

Round 1 Expert Questionnaires. This round employed the cut-of value method, a standard method for initial Delphi data processing. Predefined inclusion criteria were set as: mean score (M) >4.0, coefficient of variation (CV) < 0.25, and Proportion of full scores (K) > 20% [18] [19]. As shown in Table 2, Following Round 1, six second-level indicators—"Vigilance Awareness," "Value Awareness," "Humanistic Awareness," "Computational Thinking," "Programming Thinking" and "Critical Thinking"—failed to meet the criteria and were subsequently removed. In response to experts' feedback, the definitions of "Foundational AI Knowledge" and "Interdisciplinary Thinking" were

revised and supplemented. Additionally, “Innovative Thinking” and its official interpretation were added. These modifications formed the basis for the Round 2 questionnaire.

Table 2. Data Analysis of Round 1 Questionnaire Analysis

First-level	Second-level	Mean	SD	CV (%)	Full Score Prop.
AI Knowledge	Foundational AI Knowledge	4.00	0.85	0.211	26.7
	Industry-Specific AI Awareness	4.60	0.83	0.180	80.0
	AI Knowledge for Occupational Posts	4.47	0.64	0.143	53.3
AI Awareness	Vigilance Awareness	3.67	0.72	0.197	6.7
	Verification awareness	4.20	0.86	0.205	40.0
	Humanistic Awareness	3.40	1.06	0.310	13.3
	Exploration Awareness	4.53	0.83	0.184	66.7
	Value Awareness	3.93	0.89	0.225	33.3
	Risk Prevention Awareness	4.40	0.83	0.188	60.0
AI Thinking	Systems Thinking	4.07	0.96	0.236	46.7
	Computational Thinking	3.80	0.94	0.248	26.7
	Data Thinking	4.00	0.85	0.211	33.3
	Programming Thinking	3.60	0.83	0.230	20.0
	Critical Thinking	4.07	1.22	0.301	53.3
	Interdisciplinary Thinking	4.60	0.63	0.140	66.7
	Logical Thinking	4.40	0.74	0.170	53.3
AI Applications	Hands-on Operation of AI Tools	4.87	0.35	0.070	86.7
	Performance Evaluation of AI Tools	4.07	1.03	0.250	40.0
	Human-AI Collaboration	4.60	0.51	0.110	60.0
	Independent AI Creation	4.33	0.72	0.170	46.7
	AI Skill Transfer	4.33	0.62	0.140	40.0
AI Ethics	Social responsibility	4.27	0.80	0.190	46.7
	AI Laws & Regulations	4.47	0.83	0.190	66.7
	AI Ethical compliance	4.40	0.74	0.170	53.3

Round 2 Expert Questionnaires. Based on the scoring results from 16 experts across 19 secondary AI literacy indicators, a relatively strong consensus was achieved. As shown in Table 3, core competencies such as "AI Knowledge for Occupational Posts" and "Hands-on Operation of AI Tools" received unanimous maximum scores (100% full agreement), reflecting clear industry expectations for vocational AI literacy. However, overall agreement remained suboptimal (Kendall’s coefficient of concordance, $W = 0.31$). The disagreements focused on "Performance Evaluation of AI Tools", "Systems Thinking" and "Verification awareness". The first was the only indicator with a mean score below 4.00 and exhibited high dispersion, indicating substantial divergence among experts. Although "Systems Thinking" and "Verification awareness" achieved a mean of 4.0, they exhibited a low proportion of full scores. suggesting notable difference in the emphasis placed on this indicator by participating experts. Conversely, despite a

higher CV for "Innovative Thinking "its high mean and proportion of full scores indicated underlying alignment among experts. The research team deliberated and decided to remove "Performance Evaluation of AI Tools", "Systems Thinking", and "verification awareness", while retaining “Innovative Thinking”.

Table 3. Data Analysis of Round 2 Questionnairel Analysis

First-level	Second-level	Mean	SD	CV (%)	Full Score Prop.
AI Knowledge	Foundational AI Knowledge	4.73	0.46	0.100	73.3
	Industry-Specific AI Awareness	4.87	0.52	0.110	93.3
	AI Knowledge for Occupational Posts	5.00	0.00	0.000	100.0
AI Awareness	Verification awareness	4.20	0.77	0.180	40.0
	Exploration Awareness	4.73	0.46	0.100	73.3
	Risk Prevention Awareness	4.87	0.52	0.110	93.3
AI Thinking	Systems Thinking	4.00	0.76	0.190	26.7
	Data Thinking	4.47	0.74	0.170	60.0
	Interdisciplinary Thinking	4.60	0.63	0.140	66.7
	Logical Thinking	4.47	0.52	0.120	46.7
	Innovative thinking	4.33	0.90	0.210	53.3
AI Applications	Hands-on Operation of AI Tools	5.00	0.00	0.000	100.0
	Performance Evaluation of AI Tools	3.80	0.94	0.250	20.0
	Human-AI Collaboration	4.80	0.41	0.090	80.0
	Independent AI Creation	4.53	0.52	0.120	53.3
	AI Skill Transfer	4.20	0.68	0.160	33.3
AI Ethics	Social responsibility	4.80	0.56	0.120	86.7
	AI Laws & Regulations	4.87	0.52	0.110	93.3
	AI Ethical compliance	4.87	0.52	0.110	93.3

Round 3 Expert Feedback. Based on the feedback collected from the first two rounds of expert consultations, and having shared the key divergences identified in the second round with the panel, the framework adopted for the third round of the survey includes 5 first-level dimensions and 16 second-level dimensions. A total of 16 questionnaires were distributed and collected. The feedback from the third round of is shown in Table 4.As shown in Table 4, the coefficient of variation (CV) of most indicators is below 15%, indicating a high degree of consistency among experts in their judgment of the importance of each indicator. "Data Thinking" are slightly higher than those of other indicators. It is suggested that the connotations of these indicators be more precisely defined in the future. Notably, the indicator "Practical Operation of AI Tools in the Position" received full marks from all 16 experts, highlighting its core position in the framework of artificial intelligence literacy in vocational colleges. The results of statistical tests show that the Kendall’s coefficient of concordance($W = 0.397$, $\chi^2 = 95.28$, $p < 0.001$), reaching the significance level, indicating that the ex- pert ratings are statistically significant. The round 3 data verify the scientificity and reliability of the construction of the indicator system. This iterative refinement process yielded the finalized capabilities framework presented as shown in Table 5.

Table 4. Final Consultation Results and Statistical Analysis

First-level	Second-level	Mean	SD	CV (%)	Full Score Prop.
AI Knowledge	Foundational AI Knowledge	4.813	0.403	8.38%	0.813
	Industry-Specific AI Technology Awareness	4.875	0.342	7.01%	0.875
	Occupational AI Knowledge	4.875	0.342	7.01%	0.875
AI Awareness	Exploration Awareness	4.438	0.512	11.54%	0.438
	Risk Prevention Awareness	4.625	0.500	10.81%	0.625
AI Thinking	Data Thinking	4.500	0.730	16.22%	0.625
	Interdisciplinary Thinking	4.500	0.632	14.04%	0.563
	Logical Thinking	4.500	0.516	11.47%	0.500
	Innovative Thinking	4.375	0.619	14.15%	0.438
AI Applications	Hands-on Operation of AI Tools	5.000	0.000	0.00%	1.000
	Human-AI Collaborating	4.688	0.602	12.84%	0.750
	Independent AI Creation	4.438	0.629	14.17%	0.500
	AI Skill Transfer	4.438	0.629	14.17%	0.500
AI Ethics	Social Responsibility	4.875	0.342	7.01%	0.875
	AI Laws & Regulations	4.813	0.403	8.38%	0.813
	AI Ethical Compliance	4.625	0.500	10.81%	0.625

Table 5. Final AI Literacy Framework

First-level	Second-level	Interpretation of Second-level Indicators
AI Knowledge	Foundational AI Knowledge	Be aware of fundamental AI concepts, development history, trends and core technology frameworks
	Industry-Specific AI Technology Awareness	Be aware of AI technologies related to one's professional field (such as industrial AI in manufacturing and intelligent service AI in the service industry)
	AI Knowledge for Occupational Posts	Understanding of AI application principles and workflows in occupational positions
AI Awareness	Exploration Awareness	A willingness to actively explore and experience new AI products, as well as the willingness to apply AI technologies in industry and daily problem-solving.
	Risk Prevention Awareness	Maintain awareness of data security, as well as AI's opportunities and potential threats, in learning and work scenarios

AI Thinking	Data Thinking	A competence for understanding data, data finding, data synthesis, data interpretation and data evaluation
	Interdisciplinary Thinking	Thinking competence that organically integrates AI knowledge and technical capabilities with other disciplinary fields, enabling learners to conduct interdisciplinary research and solve complex problems by applying AI technology
	Logical Thinking	A competence to leverage AI-generated logical reasoning path- ways to conduct rational analysis and solve problems efficiently in occupational and industry practice contexts
	Innovative thinking	A competence to leverage AI systems combined with human creativity, break through cognitive boundaries, and achieve high-level creative outcomes such as experimental exploration and creative inspiration [20] [21]
AI Applications	Hands-on Operation of AI Tools	A competence to proficiently operate AI tools commonly used in specific occupational posts such as prompt design and optimization [22]
	Human-AI Collaboration	The competence to collaborate with AI systems to accomplish professional tasks, improving work quality and efficiency, such as workflows automation [22]
	Independent AI Creation	Using AI technology to creatively solve practical problems in occupational and industry contexts
	AI Skill Transfer	A competence to apply AI-related knowledge and skills across diverse professional and industry contexts
AI Ethics	Social responsibility	Ensure equity, fairness and responsibility to others and society [23]
	AI Laws & Regulations	Comply with laws and regulations in AI
	AI ethical compliance	Comply with ethical norms in AI, which encompasses regulating the conduct of ourselves, others, and AI systems to prevent ethical breaches

4 Conclusion

The integration of AI into vocational education marks a profound shift [22], reshaping how technical skills are taught and learned, while imposing novel demands on the cultivation of vocational students. Synthesizing insights from global research in vocational, higher, and K-12 education, this study employed a three-round Delphi process to develop an AI literacy framework for vocational college students. Consisting of 5 first-level and 15 second-level indicators, this framework not only elucidates the common requirements imposed by AI development on vocational college students but also reveals the specific demands of professional positions regarding AI literacy. First, vocational college students should, just like their counterparts in regular universities, acquire solid foundational knowledge of artificial intelligence (AI) , proficiently mastering the

basic concepts, developmental history, future trends, and core technical architecture of AI. Particularly important is that vocational students need to be well-versed in AI technologies relevant to their specific professional posts and industries, as these foundational skills are crucial when they enter the workforce. Second, in the context of accelerating technological iteration and increasingly complex application scenarios, vocational college students face considerable challenges in adapting to the dynamic changes of future occupational posts. Exploration awareness stimulates individual curiosity toward the unknown, Concurrently, risk prevention awareness provides essential boundaries, ensuring that exploratory activities remain within ethical and safety frameworks while mitigating hazards associated with unregulated investigation. AI thinking is particularly critical. Not only helps students in constructing systematic logical frameworks when navigating complex application scenarios and facilitates effective data integration and analysis, but also enables them to make more insightful decisions by deeply integrating domain-specific knowledge with AI technologies.

For vocational college students, proficiency in operating industry-standard AI tools and mastering relevant AI devices, software, and applications constitutes a fundamental literacy in the AI era. As AI accelerates the transformation of industries and sectors, students must develop the adaptability to navigate shifting occupational roles and evolving industry scenarios. Continuously acquiring new skills and enhancing competencies in Human-AI Collaborative, AI-driven Professional Innovation, and AI Technology Transfer, will enable students to evolve from basic tool operators into domain experts capable of solving complex occupational challenges. This ensures they remain valued and in demand amid ongoing techno- logical evolution in the workplace. Finally, as vocational college students are at a critical stage of internalizing societal, legal and ethical norms, they require not only technical proficiency but also the cultivation of core values, ethical awareness, and legal conscious- ness. They must adhere to stringent ethical and legal standards when deploying AI technologies, particularly concerning data protection, privacy rights, intellectual property, algorithmic bias, and so on.

5 Limitation and Future Research

While the framework is designed with "industry- and discipline- informed" principles, Level-3 indicators will be differentiated across vocational disciplines in future phased research. Currently, the framework is positioned as a consensus-based model, with quantitative validation through factor analysis and pilot implementation planned for the next research phase. Future research can further explore the weight distribution of each dimension of the framework and the practical application of the evaluation system. It is also recommended to dynamically update the literacy framework in response to evolving industry trends, sector-specific demands, and disciplinary characteristics to enhance both its accuracy and foresight.

6 Recommendations and Implications

In order to enhance the AI literacy of vocational college students, this section proposes the following recommendations, based on the AI literacy framework aforementioned:

(1) Formulate a systematic AI literacy cultivation framework and refine the evaluation mechanism for vocational college students. Education authorities, in collaboration with industry associations, corporate experts, and academic institutions, should expedite the formulation of Guidelines for the Cultivation and Evaluation of AI Literacy in Vocational Colleges, these guidelines should specify clear objectives, implementation pathways, and assessment criteria for embedding AI education into discipline-specific curricula (e.g., CNC machining, logistics, culinary arts). By scientifically defining the competency levels for "Job-Specific AI Knowledge" and "Practical Operation of Job-Specific AI Tools," students' performance in utilizing AI tools to solve problems within authentic production environments should be incorporated into formal assessments. This will provide standardized, actionable institutional guidelines for vocational colleges to precisely enhance students' AI literacy.

(2) Deepen industry-education integration and construct authentic "AI training scenarios" In the digital-intelligent era, vocational education must transcend traditional classroom teaching and pivot toward deep industry-education integration. It is recommended to establish "school-enterprise collaborative innovation training bases" through a dual-system cooperation model. Such bases should move beyond merely equipment sharing to focus on integrating authentic corporate business processes and data flows. Specifically, vocational colleges should partner with industry-leading enterprises to co-develop "AI Digital Transformation Laboratories," embedding real-world operational challenges—such as production scheduling, equipment maintenance, or supply chain management—into the curriculum. Through the model of "students completing projects under the guidance of enterprise mentors", students will conduct AI data analysis, AI model application and optimization in authentic industrial internet environments. The approach not only enhances hands-on practical competencies but also, through exposure to authentic scenarios, cultivates students' capacity for rapid learning and skill transfer when confronted with complex professional challenges.

(3) Strengthen ethics education and solidify professional bottom lines. It is imperative to prioritize ethical and legal education within AI literacy cultivation. Vocational colleges should incorporate AI ethics education into their compulsory curricula, with particular emphasis on data security, privacy protection, and professional accountability. By employing case-based learning that juxtaposes positive and negative examples within authentic contexts, students can better comprehend the societal risks and technological biases that may arise from the application of AI technologies in professional settings. This approach will help cultivate students' awareness of legal compliance and ability for moral self-discipline during the use of AI technologies.

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