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Article

Mechanism Reconfiguration and Practical Pathways for AI-Empowered Labor Education in Higher Education

Linhui Li [1], Haoyue Xue [2,*], Hua Yang [1] and Nila Lan [1]

[1] Academic Affairs Office, Guilin University of Aerospace Technology, Guilin, China
[2] School of Artificial Intelligence, Guilin University of Aerospace Technology, Guilin, China
* Correspondence: Haoyue Xue, School of Artificial Intelligence, Guilin University of Aerospace Technology, Guilin, China

Abstract: With the rapid development of artificial intelligence (AI), labor education in higher education institutions is accelerating toward an unprecedented intelligent transformation. Based on a comprehensive combination of normative research and literature analysis, this study constructs a robust mechanism framework for AI-empowered labor education and systematically examines its underlying value implications, practical dilemmas, and strategic implementation pathways. It is found that current labor education in universities still suffers from lagging pedagogical concepts, significant misalignment between educational objectives and practical implementation, insufficient process effectiveness, and limited scenario provision for students. From the perspective of mechanism reconstruction, this study proposes an innovative four-dimensional operational model encompassing "task generation—process co-creation—ability evolution—scenario ecosystem." Furthermore, it clarifies the structural components and operational logic of this model: optimizing task supply through "generation-driven and context-embedded" mechanisms; reconstructing teaching processes via "human–AI collaboration and data-driven feedback"; improving evaluation systems through "process-oriented and progressive development"; and expanding practice scenarios through "virtual–real integration and cross-domain linkage." The deep integration of AI technologies promotes labor education from static provision to dynamic generation and from unilateral implementation to collaborative co-creation, thereby facilitating a crucial transition from "linear execution" to "systemic coordination" in educational operations. Ultimately, this study provides both rigorous theoretical grounding and actionable practical guidance for the high-quality, sustainable development of labor education in contemporary higher education.

Keywords: labor education; higher education; artificial intelligence; mechanism reconstruction; educational pathways; pedagogical innovation

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1. Introduction

The rapid advancement of artificial intelligence (AI) is profoundly transforming modes of social production and educational paradigms. As a core engine of new-quality productive forces, AI not only reshapes the factors of production but also imposes new requirements on labor education in higher education institutions. Estimates suggest that the scale of China's core AI industry has reached RMB 900 billion, and the wave of intelligent transformation is reshaping traditional forms of labor [1]. Against this backdrop, conventional concepts, content, and methods of labor education in universities can no longer meet the demands arising from the transition of labor forms from "physical-oriented" to "intellectual-interactive," thus necessitating profound transformation through technological empowerment.

At present, labor education in higher education institutions generally suffers from relatively outdated educational concepts, limited forms of practice, and incomplete evaluation systems, making it difficult to effectively cultivate students' future-oriented labor literacy and innovative capabilities [2, 3]. The deep integration of AI technologies

provides new possibilities for addressing these challenges. Through intelligent instructional design, personalized learning pathways, and immersive experiential environments, AI can significantly enhance the relevance and effectiveness of labor education. Exploring the development pathways of AI-empowered labor education is therefore of considerable theoretical and practical significance for constructing a modern labor education system and cultivating high-quality talents suited to the needs of an intelligent society. From a research perspective, existing studies tend to focus on technological applications or pathway exploration, while lacking systematic analysis at the level of "educational operational mechanisms." Accordingly, this study adopts normative analysis and theoretical construction to systematically examine the internal logic of AI-empowered labor education and to develop a mechanism model, thereby addressing this gap in the literature.

2. Value and Mission of AI-Empowered Labor Education Reform

2.1. The Contemporary Context of Integrating Artificial Intelligence and Labor Education

The rapid advancement of artificial intelligence (AI) technologies is redefining the connotation and forms of labor, thereby driving profound transformations in the philosophy of labor education. As of October 2023, the number of AI enterprises in China has exceeded 4,400, and the demand for AI-related positions is projected to increase by 36.82% year-on-year by 2025, making intelligent labor a significant component of emerging employment sectors [1, 4]. Within this context, labor education in higher education institutions must adapt to the intelligent transformation of labor forms by deeply integrating AI technologies into the entire educational process, with the aim of cultivating students' competencies in intelligent labor and innovative practice. Moreover, AI provides unprecedented technological support for labor education. Through big data analytics, machine learning, and virtual reality technologies, it enables intelligent content delivery, precise monitoring of learning processes, and the virtualization of practice environments. These advancements help overcome traditional constraints related to time, space, resource allocation, and personalized instruction. More fundamentally, AI not only transforms tools of labor but also reshapes the organization and value structure of labor itself, facilitating a shift from "physical labor dominance" to "human-machine collaboration." This transformation constitutes the fundamental driving force behind the reform of labor education.

2.2. Core Value Orientations of Labor Education Reform

The core objective of labor education reform in the new era is to cultivate high-quality talents equipped with innovative spirit, practical competence, and a strong sense of social responsibility [5, 6]. This necessitates a transition from traditional skill-oriented training toward the development of comprehensive competencies. AI-empowered labor education reflects a pursuit of educational equity. Through intelligent instructional platforms and personalized learning systems, it enables the provision of customized educational services tailored to students with diverse backgrounds and needs, thereby alleviating disparities in resource allocation.

At the same time, labor education reform carries the mission of cultivating individuals capable of meeting the demands of the times [7]. In response to the profound transformation of labor forms in the AI era, traditional forms of labor education centered on physical work are no longer sufficient. Modern labor education must emphasize the development of creative thinking, collaborative communication, and human-machine interaction competencies, enabling students to realize their unique value within intelligent work environments. This transformation represents not merely a methodological innovation but a fundamental shift in educational philosophy—from "adaptive education" to "leading education." From a theoretical perspective, this shift reflects the integration of constructivist learning theory, human-machine collaboration theory, and the logic of digital transformation in education, thereby promoting a

transition in labor education from "knowledge transmission" to "situated construction and competence generation."

2.3. The Mission of AI-Empowered Labor Education

AI-empowered labor education undertakes a critical mission in leading the reform and development of higher education. By leveraging technological innovation to drive transformations in educational models, it provides strong support for the construction of a high-quality education system [8]. In the context of intensifying global competition in education, Chinese universities must seize the strategic high ground of AI applications in education and cultivate innovative talents with international competitiveness through the intelligent transformation of labor education. Simultaneously, AI-enabled labor education also serves the broader mission of promoting socio-economic development. The talent gap in AI-related emerging professions is expected to exceed five million in the coming years. Therefore, higher education institutions must proactively align labor education with industrial development needs to supply high-quality human resources for an intelligent society. From the perspective of educational governance, the integration of AI into labor education is not merely a technological application at the instructional level but represents a systemic institutional adjustment that enables higher education systems to adapt to the demands of an intelligent society.

3. Practical Dilemmas of Labor Education in the AI Era

3.1. The Tension between Traditional Labor Concepts and Emerging Forms of Labor

The rapid development of artificial intelligence is fundamentally reshaping the nature and forms of labor, giving rise to a pronounced tension between traditional labor concepts—centered on physical work and manual operations—and the practices of labor in the intelligent era. A recent survey revealed that 44.28% of respondents had participated in handicraft-based labor activities and 43.84% in agricultural labor, whereas only 18.99% showed a preference for purely physical labor and 34.24% preferred creative labor practices. Such lagging educational content design makes it difficult for students to understand and adapt to the evolving connotations of labor in the context of AI, thereby hindering the formation of labor values aligned with contemporary societal development [9, 10]. Traditional labor education emphasizes repetitive operations and standardized procedures, whereas labor in the AI era increasingly prioritizes creative thinking, problem-solving abilities, and human-machine collaboration skills.

Moreover, labor education in universities faces challenges related to value cognition bias. Empirical evidence indicates that 36.4% of students frequently rely on third-party services to substitute personal labor, while 43.5% tend to undervalue physical labor. Although most students hold positive attitudes toward AI, only a minority express concerns about its potential impact on humanity, reflecting a lack of accurate understanding of the role and value of human labor within intelligent systems. Such cognitive biases not only diminish students' engagement but also constrain the effectiveness of labor education in fostering comprehensive competencies and innovation capacity [11, 12]. Fundamentally, these issues reveal a deficiency in value-oriented guidance within labor education.

3.2. Misalignment between Educational Objectives and Implementation Pathways

The formulation of labor education objectives in higher education institutions tends to be overly macro-level and abstract, lacking precise alignment with the competency requirements of the AI era. Survey data indicate that 72.3% of labor education courses operate independently without effective integration with disciplinary education, and nearly 76% of institutions primarily rely on theoretical instruction. Only 31.5% of course content reflects the impact of emerging technologies such as AI and big data on labor forms. This misalignment is manifested in the disconnection between theoretical instruction and practical application, resulting in students' inability to translate acquired knowledge into competencies suited to intelligent work environments. Furthermore, the

design of implementation pathways lacks systematicity and specificity, often neglecting the organic integration of AI technologies with labor education content. While a minority of institutions have introduced intelligent teaching tools and platforms, the majority still rely on traditional lecture-based and experiential approaches. Such limitations significantly reduce the effectiveness of labor education in cultivating students' adaptability and innovative capabilities within AI-driven environments. At a deeper level, this issue stems from the absence of a responsive mechanism linking educational objective-setting with changes in industrial structure and technological development, leading to a structural disjunction between the objective system and the practice system.

3.3. Insufficient Effectiveness Across the Educational Process

In practice, labor education in universities commonly suffers from weak coordination across key stages, resulting in limited overall effectiveness [13, 14]. Critical components—including curriculum design, instructional implementation, practical guidance, and evaluation—lack unified quality standards and coherent assessment mechanisms, thereby undermining the integrity of the educational process. More than 60% of institutions exhibit significant deficiencies in process management, such as outdated teaching content, single-mode instructional approaches, and incomplete evaluation systems. Although the AI era demands higher levels of adaptability and flexibility, current labor education processes largely remain within traditional paradigms, failing to accommodate students' personalized learning needs and developmental trajectories. Additionally, the absence of real-time monitoring and dynamic adjustment mechanisms prevents the realization of precision teaching and individualized guidance, ultimately constraining the improvement of educational quality. From a systems perspective, this problem arises from the lack of data-driven process regulation mechanisms, which inhibits the dynamic optimization of instructional activities.

3.4. Limitations in the Construction of Labor Education Scenarios

The construction of labor education scenarios is currently constrained by significant temporal, spatial, and technological limitations, restricting students' access to authentic experiences of intelligent labor. Although more than half of universities have adopted AI technologies in teaching activities, the application of such technologies in labor education remains underdeveloped. Most institutions continue to rely on traditional practice settings, with insufficient development of intelligent labor practice bases. This scenario limitation not only restricts students' understanding and experience of emerging labor forms but also hinders the effective integration of labor education with disciplinary learning. In the AI era, labor scenarios are characterized by the integration of virtual and physical environments and cross-domain collaboration, requiring educational settings capable of simulating and reproducing real intelligent work contexts. However, current investments and infrastructure development in this area remain inadequate, lacking systematic planning and forward-looking design. Consequently, a substantial gap persists between existing labor education scenarios and the demands of contemporary development. At its core, this issue reflects the persistence of a "single physical space" paradigm, rather than the formation of an ecosystem characterized by "virtual-real integration and multi-actor collaboration."

4. Practical Pathways for AI-Empowered Labor Education Reform

4.1. Task Reconstruction: Building a Dynamic Labor Task System Driven by Generation and Contextual Embedding

Traditional labor education task systems in higher education often exhibit static and standardized characteristics, making them unsuitable for the rapid evolution of labor forms in the AI era and the personalized needs of learners. A dynamically generated task system, grounded in the principle of generative driving, emphasizes adaptive task creation and real-time optimization [15]. By leveraging AI algorithms to analyze multidimensional learner data—such as knowledge base, skill level, and interest

preferences—labor education tasks can be dynamically generated to align with individual developmental needs. This generative mechanism not only considers the educational value and difficulty gradient of tasks but also enables real-time adjustments based on learning progress and feedback, ensuring a balance between challenge and attainability. Furthermore, it facilitates the integration of interdisciplinary knowledge elements, organically linking labor education with professional learning, innovation practice, and social service to form a comprehensive and open task ecosystem. This represents a transition from "static task allocation" to a "dynamic task generation mechanism," enabling intelligent and personalized task provision in labor education.

Contextual embedding, as a core feature of this dynamic task system, emphasizes situating labor education tasks within authentic and multidimensional environments. Through technologies such as virtual reality (VR) and augmented reality (AR), immersive labor experience scenarios can be constructed. These contextualized designs encompass not only physical space simulations but also sociocultural contexts, historical trajectories, and future development trends, allowing learners to engage in labor practices within environments that balance authenticity and safety [16]. AI technologies can further construct differentiated contextual scenarios based on students' disciplinary backgrounds and career orientations—such as intelligent manufacturing workshops, digital agriculture platforms, and innovation incubators—enabling students to develop labor awareness and skills in environments closely aligned with future workplaces. Through contextual embedding, labor education tasks are transformed from abstract theoretical learning into concrete experiential practices, expanding from isolated skill training to the cultivation of comprehensive competencies. At its core, this mechanism establishes an intelligent supply model characterized by "demand identification--task generation--dynamic adjustment," enabling the adaptive evolution of labor education content.

4.2. Process Co-Creation: Establishing a Human--Machine Collaborative and Data-Feedback Teaching Mechanism

The deep integration of AI technologies provides critical support for the reconstruction of labor education processes in higher education, facilitating a shift from traditional one-way instructional models to intelligent, data-driven, bidirectional interactive systems. Over 98% of universities in China have initiated the construction of intelligent teaching systems. However, digital applications in labor education remain relatively underdeveloped, with most institutions still relying on traditional practice settings. The establishment of a "human--machine collaboration--data feedback" teaching mechanism centers on constructing a closed-loop instructional system in which teachers play a leading role, AI functions as an enabling tool, and data drives decision-making. This mechanism enhances the scientific rigor and precision of labor education while addressing key challenges such as ambiguous evaluation standards, delayed feedback, and insufficient instructional guidance.

Effective implementation of this model requires a clear delineation of roles between teachers and AI systems. Teachers act as organizers and facilitators, responsible for instructional design, value guidance, emotional support, and complex problem-solving. In contrast, AI systems undertake technical functions such as data collection, process monitoring, intelligent recommendation, and auxiliary evaluation. During the implementation of labor education, AI technologies—including IoT sensors, wearable devices, and video analytics systems—enable the real-time collection of multidimensional data on students' labor behaviors, skill acquisition, and engagement levels, thereby generating digital learner profiles. Data feedback systems, based on machine learning algorithms, conduct in-depth analyses of these data to identify students' strengths and weaknesses in areas such as labor skills, attitudes, and teamwork. These insights provide teachers with precise instructional adjustment recommendations while delivering personalized learning resources and improvement strategies to students. Ultimately, this mechanism forms a closed-loop operational system characterized by "data collection--

intelligent analysis--feedback regulation," enabling dynamic optimization of the teaching process.

4.3. Evaluation Innovation: Constructing a Multidimensional Evaluation System Oriented Toward Process and Competence Progression

AI-enabled labor education necessitates a fundamental shift from traditional outcome-based evaluation models to a multidimensional framework emphasizing process orientation and competence progression. This evaluation system utilizes AI technologies to conduct continuous monitoring and data collection throughout the entire labor education process, incorporating dimensions such as learning behavior analysis, skill acquisition trajectories, and innovation capability assessment. Through these approaches, a comprehensive evaluation index system is established, encompassing labor attitudes, technical skills, work ethics, and innovation capacity. AI systems can record students' performance data across diverse labor scenarios in real time, including participation levels, task completion quality, collaboration ability, and problem-solving competence. These systems generate personalized development reports through big data analytics, providing precise feedback and improvement recommendations. Additionally, intelligent evaluation systems can identify students' stages of competence development and formulate targeted advancement strategies based on progression models.

The core of this multidimensional evaluation system lies in the construction of a hierarchical competence framework, which decomposes labor education objectives into three levels: foundational labor literacy, professional labor skills, and innovative labor capabilities. Each level is further subdivided into specific evaluation indicators and criteria. AI technologies, such as natural language processing, image recognition, and behavioral analytics, enable intelligent assessment of students' practical outputs. When combined with peer evaluation, teacher evaluation, and self-assessment, these tools form a multidimensional evaluation network. Importantly, evaluation outcomes not only reflect students' current competence levels but also emphasize developmental trajectories and potential. By establishing individual labor education portfolios and growth maps, the system provides sustained guidance for lifelong labor competency development [17]. This evaluation innovation enhances both the scientific validity and objectivity of assessment while simultaneously stimulating students' intrinsic motivation to engage in labor education, thereby improving overall educational quality.

4.4. Scenario Expansion: Constructing a New Ecosystem of Labor Education through Virtual--Real Integration and Cross-Domain Collaboration

In the context of rapid AI development, the limitations of traditional labor education scenarios have become increasingly evident, necessitating the construction of a more open, diversified, and integrated educational ecosystem. China's education informatization market has grown from approximately 437 billion yuan in 2019 to nearly 578 billion yuan in 2023, with higher education accounting for over 25% of total investment [1, 7]. This provides a solid foundation for the digital reconstruction of labor education scenarios. By building a labor education ecosystem characterized by "virtual--real integration and cross-domain collaboration," it becomes possible to overcome constraints related to time, space, resource allocation, and practice opportunities, thereby facilitating the transition from isolated practice settings to a multi-actor collaborative system.

The construction of such scenarios requires the extensive application of advanced technologies, including AI, virtual reality, and augmented reality, to create immersive and interactive digital labor environments [10, 13]. In the virtual dimension, digital twin technologies can be employed to develop high-fidelity simulation platforms, enabling students to engage in labor practices within virtual factories, intelligent farms, and digital service environments. AI algorithms can further support personalized learning path planning and real-time feedback evaluation. In the physical dimension, reliance on on-campus and off-campus labor education bases should be complemented by intelligent monitoring systems. Technologies such as IoT sensors and wearable devices enable real-time collection of students' labor process data, forming comprehensive behavioral profiles.

The establishment of cross-domain collaboration mechanisms involves breaking down barriers between on-campus and off-campus resources, online and offline environments, and theoretical and practical domains. This facilitates the formation of a multi-stakeholder labor education community, optimizing resource allocation and integration while providing students with richer and more diverse experiential opportunities for development.

5. Conclusion

This study systematically examines the opportunities and challenges associated with AI-enabled transformation of labor education in higher education. While AI reshapes labor forms and educational modalities, providing critical support for the renewal of educational concepts and models, multiple practical challenges remain. To address these issues, this study proposes a four-dimensional mechanism model—comprising task generation, process co-creation, competence progression, and scenario ecology—which elucidates the internal logic of AI-enabled labor education from both structural and operational perspectives. The deep integration of AI facilitates a transition in labor education from static implementation to dynamic generation, and from unidirectional instruction to collaborative co-creation, thereby enabling a systemic shift from "element optimization" to "mechanism reconstruction." Future research should further employ empirical methodologies to validate and refine the proposed mechanism model, thereby enhancing its explanatory power and practical applicability.

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