Research on the Development Trends of Higher Vocational Education Driven by Artificial Intelligence

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Abstract: *The integration of artificial intelligence and higher vocational education is reshaping the educational ecosystem at an unprecedented pace. This article aims to systematically delineate the core development trajectory and realistic landscape of AI-driven higher vocational education. Relevant data indicates that the application of artificial intelligence in China's higher vocational colleges has entered a phase of large-scale exploration—approximately half of these institutions have introduced general AI courses, and over two-thirds are utilizing AI to assist in teaching. At a deeper logical level, this process is propelling a triple transformation in vocational education: the educational philosophy shifting from knowledge transmission to competency-orientation, the teaching paradigm transitioning from experience-driven to data-driven approaches, and the ecosystem evolving from fragmented operations to intelligent synergy.*

At the level of practical teaching, the traditional dual structure of teacher-student interaction is gradually giving way to a new tripartite model of "teacher—AI—student" engagement. In the dimension of talent cultivation, the development of "AI+X" competencies has become the core orientation, emphasizing the deep integration of technological instrumentality with professional scenarios and advancing teaching towards a "code-free, tool-based, scenario-oriented" direction. The integration of industry and education is also undergoing profound changes: the supply of teaching resources is shifting from a school-dominated "supply side" to an enterprise-needs-oriented "demand side," with 60% of vocational colleges now engaged in school-enterprise collaborative curriculum development.

Of course, this journey is not without challenges. The gradient in AI literacy between teachers and students, the superficial integration of technology and teaching, insufficient infrastructure support, and the accompanying ethical and security considerations remain key bottlenecks constraining the deep empowerment of artificial intelligence. Looking ahead, with continuous breakthroughs in key technologies such as generative AI, intelligent agents, and virtual simulation, higher vocational education is poised to advance toward a higher-quality development stage, driven by the dual engines of "intelligent empowerment" and "industry-education collaboration." The ultimate benchmark for success will return to the most fundamental question: whether students can apply what they have learned and solve real-world problems.

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Keywords: *artificial intelligence; higher vocational education; vocational education; intelligent education; entegration of industry and education*

1. Introduction

Artificial intelligence technology is progressively embedding itself into all levels of the education system with unprecedented depth and breadth. As the type of education most closely connected to industrial development, vocational education bears both the historic opportunity for profound transformation and the practical pressure of rapid

technological iteration in the current wave of artificial intelligence. Han Xibin, Director of the Institute for AI in Education at Tsinghua University's School of Education, points out that vocational education "has entered an intelligent era that is changing its underlying logic and reshaping its educational ecosystem."

This judgment is supported by solid policy foundations and empirical data. In 2025, the Ministry of Education released 758 newly revised or formulated professional teaching standards for vocational education, explicitly emphasizing requirements such as "strengthening practical teaching" and "enhancing on-campus practical training instruction." In May of the same year, the Informatization Teaching Guidance Committee for Vocational Colleges under the Ministry of Education issued the "Guidelines for Artificial Intelligence Application in Vocational Colleges," which explicitly recommends that vocational colleges integrate internal and external resources to plan and construct platforms such as AI laboratories and intelligent virtual simulation training bases.

Meanwhile, the "Report on the Development of Artificial Intelligence Applications in Vocational Education (2024-2025)," based on over 1.4 million valid samples from 32 provinces nationwide, systematically outlines the realistic landscape of "AI + Vocational Education" in China. The data reveals that 71.5% of students in vocational colleges have used generative artificial intelligence for knowledge expansion, with over 70% of respondents holding a positive attitude towards this application. Nearly 50% of higher vocational colleges have introduced general AI courses; 67.33% of vocational institutions have applied AI to enhance teaching efficiency; 45.79% have developed digital resources; and 35.47% have achieved intelligent upgrades.

This article systematically examines the primary trends and evolutionary pathways shaping the development of higher vocational education under the impetus of artificial intelligence. It does so across multiple dimensions, including strategic positioning, the reconstruction of teaching relationships, the transformation of talent cultivation paradigms, the deepening of industry-education integration, and responses to practical challenges. The objective is to offer a comprehensive research reference for understanding the logic of transformation within this interdisciplinary field.

2. Strategic Positioning: From Reactive Response to Proactive Deployment

2.1 Policy Guidance and Top-Level Design

At the national level, policy orientation promoting the digital and intelligent transformation of vocational education is continuously strengthening. In 2025, the Ministry of Education released 758 newly revised or formulated professional teaching standards for vocational education, providing a systematic institutional framework for the deep integration of artificial intelligence and vocational education. The "Guidelines for Artificial Intelligence Application in Vocational Colleges," issued in the same year, further provides operational guidance across key dimensions such as practical training instruction, curriculum development, and teacher training.

Zhang Lei, Director of the Teaching and Quality Division of the Department of Vocational and Adult Education at the Ministry of Education, points out that vocational education must take "program adjustment, standard formulation, and resource development" as its three core strategic levers to systematically build a new educational ecosystem deeply integrated with artificial intelligence. He emphasizes that vocational education, as a frontier domain in implementing the national strategy for educational digitalization, must closely align with national strategic needs and industrial development trends, systematically advancing the restructuring of program systems and the innovation of teaching models.

Under the strong guidance of policies, vocational colleges have significantly enhanced their awareness of strategic planning. According to the assessment based on the "Artificial Intelligence Application Readiness Framework" in the

"Report on the Development of Artificial Intelligence Applications in Vocational Education," the current overall level of AI application in vocational colleges nationwide scores 2.18 points (out of 4), with the "strategic planning" dimension scoring the highest at 2.4 points. Han Xibin interprets this data as indicating that institutions generally recognize the importance of AI applications and are actively planning their deployment, suggesting that awareness at the strategic level is essentially in place.

2.2 Development Stage Assessment: The Phase of Large-Scale Experimentation

The "Report on the Development of Artificial Intelligence Applications in Vocational Education (2024–2025)" indicates that the current state of AI adoption in China's vocational colleges is still in an "initial stage." Although the overall level of integration remains limited, the sector has officially entered a "phase of large-scale experimentation." Specific indicators reveal a relatively clear trend: over half of vocational colleges have begun responding to regional AI-related policies; nearly 40 percent have formulated relatively well-defined AI application development plans; 30 percent have initiated project evaluation mechanisms to standardize AI practices; and close to 20 percent have established concrete budget allocations for AI applications.

This development stage exhibits distinct common characteristics: institutions generally possess a clear willingness to apply AI, yet systematic, comprehensive solutions have not yet been formed. While exploratory applications are relatively active in localized areas, overall coordination at the systemic level still requires enhancement. Han Xibin vividly describes this as a "tough battle that has just begun." He recalls that since the emergence of DeepSeek in early 2024, frontline teachers and administrators in numerous vocational colleges have generally exhibited a certain degree of anxiety. This psychological response reflects the acute awareness among vocational education practitioners of the urgency of technological change, while also exposing their practical confusion and uncertainty regarding the choice of response pathways.

2.3 Regional Disparities and Uneven Development

Although vocational colleges have enhanced their strategic planning awareness in the field of artificial intelligence applications, the issues of regional development imbalances and resource allocation disparities remain prominent. The "Report on the Development of Artificial Intelligence Applications in Vocational Education (2024-2025)" points out that while teachers in vocational colleges have "preliminarily acquired intelligent teaching competencies," "regional disparities are significant"—taking the duration of AI tool usage as an example, only about 20% of teachers have continuously used relevant tools for more than one year. In the dimensions of technical environment support and data preparation, the national average score falls below the normal level. This data reflects that most institutions still face practical difficulties in areas such as computing infrastructure configuration, technology platform selection, and data governance capabilities.

Han Xibin further analyzes that empowering education with artificial intelligence currently requires the systematic configuration of technical conditions including computing infrastructure, large language models, and even professional knowledge bases. However, given the relatively rapid iteration of related technologies, the costs of such technical configuration remain high for most vocational colleges, constituting a significant constraining factor for large-scale application at the current stage.

3. Reconstruction of Teaching Relationships: From a "Teacher-Student" Dual Structure to a "Teacher-Machine-Student" Tripartite Model

3.1 The Rise of Generative Engine Optimization

The deep integration of artificial intelligence is fundamentally reshaping teaching relationships in vocational education, with its core lying in the systematic restructuring of the dynamic among teachers, AI agents, and students. Scholars such as Wang Youmei observe that the involvement of generative AI introduces a structural "increment" to the teaching agents—by simulating, generating, and recreating authentic vocational training scenarios, it deconstructs the traditionally complex process of skill acquisition into customizable and combinable learning units, thereby building traceable, replicable, and actionable real-world teaching environments. This technological trajectory is accelerating the paradigm shift from the conventional "teacher-student" binary toward a "teacher-machine-student" triadic interactive framework.

On a concrete level, this transformation unfolds across three structural dimensions: first, the role of teachers is evolving—from unidirectional transmitters of knowledge to designers of learning environments and pedagogical contexts; second, the identity of students is likewise shifting—from passive recipients of knowledge to active explorers guided by teachers and empowered by AI; third, the design logic of the instructional process is undergoing a transition—from traditional experience-oriented approaches to data-driven precision teaching.

3.2 Teachers' Challenges and Transformation

The advent of the artificial intelligence era has imposed higher demands on the competency structure of teachers. Han Xibin points out that the core challenges confronting teachers lie in how to effectively design "AI+" teaching activities, how to guide students, regulate learning behaviors, and stimulate their learning motivation, as well as how to systematically enhance students' thinking abilities and human-machine collaboration competencies—these constitute the new propositions for the development of the vocational education teaching force in the intelligent era.

Data from the Report indicates that teachers in vocational colleges generally recognize the positive role of artificial intelligence in enhancing students' self-learning abilities, improving teaching efficiency, and promoting personalized instruction. However, they simultaneously express concerns regarding potential risks such as "weakening teacher-student emotional communication, inhibiting teacher innovation, and diminishing students' critical thinking." This ambivalent psychological state reflects the complex cognitive structures and adaptive pressures experienced by teachers amidst the impact of technological change.

Examined from the perspective of practical application, current utilization of artificial intelligence by teachers remains primarily confined to the instrumental level of enhancing efficiency. Substantive breakthroughs in deep integration and innovative application within the teaching process have yet to be achieved. Analyzed from the standpoint of international research, the development of teacher training systems has emerged as one of the critical challenges requiring urgent attention in the process of empowering vocational education with artificial intelligence.

3.3 Students' Deep Engagement and Advanced Usage

In contrast to the cautious stance of teachers, students exhibit a notably more active pattern in their application of artificial intelligence. According to data from the Report, 71.5% of students in vocational colleges have utilized generative AI for knowledge expansion, with over 70% of respondents expressing a positive attitude toward this practice. Moreover, students' interest in areas such as "tool usage methods," "applications within professional fields," and

"industry trends and future developments" each exceeds 50%, reflecting learners' proactive exploration in technology adoption.

Zeng Wenquan, Vice President of Guangdong Vocational College of Science and Technology, emphasized in articulating the vision for the institution's AI general education course that its core orientation is "student-centered." The goal is to harness AI-driven interactive learning to ignite students' intrinsic motivation, enabling them to become active agents in their learning journey—capable of independent thinking and practical application. He noted that unlocking students' subjective initiative is essential, and this requires the dual support of high-quality teaching resources and well-developed technological platforms. This insight reveals the underlying logic of shifting the focus from "teaching" to "learning" in AI-empowered vocational education, and also reflects higher vocational institutions' reaffirmation of the learner's central role in driving pedagogical change.

3.4 Exploration of New Teaching Models

In response to the systemic transformation of teaching relationships, several higher vocational colleges have taken the lead in experimenting with new instructional models. Nanjing Vocational College of Information Technology began developing its artificial intelligence curriculum in 2020, with its evolution roughly falling into two phases.

In the early phase, the college adopted a strategy of universal curriculum transplantation, directly introducing existing AI course content across all majors. However, due to the high programming threshold embedded in the course design, students faced increased cognitive load and a noticeable decline in learning interest.

In the subsequent phase, the college revised its curriculum design approach, establishing the guiding principle of "code-free, tool-oriented, and scenario-based" learning, with the goal of cultivating "versatile talents with an AI cross-disciplinary vision and application capabilities." Building on this principle, the school developed a "layered and categorized blended teaching method," in which instructors select appropriate AI tools and practical cases based on students’ technical backgrounds and future professional contexts. This approach has significantly lowered technical barriers, enabling even students with limited programming experience to complete learning tasks that were previously difficult to undertake independently. It demonstrates the inclusive value of AI in vocational education and highlights its potential for pedagogical innovation.

4. Paradigm Innovation in Talent Cultivation: From "Knowledge-Based" to "Competency-Based"

4.1 Large-Scale Adoption of AI General Education Courses

The development of AI general education courses has become a key pathway for higher vocational colleges to advance AI-enabled talent cultivation. Data from the Report on the Development of Artificial Intelligence Applications in Vocational Education (2024–2025) shows that nearly 50% of higher vocational colleges have introduced AI general education courses, either across all programs or in selected ones. Among them, 22.53% have achieved full coverage, while 26.61% have partial coverage. These figures indicate that the integration of AI general education into higher vocational instruction has begun to take shape on a measurable scale.

At the level of top-level curriculum design, the Informatization Teaching Guidance Committee for Vocational Colleges under the Ministry of Education is leading the development of curriculum standards and teaching guidelines for AI general education across secondary vocational schools, higher vocational colleges, and vocational undergraduate institutions. Shenzhen Polytechnic University is responsible for leading the vocational undergraduate segment, and its "AI Applications" course has been launched on the Smart Vocational Education MOOC platform. Beijing Vocational

University of Science and Technology has offered AI general education courses across all its higher vocational programs since 2020. The newly developed textbooks supporting these courses have sold nearly 10,000 copies within two years, reflecting initial progress in curriculum resource development in this field.

4.2 Cultivating "AI+X" Interdisciplinary Competencies

The core educational objective of AI general education courses is undergoing a profound evolution—from a "technology-oriented cognitive approach" toward an "AI+X interdisciplinary competency orientation." He Miao, Dean of the School of Artificial Intelligence at Nanjing Vocational College of Information Technology, points out that these courses are designed to "take AI technology awareness and application as the entry point" for students not majoring in AI, aiming to "cultivate their ability to apply AI within their own professional fields and to preliminarily shape an 'AI+' interdisciplinary mindset."

To address the diverse learning needs of students from varying disciplinary backgrounds and knowledge foundations, Shenzhen Polytechnic University has developed a "layered and categorized" curriculum design framework. "Layering" refers to the progressive structuring of AI knowledge and skills into sequential learning levels, while "categorization" involves the differentiated configuration of course content based on students' disciplinary attributes, foundational proficiency, and occupational requirements. Zhang Ping, head of the AI Technology Application program at Beijing Vocational University of Science and Technology, has led the design of "AI+X Frontier Expansion Modules," delivering customized teaching practices tailored to student cohorts in fields such as arts, management, and science and engineering.

He Miao encapsulates this approach as an "instruction-manual-style" curriculum logic—constructing for students across all majors a complete learning pathway progressing from "fundamental concept awareness" to "professional application scenarios" and finally to "project-based practical application." This pathway design represents a systematic framework for transitioning AI general education from knowledge transmission toward competency development.

4.3 ***Deep Integration of Professional Scenarios***

The deep integration of artificial intelligence technology with professional teaching scenarios has become a critical breakthrough for higher vocational colleges in advancing innovation in talent cultivation models. Nanjing Vocational College of Information Technology, in its "scenario-based application layer" instruction, integrates AI technology with the distinctive features of various majors based on authentic enterprise AI application scenarios, embedding it deeply into professional fields such as electronic information, intelligent manufacturing, and communication technology. Specific practices include: the Intelligent Manufacturing Academy cultivating students' practical skills in using AI tools to enhance equipment operation and maintenance efficiency through the "Intelligent Diagnosis of CNC Machine Tool Failures" project; the Digital Media Art Design Academy exploring the application potential of artificial intelligence in the digital creative field through the "Painting Style Transfer" project; and at the institutional level, establishing application projects covering six typical industries, including new energy wind power forecasting and intelligent detection of network traffic anomalies, gradually building a systematic scenario-based teaching system.

Cui Baocai, Dean of the School of Network Communication at Tianjin Vocational College of Electronic Information, points out that the essential characteristic of vocational education lies in "learning by doing"—deepening theoretical understanding through practical skills training. He emphasizes that the deep integration of artificial intelligence with hardware equipment enables students to intuitively perceive the actual effects of AI-assisted control of hardware devices, thereby effectively stimulating learning interest and exploratory motivation. Under this teaching model, student evaluation criteria are gradually shifting toward comprehensive abilities in completing project tasks and solving practical problems, rather than mechanical memorization of isolated knowledge points. This transformation reflects the profound

shift in the vocational education evaluation system from knowledge-based to competency-based approaches, and also embodies the practice-oriented direction of AI-empowered vocational education in connecting with real production environments and serving industrial needs.

4.4 *The Orientation of Employment Competitiveness*

Enhancing employment competitiveness serves as the core concept that runs through the entire process of AI talent cultivation. He Miao, Dean of the School of Artificial Intelligence at Nanjing Vocational College of Information Technology, points out that the institution consistently upholds the fundamental principle that "AI general education courses must serve students' employment competitiveness." In his view, the primary goal of such courses is to cultivate students' "AI-integrated" thinking abilities and their practical capacity to apply artificial intelligence within their professional domains, thereby laying the foundation for them to solve practical problems and even optimize production methods using AI in future work scenarios.

This orientation in talent cultivation aligns closely with the demands of industrial development. According to the World Economic Forum's "Future of Jobs Report 2025," the global labor market is expected to undergo profound structural transformation by 2030, with technological innovation identified as the key driving force. The report projects a 214% increase in enterprise demand for AI development skills and a 189% rise in demand for data analysis skills. Moreover, analysis from the International Labour Organization indicates that most jobs face only partial automation, and the latest generation of generative AI is more likely to augment and complement existing work methods rather than replace them entirely. This assessment provides important guidance for shaping the direction of vocational education in the age of artificial intelligence.

5. Industry-Education Integration and Innovation in Practical Training: From "Supply-Driven" to "Demand-Driven"

5.1 School-Enterprise Collaborative Development of Curriculum Resources

The growing role of artificial intelligence is reshaping how teaching resources are developed in vocational education—shifting the logic from a traditional "supply-driven" model to one that is increasingly "demand-driven." According to the "Report on the Development of Artificial Intelligence Applications in Vocational Education (2024–2025)," 60% of vocational institutions are now using AI to support school-enterprise collaboration in curriculum development, significantly improving both efficiency and quality.

What makes this model effective is its capacity to translate cutting-edge industry advancements and real-world business needs directly into curriculum content that fits within existing teaching frameworks. Han Xibin observes that developing an AI-enabled resource system truly responsive to industry demands requires moving beyond the traditional mindset of working in isolation. Instead, it necessitates a collaborative ecosystem in which multiple stakeholders co-create and share resources. This evolution reflects a fundamental shift in how vocational education approaches resource development: transitioning from closed-door, experience-driven practices toward open, data-informed, and jointly constructed models.

Table 1 Scenario Analysis Table

Application Scenarios	Core Functions	Typical Cases
Intelligent Text Processing and Communication Enhancement	Simplifying text language, condensing content, and assisting in marketing	Helsinki Professional University of Applied Sciences in Finland has developed customized AI courses for business professionals, teaching them how to create clear and concise "instructions".
Medical Diagnosis and Personalized Care	Integrating medical data, assisting in diagnosis, and predicting health conditions	The professional training department of the Massachusetts Institute of Technology in the United States offers ChatGPT application courses for medical professionals.
Programming Education and Application Development	Automatically simplifying code, acting as a virtual programming tutor, and assisting in program design	The University of Oxford Department for Continuing Education in the UK has created an 8-week online course that teaches how to collaborate with large language models to build AI applications.
Image Processing and Product Design Support	Color correction, special effects addition, and creative presentation	The University of Cambridge in the UK has developed AIGC usage guidelines for image editors and designers, leveraging tools such as DALL·E and Midjourney.
Student Performance Feedback and Data-Driven Decision Making	Dynamically tracking learning progress and enhancing the pertinence of feedback	The University of Duisburg-Essen in Germany has published guidelines on the use of AIGC support in teaching and examinations.

5.2 Construction of Virtual Simulation Training Bases

In the field of practical training, artificial intelligence technology is driving a systemic upgrade of vocational education training models. The "Guidelines for Artificial Intelligence Application in Vocational Colleges" issued by the Ministry of Education explicitly states that vocational institutions should integrate internal and external resources to plan and construct platforms such as AI training labs and intelligent virtual simulation training bases, aiming to enhance students' immersive experience, level of interactivity, and capacity for personalized evaluation feedback during the training process.

Typical cases cited in the "Report on the Development of Artificial Intelligence Applications in Vocational Education (2024-2025)" show that Jiangsu Vocational College of Engineering and Technology has established a digital virtual simulation training base for the garment industry, while Fujian Chuanzheng Communications College has built a virtual-real integrated training base covering the entire industrial chain. By integrating artificial intelligence, big data, and virtual simulation technologies, these projects have promoted the intelligent upgrading of practical training models and effectively facilitated the implementation of "AI + professional application scenarios" in vocational education. This trend reflects the development direction of technology-enabled vocational education in aligning with industrial demands and enhancing the effectiveness of practical teaching.

5.3 The Ecological Advancement of Industry-Education Integration

Huawei is actively promoting the systematic development of modern industry colleges and industry-education integration practice centers. By establishing a tripartite support framework comprising education centers, research centers, and talent centers, the company provides comprehensive support for talent cultivation reform within the industry-education integration context and fosters the emergence of innovative educational models. Its Ascend Education

DeepSeek solution is designed to help vocational colleges build the foundational architecture for vocational education large models, facilitating a fundamental restructuring of teaching paradigms.

Meanwhile, Beijing Newland Times Technology Co., Ltd. has developed a supply-demand matching service platform for industry-education integration. Through three key initiatives—"establishing an industry-education data foundation, constructing AI-driven industry-education integration models, and advancing the digitalization of application scenarios"—the company aims to address the persistent challenges of data silos and experience-based decision-making commonly found in industry-education integration.

These initiatives illustrate that leading technology enterprises are deeply engaging in the digital transformation of vocational education through platform-based and ecosystem-oriented strategies, driving the evolution of industry-education integration from project-based collaboration toward systematic co-construction.

6. Practical Challenges and Constraints

6.1 Technological Maturity and Infrastructure Shortcomings

While AI has made notable progress in vocational colleges, deeper advancement reveals a persistent bottleneck: the technological foundation remains insufficient.

The "Report on the Development of Artificial Intelligence Applications in Vocational Education" includes a readiness assessment, with a maximum score of 4. Nationally, the average score for the "technological environment and data preparedness" dimension falls below 2. This figure is telling. It reflects fundamental issues: whether computing power is adequate, whether appropriate platforms have been selected, and whether data can be effectively managed.

For many institutions, the barrier is not a lack of willingness to adopt AI, but inadequate hardware conditions. Running large models requires computing power that is often unavailable; selecting a suitable platform carries the risk of poor choices; and while data may have been accumulated, it frequently remains unmanaged and unusable—ultimately becoming little more than dormant figures. None of these challenges can be resolved quickly or easily.

6.2 Imbalance in the Development of AI Literacy Between Teachers and Students

Beyond the infrastructure gaps, there is another issue that cannot be overlooked—whether human capabilities have kept pace with technological change. Among the 14 challenges outlined in the report, one focuses specifically on the human dimension: the development of AI literacy among teachers and students is clearly proceeding at different speeds.

Both data and observations point to a convergence of findings around several key issues. The first is the disparity itself: while students are actively engaging with AI, teachers remain in a phase of observation and exploration—the two groups are clearly not advancing at the same pace. The second concerns unmet demand. Many students are genuinely motivated to learn how to use AI and apply it within their own disciplines. Yet institutional responses have largely fallen short—there is a growing number of learners, but few courses available, and even fewer educators equipped to provide structured and coherent guidance.

Then there is the issue of the training system. This cannot be resolved by offering a few isolated courses. A workshop here, a platform there—these efforts may seem active on the surface, but they remain fragmented and fail to form a coherent pathway. In other words, the necessary scaffolding has not been built. From basic awareness of AI to practical application, and from tool-based thinking to deeper professional integration, the support structures along this continuum are largely absent in many institutions.

Ultimately, no matter how advanced AI becomes, it is still people who drive its application. Hardware can be upgraded, software can be purchased, but gaps in human capability cannot be filled through budget allocations alone.

6.3 Technology-Induced Unemployment and Skills Transition Anxiety

Employment anxiety driven by technological progress is gradually spreading into the vocational education sector. Data from the Second European Skills and Jobs Survey shows that 51% of Finnish workers believe digital technologies will impact their career prospects, with 21% of respondents expecting their jobs to be potentially replaced by machines. This societal psychological expectation is objectively pushing the vocational education system to accelerate the structural transformation of skills training models, in order to better respond to the labor market's growing demand for versatile talents equipped with technological adaptability.

6.4 Lack of Systematic Solutions

The Report indicates that while the application of artificial intelligence in teaching has entered a phase of "large-scale experimentation," a corresponding systematic solution has yet to emerge. The constraining factors are primarily manifested in the following aspects: first, policy formulation and institutional supply lag behind; second, school-enterprise collaboration has not yet formed a stable and replicable mature model in advancing AI teaching applications; third, the development of computing resources supporting AI teaching applications lags, and the capacity for technological supply remains insufficient. These issues are intertwined, collectively constituting systemic bottlenecks that constrain the high-quality development of AI-empowered higher vocational education.

7. Conclusions and Future Outlook

Overall, artificial intelligence is systematically reshaping the development landscape of higher vocational education with unprecedented depth and breadth. At the strategic level, approximately half of higher vocational institutions have introduced AI general education courses, and over 60% have applied AI to enhance teaching efficiency, reflecting a marked increase in strategic planning awareness. At the level of teaching relationships, the traditional "teacher-student" dual structure is accelerating its evolution toward a "teacher-machine-student" triadic interactive framework. In terms of talent cultivation, the development of "AI+X" interdisciplinary competencies has become a core educational objective, with the teaching philosophy of "code-free, tool-based, and scenario-oriented" approaches effectively driving innovation in teaching models. Regarding industry-education integration, AI empowerment is shifting the supply of teaching resources from a "supply-driven" to a "demand-driven" model, with 60% of vocational colleges now engaged in school-enterprise collaborative curriculum development.

However, the challenges cannot be ignored. Issues such as the uneven development of AI literacy among teachers and students, superficial integration of technology, weak infrastructure support, intensifying ethical and security risks, and the spread of skills transition anxiety remain critical bottlenecks constraining the deep empowerment of higher vocational education by artificial intelligence. An assessment by a Tsinghua University research team indicates that the overall level of AI application in vocational colleges nationwide remains in its initial stage.

Looking ahead, the intelligent transformation of higher vocational education requires focused efforts across four key dimensions:

First, we must move from "tool-based application" toward "ecological reshaping." Han Xibin points out that fragmented, isolated applications of technology are no longer sufficient to support the systemic transformation that vocational education now faces. Institutions must move beyond the traditional mindset of "going it alone" and instead

foster an innovative ecosystem rooted in multi-stakeholder collaboration, co-creation, and shared value. This calls for the formation of a tightly integrated community involving policymakers, researchers, and frontline practitioners—working together to navigate both the challenges and opportunities that come with transformation.

Second, advancing from "general education" to "professional integration." At present, nearly half of higher vocational institutions have completed the initial rollout of AI general education courses. The core task for the next phase is to deeply embed AI into the teaching systems of various disciplines, achieving the comprehensive infusion of "AI+X." The curriculum design experience of "layered and categorized" approaches explored by institutions such as Nanjing Vocational College of Information Technology and Shenzhen Polytechnic University offers valuable reference for this deepening trajectory.

Third, shifting from "efficiency enhancement" to "paradigm transformation." The application of AI should not be confined to superficial improvements in teaching efficiency; it must drive a systemic reconstruction of teaching models, evaluation systems, and even governance approaches. The criteria for student evaluation should transition from mechanical memorization of isolated knowledge points to comprehensive competencies in completing projects and solving practical problems, thereby responding to the demand for compound technical and skilled talents in the intelligent era.

Fourth, expanding from "domestic practice" to "global collaboration." Facing the continuous evolution of computational intelligence, perceptual intelligence, and even cognitive intelligence, there is an urgent need to construct a new intelligent education ecosystem featuring global consultation, enterprise co-construction, government co-governance, and vocational college co-creation, in order to collaboratively address the common challenges and seize the development opportunities presented by artificial intelligence.

In this profound transformation process, higher vocational education must proactively integrate into the developmental logic of the intelligent era, deeply internalize the technological logic of artificial intelligence, and organically combine technological empowerment with humanistic care. Only by doing so can it cultivate high-quality technical and skilled talents capable of meeting future industrial development needs, thereby securing space for sustainable development in the AI-driven educational revolution.

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