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Research on the Construction of Artificial Intelligence General-Education Courses in Comprehensive Universities under the Background of Digital-Intelligent Transformation

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Abstract

Against the backdrop of digital-intelligent transformation, this paper focuses on the bottlenecks in developing artificial intelligence general-education courses for non-computer majors in comprehensive universities. Addressing prevalent structural problems in current curricula, including fragmented teaching content, disconnection between theoretical instruction and practical training, superficial integration of curriculum-based ideological and political education, one-dimensional evaluation systems, and difficulties in implementing tiered training objectives, this study establishes a bidirectionally-empowered theoretical model for AI general education featuring "Three Integrations and Four Innovations". It further proposes a three-dimensional curriculum construction approach: reconstructing knowledge systems with in-depth integration of ideological-political elements, building a practical ecosystem for Four-Innovation education, and innovating tiered progressive training objectives together with a multi-dimensional evaluation system. Teaching practices were conducted at Yan'an University for verification. The results demonstrate that the proposed scheme effectively lowers the learning barrier for non-computer majors receiving AI general education. The courses cover all non-computer majors across the university and substantially improve students' comprehensive AI literacy and innovative practical capabilities.

Keywords

Artificial intelligence general education; Three Integrations and Four Innovations; curriculum-based ideological and political education; tiered teaching; integration of industry and education.

1. Introduction

With the iterative upgrading of digital-intelligent technologies, artificial intelligence has become a core driving force behind the transformation of higher education and industrial digital transformation. A series of policy documents on "Artificial Intelligence + Education" have been issued at the national level, requiring universities to popularize artificial intelligence general education and help all students consolidate their foundational literacy in intelligent technologies. At present, Chinese universities have gradually promoted the development of artificial intelligence general-education courses, yet the overall practice is still in its initial exploratory stage. Common structural challenges include fragmented teaching systems, disconnection between theory and practice, superficial integration of curriculum-based ideological and political education, and simplistic evaluation methods[1]. Most existing courses merely focus on teaching isolated knowledge points or optimizing classroom organization, without establishing a systematic and ecological curriculum construction system. Such courses can hardly meet the tiered training needs of non-computer majors and fail to support the

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cultivation of interdisciplinary talents and the goals of regional industrial digital development. Accordingly, it is urgent to construct an artificial intelligence general-education curriculum system adapted to the requirements of digital-intelligent transformation.

This paper constructs a bidirectionally-empowered theoretical model for AI general education featuring “Three Integrations and Four Innovations” to address the dilemma of superficial integration in which ideological-political elements are separated from technical teaching, so as to realize the isomorphic coexistence of value rationality and instrumental rationality. It innovates a teaching mode that couples a tiered-progressive objective system with the six-closed-loop PBL organizational form, and reveals the internal mechanism of AI literacy formation among non-computer majors. Meanwhile, it deepens research on the collaborative talent-training mechanism of industry-education integration and establishes a multi-dimensional evaluation theoretical system centered on process-oriented assessment. It is expected to enrich research findings in educational technology and the digital transformation of general education, and provide brand-new knowledge-generation paths and methodological paradigms for this field.

2. Analysis of Pain-Point Problems

From the existing practices of artificial intelligence general-education curriculum construction in domestic universities, it is not difficult to identify that, apart from the common problems mentioned above, the training-related pain points for students with diverse academic backgrounds are more prominent. First, comprehensive universities cover a wide range of disciplines, and students from liberal arts, science, engineering and medicine show significant heterogeneity in their mathematical and theoretical foundations. A unified curriculum with excessive difficulty will greatly raise the learning threshold and create obstacles for students majoring in humanities and social sciences. By contrast, overly simple curricula fail to satisfy the advanced learning demands of science and engineering students, which ultimately prevents the effective implementation of tiered teaching. Second, in most universities, artificial intelligence general-education courses are developed solely under the leadership of the School of Computer Science. The absence of collaborative mechanisms across different schools results in poor alignment between course content and discipline-specific application scenarios. Consequently, students cannot effectively connect the AI knowledge they have acquired with the research and practical scenarios of their own majors, making it difficult to achieve the competency-building goal for interdisciplinary talents under the “AI + Discipline” framework. Third, supporting resources for front-line instructors are insufficient. Most teachers lack practical experience in AI technology application and practical teaching design, and struggle to develop high-quality teaching materials tailored to the positioning of AI general education, which further restricts the improvement of curriculum construction quality. All the above-mentioned pain points constitute core bottlenecks limiting the educational value of current artificial intelligence general education.

3. Exploration and Practice of Curriculum Construction

Focusing on the artificial intelligence general-education curriculum system for non-computer majors, this paper takes content design featuring reconstructed knowledge systems and in-depth integration of ideological-political elements as its core research orientation, aiming to solve the practical dilemma of disconnection between knowledge imparting and value guidance in general education. Based on the “Three Integrations” teaching framework, blended teaching practice is studied, with emphasis on exploring the operational mechanism of collaborative online-offline teaching spaces and co-construction and sharing of industry-education integration resources. A multi-dimensional curriculum evaluation system centered on

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process-oriented assessment is established. Empirical analysis is adopted to verify its effectiveness and application value in AI literacy diagnosis, learning-outcome feedback and teaching improvement.

3.1. Theoretical Design of Knowledge System Reconstruction and In-depth Integration of Ideological-Political Elements

The core of this research is to address three structural dilemmas in artificial intelligence general-education courses: dense knowledge points, broad interdisciplinary coverage, and high learning thresholds, which have long restricted the teaching effectiveness of general-education courses. To effectively tackle the above-mentioned challenges, the teaching team systematically sorts out 50 classic teaching cases in the fields of machine learning, deep learning, large-scale models and so on. Hot-topic issues that reflect cutting-edge disciplinary trends, respond to real-world social concerns and attract high student attention are selected as teaching materials. On this basis, relying on these case materials, a hierarchical content organization logic of "problem-driven guidance — value shaping — emotional sublimation" is constructed. Real-world problems serve as teaching entry points to stimulate students' inquiry interest and cognitive conflicts. Value judgment and ethical speculation are naturally infiltrated in the process of problem-solving, guiding students to develop sound views on science and technology and a sense of responsibility. Further, deep-seated emotional resonance promotes the internalization and sublimation of value identification, and realizes progressive integration among cognition, value and emotion.

The core breakthrough lies in transforming ideological-political educational elements including algorithm ethics, data security, and dedication to the country through science and technology into concrete teaching scenarios. Abstract value concepts are embedded into specific technical discussions and practical scenarios, replacing the traditional one-way indoctrination mode. Instead of passively receiving moral instruction, students actively encounter ethical dilemmas and perceive value tensions behind technologies when analyzing cases and solving problems, which achieves synchronous resonance between professional knowledge instruction and ideological-political value guidance[2-3]. Meanwhile, to ensure measurable and controllable educational outcomes of curriculum-based ideological and political education, this study establishes a quantifiable and observable evaluation indicator system. Observation points are set from multiple dimensions of cognition, emotion and behavior to dynamically track and systematically assess the infiltration degree and internalization effect of value guidance. Accordingly, value guidance achieves organic unification of implicit infiltration and explicit outcomes in general education. It avoids rigid embedding of ideological-political education and guarantees the effective implementation of the fundamental task of fostering virtue through education within artificial intelligence general-education courses.

3.2. Ecological Construction and Operational Mechanism of the "Four Innovations" Practical System

Aiming at the shortage of hands-on practical opportunities for students in current artificial intelligence general-education courses, the teaching team proceeds from top-level design and integrates four core elements: teaching research, discipline competitions, scientific research projects, and innovation practice. A closed-loop practical ecosystem of "classroom — competition — scientific research — innovation" is constructed to realize deep coupling between theoretical instruction and practical training. The four elements feature well-defined functions and provide collaborative support. Teaching research offers conceptual guidance for practical design and ensures rational and systematic content. Discipline competitions promote learning via contests and stimulate students' motivation for improvement. Scientific research projects train students' academic thinking. Innovation practice cultivates students' pioneering awareness and comprehensive literacy[4-6]. These four components form a positive cycle.

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Students achieve competency advancement through classroom learning, competition assessment, in-depth scientific research and innovative practice, while practical experience feeds back into classroom teaching to build a virtuous mechanism for continuous optimization.

At the teaching-design level, to bridge the gap between theoretical knowledge and industrial applications, the curriculum is driven by real-world industrial projects. Practical tasks are designed around actual business scenarios and engineering problems, enabling students to apply course knowledge in problem-solving and enhancing their sense of situational engagement. Meanwhile, relying on school-enterprise co-built practical teaching carriers, enterprise technical platforms, data resources and engineering cases are introduced to provide students with training environments and hands-on conditions close to real-industry scenarios. On this basis, evaluation criteria of high-level discipline competitions, including the "Internet +" College Students' Innovation and Entrepreneurship Competition and Lanqiao Cup National Software and Information Technology Professionals Competition, are transformed into curriculum project requirements and quality standards. Clear foundations are thus provided for objective setting, process management and outcome evaluation of practical tasks, ensuring that practical teaching content maintains technical cutting-edge nature and appropriate challenge levels and preventing practical sessions from becoming mere formalities.

The key breakthrough is the establishment of a student-centered full-chain competency cultivation matrix. In accordance with the educational objectives of general-education courses and the law of student development, this matrix defines the focus of competency training for each practical session. Through task sequences designed from easy to difficult, it promotes the gradual and gradient development of knowledge-transformation capability, practical operation capability, research-exploration capability and autonomous-learning capability. At the basic stage, students realize knowledge transformation and master practical operation procedures. At the advanced stage, they independently complete projects to exercise research-exploration and problem-solving capabilities. At the high-level stage, comprehensive innovative projects are finished to achieve integrated improvement of competencies. Consequently, theoretical and practical teaching form a closely-connected dual-track structure, giving full play to the supporting role of practical education and resolving the long-standing defect of disconnection between theory and practice in general-education courses.

3.3. Precision Design of Tiered-Progressive Teaching Objectives and Innovation of Evaluation System

To remedy the defects of imperfect curriculum teaching systems and simplistic evaluation methods, a three-level progressive teaching objective system of "basic cognition — skill mastery — comprehensive application" is constructed, which is precisely mapped onto five core competency dimensions including literature interpretation, principle analysis and innovative expression. Considering the heterogeneity of students' mathematical foundations across disciplines in comprehensive universities, modular elective tasks corresponding to the three-level teaching objectives are set within this tiered system[7]. Students in humanities and social sciences with weak foundations complete modules for basic cognition, whose core goals are to establish fundamental understanding of artificial intelligence and shape sound views on science and technology ethics. Students in science and engineering with solid foundations take advanced skill training and comprehensive application projects to meet their demands for expanding AI technology application capabilities, thus realizing the implementation of tiered teaching. To satisfy the talent-training requirements of cross-scenario integration under "AI + Discipline", this system reserves interfaces for professional scenario-oriented content docking. It supports the curriculum team to collaboratively develop sub-module practical tasks matching disciplinary demands together with other schools, helping students build connections between artificial intelligence technologies and professional application scenarios and

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fostering interdisciplinary comprehensive competencies. Aiming at the shortage of teaching resources for instructors, standardized resource packages covering teaching designs, case materials, examination question banks and training materials corresponding to objectives at all levels are developed. These packages assist teachers in clarifying curriculum positioning and organizing instruction, lower implementation difficulty and guarantee steady improvement of curriculum construction quality.

At the teaching-organization level, a closed-loop teaching organizational form based on the PBL model is developed: "task introduction — scenario-based practice — summary and reflection". A learning support system covering the whole process of pre-class, in-class and after-class sessions is established. At the evaluation-design level, the weight of process-oriented assessment is raised to 40%. Assessment observation points cover completion of online assignments, literature reading, classroom performance, group discussions, computer practice, project deliverables and other dimensions. A tripartite evaluation subject system consisting of teacher evaluation, student peer evaluation and platform data-driven evaluation is adopted to realize whole-process dynamic diagnosis and value-added evaluation of learning outcomes, and improve the precision of teaching feedback and teaching optimization.

4. Effects of Curriculum Construction

Verified by teaching practices at Yan'an University, a comprehensive university, the above-mentioned curriculum construction scheme has achieved remarkable educational outcomes. First, the scope of course participants has been greatly expanded. Current teaching classes cover all non-computer majors across the university, which indicates that the tiered curriculum design effectively accommodates the learning needs of students with varied foundations and lowers the access threshold for artificial intelligence general education. Second, students' comprehensive AI literacy has been significantly improved. Students have won provincial-ministerial-level and higher discipline competition awards and applied for various college students' innovation and entrepreneurship training program projects through course practical projects, which fully demonstrates the supporting role of the practical ecosystem in student competency cultivation. Third, the educational outcomes of curriculum-based ideological and political education have been widely recognized. According to curriculum ideological-political effect evaluation data, more than 87% of students hold the view that embedded contents such as science and technology ethics and patriotism have exerted positive influences on their value formation, realizing the collaborative educational goal of knowledge imparting and value guidance.

5. Conclusion

Targeting existing problems of artificial intelligence general-education courses in universities, including complicated knowledge systems, disconnection between theory and practice, simplistic evaluation methods, and superficial integration of ideological-political elements, this paper carries out systematic optimization of the curriculum system from three dimensions against the development trend of digital-intelligent education. Firstly, the curriculum knowledge system is reconstructed. Ideological-political elements are embedded into concrete teaching scenarios, and quantitative evaluation indicators for curriculum-based ideological and political education are established. Secondly, the "Four Innovations" closed-loop practical ecosystem covering "classroom teaching — discipline competitions — scientific research training — innovation practice" is constructed. Project-oriented teaching reform is implemented relying on school-enterprise co-built platforms and evaluation criteria of high-level competitions. Thirdly, a tiered-progressive teaching objective system is built. A teaching organizational framework covering the whole teaching process is developed based on the PBL

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teaching model, and a tripartite-subject whole-process value-added evaluation mechanism is innovatively formed. Practices show that this reform path can effectively improve the teaching quality and educational performance of artificial intelligence general-education courses.

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