Research on the Construction Logic and Practical Pathways of a General Education Curriculum System for Artificial Intelligence

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Abstract: As AI literacy becomes a fundamental capability for citizens in the new era, developing a systematic and scientific general education curriculum system for artificial intelligence (AI) has emerged as a critical task for deepening educational reform in higher education institutions. However, the construction of such a curriculum system in Chinese universities still faces numerous practical challenges. Guided by the principle of fostering virtue and nurturing talent, and integrating the developmental patterns of AI technology with the talent cultivation objectives of higher education institutions, this paper clarifies the core construction logic of an AI general education curriculum system, comprehensively analyzes the prominent difficulties in current practice, and proposes targeted optimization pathways across dimensions such as curriculum orientation, content development, teaching models, faculty development, and evaluation systems. The aim is to provide theoretical support and practical reference for the reform of AI general education in universities, thereby contributing to the establishment of a vertically integrated and horizontally connected AI education system across all educational stages.

Keywords: Artificial Intelligence; General Education; Curriculum System; Talent Development

1. Introduction

In April 2025, nine Chinese ministries and commissions, including the Ministry of Education, jointly issued the "Opinions on Accelerating the Digitalization of Education," explicitly calling for the development of "general + specialized" AI general education courses in higher education institutions. In April 2026, five ministries, including the Ministry of Education, issued the "AI + Education Action Plan," further proposing that by 2030, a vertically integrated and horizontally connected AI education system spanning all educational stages and society-wide general education be established. At the higher education level, the plan advocates for AI to become a public basic course in universities, with textbooks tailored to different academic disciplines, ensuring that all students acquire AI knowledge. This series of policies signifies that AI general education has transitioned from an autonomous exploration by universities to a national strategic priority.

As a general-purpose technology, AI is profoundly reshaping modes of social production and the structure of talent demands. Universities, as the core sites for talent development, urgently need to establish a scientific and systematic AI general education system to cultivate interdisciplinary talents equipped with AI literacy. However, in the process of offering AI general education courses, universities generally face challenges such as ambiguous course positioning, fragmented content, and significant disciplinary barriers [1]. How to construct a general education curriculum system that not only aligns with the characteristics of AI technology but also meets the needs of students from diverse disciplinary backgrounds is a theoretical and practical issue demanding in-depth research.

2. The Construction Logic of an AI General Education Curriculum System in Higher Education Institutions

The construction of an AI general education curriculum system in universities should be fundamentally guided by the principle of fostering virtue and nurturing talent, adhering to the core logic of "value orientation, demand orientation, gradual progression, and integrated innovation" to achieve the trinity of educational goals encompassing knowledge, capability, and values.

2.1 Value Orientation Logic

Fostering virtue and nurturing talent is the fundamental task of education in China and constitutes the primary logical foundation for constructing an AI general education curriculum system. As a "double-edged sword," AI technology, while driving social productivity and enhancing governance efficiency, also raises a series of ethical and social issues such as data security, algorithmic bias, and information cocoons. Therefore, AI general education must integrate value orientation throughout the entire process of curriculum system construction and instructional implementation, guiding students to embrace a "technology for good" mindset. In ethically contested situations involving AI, mere knowledge transmission is insufficient to help students form correct value attitudes; strengthening value orientation and ethical guidance is essential—a core prerequisite for developing the ethical dimension of the curriculum.

The curriculum system must prioritize ethics education, incorporating AI ethics as a core content module, enabling students to clearly understand the ethical boundaries of AI technology, cultivate their critical thinking and sense of social responsibility, and prevent risks arising from technology misuse. Simultaneously, adhering to the core requirements of "education-oriented, AI for good," the curriculum should organically integrate moral, intellectual, physical, aesthetic, and labor education with AI education, strengthening the synergistic effect of science and technology education with humanities education. This enables students to develop a proper view of technology, values, and life while mastering AI knowledge and skills, thereby achieving the coordinated enhancement of "technological literacy" and "humanistic literacy." The ideal of "not being confined to a single tool" advocated by general education, which aims to cultivate "virtuous individuals," aligns closely with the value orientation logic of AI general education and should serve as an important conceptual foundation for curriculum construction.

2.2 Demand Orientation Logic

The core goal of AI general education in higher education institutions is to cultivate high-quality talents adapted to the intelligent era. Therefore, curriculum system construction must be guided by the dual demands of student development needs and societal development needs, achieving an organic unity between "teaching according to aptitude" and "matching supply with demand." From the perspective of student development needs, students from different majors and levels have significantly different needs for AI knowledge: science and engineering students tend to focus more on the principles and practical applications of AI technology; humanities and social sciences students are more concerned with the integration of AI with their own disciplinary fields; and art students pay more attention to the application of AI in creative design. Disciplinary background and prior educational experience are important factors influencing students' AI knowledge needs. Most students recognize the importance of AI knowledge for their personal development, but their overall technical foundation is relatively weak, leading to a pronounced demand for targeted courses.

From the perspective of societal development needs, as AI technology becomes deeply integrated across various industries, the demand for AI literacy among professionals continues to rise. Whether in technical or managerial roles, employees are expected to possess basic AI awareness and application capabilities. The widespread application of AI technology will lead to the redistribution and migration of employment structures. Accelerating the implementation of AI general education in universities can effectively reduce technology-induced unemployment caused by skill mismatches. Therefore, curriculum system construction must closely align with industry development trends, incorporate typical application cases of AI across different fields, and enable students to systematically understand the industrial application scenarios of AI technology, thereby enhancing their employability and social adaptability, fulfilling the requirements of "supporting high-quality employment." At the same time, in line with the overall deployment of AI education across all educational stages, the curriculum should achieve effective articulation with AI general education in primary and secondary schools, establishing a progressively layered and spirally ascending curriculum system that lays a solid foundation for students' subsequent learning and development [2].

2.3 Gradual Progression Logic

AI technology is highly specialized and complex, while the target audience of general education in universities comprises all students, whose knowledge bases and cognitive levels vary considerably. Therefore, curriculum system construction must strictly follow the laws of students' cognitive development, following the logic of "from basic to advanced, from theory to practice, from popularization to enhancement" to build a tiered curriculum system, abandoning a "one-size-fits-all" teaching model to ensure that students at different levels can all obtain an effective learning experience. The concept of stratified cultivation, as an important approach to AI talent development, divides talent cultivation into different levels and provides a valuable reference for constructing AI general education curriculum systems in universities.

Specifically, the curriculum system can be divided into three levels: the foundational level focuses on core AI concepts, development history, and basic principles, aiming to help students establish an overall understanding of AI and master basic AI terminology and ways of thinking—this is the core content that all students must master; the intermediate level focuses on key AI technologies and typical applications, integrating interdisciplinary content based on the characteristics of different majors, guiding students to deeply understand the application logic of AI technology and enhance their technical application capabilities; the advanced level focuses on cutting-edge AI developments and innovative practices, encouraging students to engage in AI-related innovative design and project research, cultivating their innovative thinking and research abilities, and meeting the personalized development needs of some students. This tiered curriculum system not only conforms to the laws of students' cognitive development but also achieves an organic combination of "popularization and enhancement," aligning with the goal of cultivating interdisciplinary innovation capabilities in AI at the higher education level.

2.4 Integrated Innovation Logic

The essence of AI technology is the product of interdisciplinary integration, and its development and application rely on support from multiple disciplines, including computer science, mathematics, linguistics, ethics, and sociology [3]. Therefore, the construction of an AI general education curriculum system in universities must follow the logic of integrated innovation, breaking down disciplinary barriers, promoting deep integration between AI and various disciplines, and building an interdisciplinary curriculum system. Drawing on the experience of restructuring specific disciplinary general education courses, promoting the deep integration of AI with disciplinary teaching is an important practical pathway for curriculum system integration and innovation.

On the one hand, the curriculum should promote the deep integration of AI with professional education, embedding AI knowledge into the general education curriculum system of each major, realizing a collaborative "AI + major" talent cultivation model. This enables students to master the application methods of AI technology in their own disciplinary fields and enhances their interdisciplinary innovation capabilities. The "bidirectional empowerment" cultivation model, which involves building a composite disciplinary system, provides a feasible pathway for constructing interdisciplinary integrated curriculum systems. On the other hand, the curriculum should promote the deep integration of AI with practical teaching, strengthening the systematic design of practical components, and incorporating innovative teaching models such as project-based learning, case analysis, and interactive practice into the curriculum system. This allows students to deepen their understanding of AI technology principles and application methods through practice, enhancing their practical and innovative capabilities. At the same time, in line with the core requirement of "application orientation," the curriculum should promote the integration of AI with innovative teaching models, constructing human-machine collaborative and virtual-real blended teaching scenarios to enhance the effectiveness of course instruction, thereby realizing the effective extension of the educational philosophy of "sharing, co-construction, practice empowerment" at the higher education level.

3. Real-World Difficulties in AI General Education

Although AI general education has been gradually rolled out nationwide, a review of existing research reveals that universities still face multiple deep-seated difficulties in advancing AI general education.

3.1 Ambiguous Course Positioning and Fragmented Goal Systems

AI general education first faces the fundamental questions of "why teach" and "what to teach." In an era where AI is accelerating the replacement of rule-based mental labor, the advantages of majors centered on standardized training are being gradually eroded. Compared to "betting on" a single major, cultivating general competencies holds greater long-term value. However, most universities currently position AI general education merely as "tool skills training," failing to elevate it to the level of literacy education. General education faces three core challenges: outdated course content, weak practical components, and insufficient student intrinsic motivation. The underlying logic of traditional general education is facing a triple disruption—the transfer of knowledge production rights, the algorithmicization of cognitive pathways, and the crisis of human subjectivity—plunging it into unprecedented difficulties [4].

In terms of goal systems, there is a lack of unified cultivation standards across universities. Current AI education practices face practical challenges such as fragmented course objectives, repetitive course content, and lagging evaluation systems. At the higher education level, although AI literacy frameworks exhibit "functional convergence," there are significant differences in knowledge breadth and technical depth, the granularity of stage division, and the specificity of implementation support strategies. This "structural heterogeneity" makes it difficult to align AI general education goals across different universities and disciplines.

3.2 Fragmented Course Content Systems and Prominent Disciplinary Barriers

The systematic organization of course content is a core challenge for AI general education. AI general education courses in universities face challenges including the diversity of student needs, the rapid pace of knowledge updates, the expansion of teaching scale, and the cultivation of core values [5,6]. Traditional university computer general education centered on a "single computer system" can no longer meet the developmental needs of students from various disciplines in the AI era. The differences in knowledge structures and technical routes resulting from the intersection of AI with different disciplines constitute a key difficulty in curriculum development.

The persistence of disciplinary barriers exacerbates this problem. From the perspective of the "New Liberal Arts," university general education requires innovative cultivation concepts and reformed teaching content. The "New Liberal Arts" initiative represents a proactive response from the humanities and social sciences to the new round of technological revolution and industrial transformation represented by AI. However, the integration of technology with the humanities and social sciences still requires further deepening. Humanities education cannot avoid the complex issues brought about by cutting-edge scientific and technological developments; it should actively respond to the profound impacts of technological change on social culture, ethics, and morality.

3.3 Structural Shortages and Capacity Gaps in the Teaching Workforce

Faculty issues are a key bottleneck constraining the quality of AI general education [7,8]. Current university teacher competency frameworks suffer from problems such as homogenization and disciplinary disconnect, making it difficult to meet the demands of the deep integration of AI with higher education. Teachers are relatively weak in basic knowledge and skills related to cultural knowledge and digital technology, the arrangement and implementation of personalized learning activities, and classroom teaching innovation capabilities. The inadequate professional capabilities of university AI teachers and the lack of clear competency standards have become major obstacles to the development of AI education.

AI general education courses require teachers who possess professional AI knowledge and can effectively teach students from diverse disciplinary backgrounds—a "AI-knowledgeable, pedagogically skilled, and cross-disciplinary" composite teacher profile that is extremely scarce. Currently, the majority of faculty in most universities are still drawn from computer-related disciplines, making it difficult to meet the demands of large-scale general education, let alone deliver differentiated instruction to students from different disciplinary backgrounds.

3.4 Significant Variation in Student Needs and Difficulty Organizing Differentiated

Instruction

The heterogeneous needs of students pose a serious challenge to AI general education [9]. Disciplinary background and regional origin are important factors influencing students' AI knowledge mastery, literacy levels, and knowledge needs. Most freshmen have not yet been exposed to AI-related knowledge; science and engineering students have better programming foundations than humanities and social sciences students, but the overall technical foundation of freshmen is weak. Significant differences exist in AI knowledge foundations and literacy levels among students in science, engineering, agriculture, and medicine; humanities and social sciences; and humanities and arts.

Although the concept of classification and stratification has been widely recognized, effectively implementing differentiated instruction for students with different disciplinary backgrounds and learning foundations poses high demands on teaching organization and management. Regional university course alliances have undergone stages of resource sharing, teaching collaboration, and intelligent collaboration. However, challenges remain in areas such as inter-institutional academic system connectivity and quality assurance system construction. Large universities with "thousand-person lecture courses" often struggle to accommodate students' personalized learning needs, leading to a dilemma where some students "cannot get enough" while others "cannot digest what is taught."

3.5 Weak Ethics Education and Lagging Evaluation Mechanisms

AI ethics education is generally marginalized in current curriculum systems [10]. Strengthening AI ethics and social responsibility education is an important trend in the development of AI literacy courses globally, but there is still significant room for improvement in this area in Chinese universities. Technological development brings ethical issues, triggering epistemological revolutions, methodological revolutions, and transformations in teaching methods. However, the reform of teaching content related to the ethics of science and technology has lagged relatively behind. In complex ethical controversies surrounding technology, knowledge alone struggles to explain the formation mechanisms of public attitudes; psychological factors play multidimensional moderating roles in technological ethical controversies.

In terms of evaluation mechanisms, current AI general education assessments are still dominated by traditional examination models, making it difficult to effectively evaluate students' comprehensive literacy. Learning evaluation urgently needs to shift from a focus on knowledge content mastery to an emphasis on capability development and skill acquisition, including soft skills or general competencies. However, at present, most universities have not yet established a multi-evaluation system that combines process-oriented, value-added, and summative evaluations, and the evaluation content fails to cover multiple dimensions such as knowledge mastery, tool application ability, ethical judgment, and innovative thinking.

4. Optimized Practical Pathways for AI General Education Curriculum Systems in Higher Education Institutions

Addressing the prominent difficulties in the current practice of AI general education curriculum systems in universities, this paper proposes targeted optimization pathways across five dimensions: course positioning, content development, teaching models, faculty development, and evaluation systems, aiming to promote the improvement and implementation of AI general education curriculum systems and enhance the quality and effectiveness of general education.

4.1 Clarify Course Positioning and Anchor Core Educational Goals

Accurately define the positioning and core educational goals of AI general education. On the one hand, clarify the "general education" nature of AI general education, strictly distinguishing it from professional AI education. Take "cultivating AI core literacy for all students" as the central goal, focusing on the trinity of "knowledge transmission, capability development, and value formation." Guide students to develop a proper view of technology and values, master basic AI concepts, ways of thinking, and application skills, adapt to the demands of the intelligent era, and implement the requirements of "promoting AI education across all educational stages and society-wide general education." On the other hand, based on

the institutional characteristics and talent cultivation objectives of each university, clarify the positioning and focus of the course: comprehensive universities may focus on interdisciplinary integration, building a multi-disciplinary collaborative curriculum system; science and engineering universities may focus on technical application and innovative practice, enhancing students' technical application capabilities; liberal arts universities may focus on the integration of AI with the humanities and social sciences, strengthening ethics education and value orientation. At the same time, strengthen the emphasis on AI general education by incorporating it into the core general education curriculum system of the university, increase resource investment, and carry out systematic planning and deployment to ensure the orderly construction and implementation of the curriculum system. Achieve seamless articulation with AI general education in primary and secondary schools, building a vertically integrated curriculum system across all educational stages.

4.2 Optimize Course Content and Build a Tiered System

In response to the significant differences in students' disciplinary backgrounds, knowledge bases, and learning needs, a vertically tiered and horizontally categorized course content system should be constructed [11]. Vertically, three capability levels should be established according to the laws of cognitive development: the foundational general level, aimed at all students, focuses on "understanding AI," introducing basic concepts, development history, technical boundaries, and social impacts, demystifying the technology; the intermediate capability level, intended for students with interest or higher disciplinary relevance, focuses on "using AI," training practical skills such as prompt engineering, data analysis, and human-machine collaboration, strengthening integration with professional studies; the advanced innovation level, targeted at high-potential students, takes the dual main lines of "innovating with AI" and "governing AI well," guiding them to explore cutting-edge topics of AI empowerment in their own disciplines and systematically cultivating ethical judgment abilities concerning algorithmic fairness, data privacy, and other issues. Horizontally, differentiated content modules should be designed for different disciplinary categories such as science, engineering, agriculture, medicine, humanities and social sciences, and arts and sports. Science and engineering students may focus on algorithmic principles and programming practices; humanities and social sciences students should be oriented toward the social impacts of AI and ethical reasoning; arts and sports students could focus on the application scenarios of generative AI in creation and training. Additionally, course content must establish a dynamic update mechanism, promptly incorporating cutting-edge technologies such as large models and embodied AI, to avoid content lagging behind technological iterations. Through this tiered and categorized course content design, students with different starting points can achieve substantial improvement based on their existing foundations, realizing the organic unity of "teaching according to aptitude" and "development for all."

4.3 Promote Textbook and Resource Development, Enhance Competency Frameworks

Textbooks should be designed around the four-dimensional competency framework of "understanding—using—innovating—governing, " featuring progressively layered learning modules. Each module should integrate theoretical explanations, case analyses, and practical tasks, guiding students from knowledge acquisition to capability transfer. At the same time, textbooks need to be dynamically updated, incorporating cutting-edge AI technologies such as generative AI and large models in a timely manner to avoid content lagging behind technological development. Universities should make full use of the thousands of high-quality AI courses aggregated on the National Smart Education Platform to reduce redundant construction costs. On this basis, develop differentiated teaching resources based on institutional characteristics: research-oriented universities may focus on AI thinking and cutting-edge exploration resources; application-oriented universities should emphasize project-based learning resources driven by industry scenarios; vocational colleges should focus on AI tool operation and job application resources. Furthermore, a multidimensional resource system should be constructed, including virtual simulation experiment platforms, open-source code libraries,

and ethics case collections, to support blended learning and student self-directed learning. Through the coordinated development of textbooks and resources, a solid foundation can be provided for tiered and categorized teaching.

4.4 Reform Teaching Paradigms and Create "Teacher-Student-Machine" Interactive Contexts

In the AI era, it is even more necessary to fully construct "teacher-student-machine" interactive contexts under teacher guidance [12], enabling AI to truly empower the core goal of university education: "cultivating people." Generative AI holds promise for solving the problems of unequal distribution of educational resources and personalized teaching difficulties. It is necessary to promote interdisciplinary integration in courses, establish AI general education courses, and innovate assessment methods. New teaching models such as human-machine collaboration, project-based learning, and blended learning should become the mainstream teaching paradigms for AI general education courses. Specifically, in the human-machine collaborative teaching model, the teacher is responsible for goal setting, value guidance, and deep questioning, while AI assumes auxiliary roles such as knowledge Q&A, initial assignment evaluation, and learning path recommendation, forming a classroom ecology of three-way interaction among "teacher, student, and intelligent agent." Project-based learning is driven by real-world problems, such as designing an intelligent campus service solution or analyzing the ethical risks of AI applications in a specific industry, prompting students to integrate knowledge, tools, and ethical judgment through "learning by doing." Blended learning organically combines online self-directed learning with offline seminars and practice. The online component uses intelligent recommendation systems to deliver personalized learning content, while the offline component focuses on higher-order thinking training and collaborative inquiry. Moreover, teaching paradigm reform also needs to cultivate students' critical thinking and innovative awareness, avoiding "cognitive offloading"—where students over-rely on AI to complete learning tasks and lose independent thinking ability. Through the systematic transformation of teaching paradigms, a fundamental shift from "knowledge transmission" to "capability construction" can be truly achieved.

4.5 Strengthen Faculty Development and Build Professional Teaching Teams

Implement the dual-track strategy of "classified construction" and "phased practice" for university teachers' artificial intelligence literacy, and design a three-stage implementation path of "basic cultivation - professional deepening - leadership innovation". The basic cultivation stage is oriented to all teachers, popularizing basic concepts of artificial intelligence, common tools and teaching application scenarios through short-term workshops and online courses, so as to eliminate technical fear and cognitive blind spots. The professional deepening stage focuses on teachers responsible for delivering AI general education courses, organizing thematic training, interdisciplinary teaching and research, and corporate practice, enabling them to master differentiated teaching strategies for students from different disciplinary backgrounds and to develop "AI+X" integrated cases. In the leadership innovation stage, backbone teachers are selected to participate in curriculum system design, teaching standard formulation, and artificial intelligence education research, so as to play a demonstration and leading role. Teacher digital literacy assessment is an important direction in vocational education digitalization research. Universities should establish a regular mechanism for assessing teachers' digital literacy, and based on the assessment results, accurately deliver training content, achieving "assessment-driven training, training-driven teaching improvement." At the same time, encourage the formation of interdisciplinary teaching teams, where computer science teachers collaborate with teachers from humanities, social sciences, arts, management, and other disciplines, compensating for the limitations of a single disciplinary background. Universities should incorporate AI teaching capabilities into teacher promotion and teaching evaluation systems, establish special funds to support teachers in participating in high-level training and academic exchanges, and form an institutionalized faculty development guarantee mechanism.

4.6 Improve Evaluation Systems and Deepen Ethics Education

Evaluation reform should break away from traditional summative examination models and construct a multidimensional adaptive evaluation

system combining process-oriented evaluation, value-added evaluation, and summative evaluation. Process-oriented evaluation relies on learning management systems to track behavioral data such as class participation, project assignments, and learning reflections, enabling dynamic monitoring. Value-added evaluation objectively reflects the increment of students' abilities through pre-test and post-test comparison or growth portfolios, which is suitable for the practical situation where students have significant differences in basic foundations. Summative evaluation reduces the weight of knowledge reproduction and increases the assessment of comprehensive abilities such as interdisciplinary transfer, complex problem-solving, and ethical decision-making. At the same time, digital technologies and accompanying AI analysis techniques should be used to transform learning assessment methods, enabling reliable judgments of learners' mastery of complex competencies and general skills. For example, natural language processing can analyze students' critical thinking, machine learning can identify problem-solving strategies, and affective computing can assess ethical judgment abilities. These technologies can provide immediate, multidimensional feedback, supporting personalized evaluation in large-scale general education courses. Furthermore, the evaluation system must incorporate AI ethical literacy as an independent dimension. The ethics education module should assess students' internalization of values on issues such as data privacy and algorithmic fairness through teaching activities such as case studies and role-playing. Incorporate ethical literacy into the summative evaluation module and set ethical reflection tasks in process-oriented evaluation, truly achieving the cultivation goal of "governing AI well." This forms a closed-loop system of "process recording—value-added analysis—outcome assessment—ethical feedback," responding to the demand for evaluation fairness in the context of student heterogeneity and aligning with the redefinition of talent literacy in the intelligent era.

5. Conclusion

Constructing a scientific and reasonable AI general education curriculum system in higher education institutions is a key measure for implementing AI education across all educational stages, enhancing AI literacy among the general population, and cultivating high-quality talents adapted to the intelligent era. Guided by the principle of fostering virtue and nurturing talent, and integrating the developmental patterns of AI technology with the talent cultivation objectives of higher education institutions, this paper systematically reviews existing literature, clarifies the core construction logic of an AI general education curriculum system—"value orientation, demand orientation, gradual progression, and integrated innovation", comprehensively analyzes the prominent difficulties in current practice, including ambiguous course positioning, fragmented content, single teaching models, weak faculty, and unitary evaluation systems, and proposes targeted optimization pathways across the dimensions of course positioning, content development, teaching models, faculty development, and evaluation systems.

The construction and improvement of an AI general education curriculum system in higher education institutions is a long-term dynamic process that requires continuous optimization and innovation in response to cutting-edge developments in AI technology, changes in societal needs, and student development demands. In the future, universities need to further strengthen their emphasis on AI general education, deepen curriculum and teaching reforms, promote the deep integration of AI with general and professional education, and build AI general education curriculum systems that align with their institutional characteristics. At the same time, strengthen inter-institutional and university-industry collaboration, share high-quality teaching resources, enhance the professional level of faculty, improve practical teaching and evaluation systems, so that AI general education can truly achieve tangible results.

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