The Challenges of Artificial Intelligence to the Concepts of Traditional Computer Education

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Abstract: With the rapid development and in-depth application of artificial intelligence technology, the field of computer education is facing profound changes, and traditional computer education concepts are encountering unprecedented challenges. The purpose of this study is to explore the core connotation of the challenges posed by artificial intelligence to traditional computer education concepts, clarify the transformation direction of computer education concepts in the intelligent era, and provide theoretical support and practical guidance for the reform of computer education. This study adopts the methods of literature research, comparative analysis and logical deduction. First, it sorts out and combs the relevant literature on artificial intelligence and computer education at home and abroad, and clarifies the research status and existing deficiencies; then, it compares the differences between traditional computer education concepts and the educational concepts required by artificial intelligence technology, and analyzes the specific manifestations of the challenges posed by artificial intelligence to traditional computer education concepts from the aspects of educational objectives, teaching content, teaching methods and evaluation systems; finally, through logical deduction, it summarizes the core conclusions. The results show that artificial intelligence has subverted the traditional computer education concept centered on knowledge transmission, and put forward new requirements for the cultivation of students' computational thinking, innovative ability and interdisciplinary application ability; the reform of computer education needs to establish an intelligent education concept centered on ability cultivation, and realize the all-round transformation of educational objectives, teaching content, teaching methods and evaluation systems. This study enriches the theoretical research on the integration of artificial intelligence and computer education, and provides important reference for the practice of computer education reform.

Keywords: Artificial Intelligence; Traditional Computer Education; Educational Concept; Education Reform; Computational Thinking

1. Introduction

1.1 Research Background and Significance

The integration of artificial intelligence (AI) with various industries has triggered a comprehensive technological revolution, and the field of education has undergone profound changes accordingly. Computer education, as the core carrier for cultivating digital talents, is facing an unprecedented transformation trend. Traditional computer education, which has long been based on the transmission of theoretical knowledge and the training of basic operating skills, can no longer fully adapt to the talent demand brought by the rapid development of AI technology. The wide application of AI technologies such as machine learning, natural language processing, and intelligent tutoring systems has redefined the core literacy requirements for computer professionals, making the transformation of educational concepts an inevitable choice for the development of computer education.

The research on the challenges posed by AI to traditional computer education concepts is of important theoretical and practical significance. Theoretically, this research helps to enrich the theoretical system of the integration of AI and higher education, clarify the evolutionary logic of computer education concepts in the intelligent era, and provide a new theoretical perspective for the reform of computer education. Practically, this research can provide specific guidance for the optimization of computer education curricula, the innovation of teaching methods, and the

improvement of evaluation systems, helping to cultivate computer talents who meet the needs of social and industrial development, and then promoting the high-quality development of the digital economy.

1.2 Review of Domestic and Foreign Research Status

Foreign research on the integration of AI and computer education started relatively early. Scholars have carried out in-depth explorations on the application of intelligent tutoring systems in computer teaching and the impact of AI on computer talent training. Some studies focus on the design and development of AI-based personalized learning platforms, emphasizing the role of technology in improving teaching efficiency. However, most of these studies focus on the application of technical tools, and there is a lack of in-depth discussion on the inherent challenges of AI to traditional computer education concepts.

Domestic research on this topic has gradually increased in recent years, focusing on the impact of AI on computer education curricula and teaching models. Some scholars have proposed reform plans for computer education curricula based on AI technology, while others have discussed the cultivation of computational thinking in the context of AI. However, existing domestic research still has certain deficiencies: on the one hand, the research on the challenge mechanism of AI to traditional computer education concepts is not systematic enough; on the other hand, the research on the transformation path of education concepts lacks sufficient combination with industrial practice, resulting in weak practical guidance. In summary, both domestic and foreign research have not fully revealed the core connotation of the challenges of AI to traditional computer education concepts and the systematic transformation strategy, which provides a research space for this paper.

1.3 Research Ideas and Methods

This research takes the challenges of AI to traditional computer education concepts as the core research object, and follows the research idea of "defining concepts - analyzing challenges - exploring paths". First, it combs the core connotation of traditional computer education concepts and the educational value of AI technology, and clarifies the theoretical basis of the research; then, it deeply analyzes the specific manifestations of the challenges posed by AI to traditional computer education concepts from multiple dimensions such as educational objectives, teaching content, teaching methods, and evaluation systems; finally, it proposes the transformation path and practical strategy of computer education concepts in the AI era.

In terms of research methods, this paper mainly adopts three methods: literature research, comparative analysis, and case study. The literature research method is used to systematically sort out the relevant literature on AI and computer education at home and abroad, and clarify the research status and theoretical basis. The comparative analysis method is used to compare the differences between traditional computer education concepts and the educational concepts required by the AI era, so as to highlight the challenges faced by traditional education concepts. The case study method is used to select typical cases of computer education reform in domestic and foreign universities, analyze the application effect of the transformation of education concepts, and verify the feasibility of the proposed transformation path.

1.4 Research Content and Innovation Points

The main research content of this paper includes four parts: first, the definition of core concepts and theoretical basis, including the core connotation of traditional computer education concepts, the core characteristics and educational value of AI technology, and the theoretical support for the integration of AI and computer education; second, the characterization of challenges, analyzing the specific impact of AI on traditional computer education concepts from four dimensions: educational objectives, teaching content, teaching methods, and evaluation systems; third, the transformation path and practical strategy, proposing targeted reform strategies for the challenges faced by traditional computer education concepts; fourth, concluding and prospecting, summarizing the research conclusions and pointing out the direction of follow-up research.

The innovation points of this paper are mainly reflected in two aspects: first, the research perspective is innovative. It takes the "challenge mechanism" as the entry point, systematically analyzes the impact of AI on traditional computer education concepts from the root, and

reveals the inherent logic of the transformation of computer education concepts; second, the research results are innovative. Combining with the actual needs of industrial development, it proposes a systematic transformation path of computer education concepts, which realizes the organic combination of theoretical exploration and practical application, and has strong practical guidance.

2. Definition of Core Concepts and Theoretical Basis

2.1 Core Connotation of Traditional Computer Education Concepts

Traditional computer education concepts take the transmission of theoretical knowledge and the training of basic skills as the core, and form a relatively fixed educational model with the discipline system as the guide. Its core connotation is mainly reflected in three aspects: first, in terms of educational objectives, it focuses on cultivating students' mastery of basic computer theoretical knowledge and traditional programming skills, emphasizing the accumulation of knowledge; second, in terms of teaching content, it takes the logical system of computer disciplines as the main line, focusing on the teaching of professional basic courses such as data structure, operating system, and computer composition principle, with relatively single content; third, in terms of teaching methods, it adopts the traditional teacher-centered teaching mode, with classroom teaching as the main form, and the interaction between teachers and students is insufficient. This kind of education concept has played an important role in the initial stage of computer popularization, but with the development of AI technology, its limitations have become increasingly prominent.

2.2 Core Characteristics and Educational Value of Artificial Intelligence Technology

AI technology has three core characteristics: autonomy, learning ability, and interactivity. Autonomy means that AI systems can complete specific tasks independently without human intervention; learning ability means that AI systems can continuously optimize their own performance through data learning; interactivity means that AI systems can conduct effective interaction with humans and the environment. These core characteristics make AI technology have important educational value in the field of computer education.

The educational value of AI technology is mainly reflected in three aspects: first, it promotes the personalization of teaching. Through intelligent analysis of students' learning data, AI can accurately grasp students' learning characteristics and needs, and provide personalized learning plans for students; second, it improves teaching efficiency. AI-based intelligent tutoring systems can realize 24-hour online tutoring, answer students' questions in a timely manner, and reduce the teaching burden of teachers; third, it promotes the innovation of teaching models. The application of AI technology makes the transformation of teaching models from teacher-centered to student-centered possible, and helps to cultivate students' independent learning ability and innovative thinking.

2.3 Theoretical Support for the Integration of Artificial Intelligence and Computer Education

The integration of AI and computer education is supported by multiple theories, among which constructivism learning theory and humanistic learning theory are the core. Constructivism learning theory holds that learning is a process of active construction of knowledge by learners, and the role of teachers is to guide learners to construct knowledge actively. AI technology provides a good technical support for the practice of constructivism learning theory. Through intelligent learning platforms, students can carry out exploratory learning and active construction of knowledge.

Humanistic learning theory emphasizes the respect for learners' individual differences and the cultivation of learners' comprehensive quality. AI technology can accurately grasp the individual differences of students through data analysis, and provide personalized learning support for students, which is consistent with the core concept of humanistic learning theory. In addition, the theory of educational ecology also provides a theoretical basis for the integration of AI and computer education. This theory holds that education is an ecological system composed of multiple elements such as teachers, students, and teaching environment. The integration of AI technology has changed the composition and operation mode of the educational ecological system, and promoted the optimization and

upgraded of the educational system.

3. Characterization of the Challenges of Artificial Intelligence to Traditional Computer Education Concepts

3.1 The Transformation Demand from Knowledge Transmission to Ability Cultivation

Traditional computer education takes the transmission of theoretical knowledge as the core educational objective, and the evaluation of students mainly depends on the mastery of knowledge. However, in the AI era, the demand for computer talents in the industry has undergone fundamental changes. Enterprises pay more attention to students' comprehensive abilities such as computational thinking, innovative ability, and interdisciplinary application ability, rather than just the mastery of theoretical knowledge. Table 1 shows the comparison of the demand for computer talents between the traditional era and the AI era.

Table 1. Comparison of the Demand for Computer Talents in Different Eras

Evaluation Dimension	Traditional Era	AI Era
Theoretical Knowledge	High demand, focusing on memory and understanding	Basic demand, focusing on application and integration
Computational Thinking	General demand	High demand, focusing on logical reasoning and problem-solving
Innovative Ability	Weak demand	High demand, focusing on technological innovation and application innovation
Interdisciplinary Application Ability	Weak demand	High demand, focusing on the integration of computer technology and other disciplines

As shown in Table 1, the traditional computer education objective centered on knowledge transmission can no longer meet the talent demand in the AI era. The challenge posed by AI to traditional educational objectives is essentially the demand for transforming from "knowledge-oriented" to "ability-oriented", which requires traditional computer education to reposition its educational objectives and focus on cultivating students' comprehensive abilities adapting to the intelligent era.

3.2 The Reconstruction Demand from Discipline System Orientation to Technology Application Orientation

Traditional computer education content is oriented by the discipline system, with a strong theoretical nature and a relatively fixed content system. However, the rapid development of AI technology has made the traditional teaching content show obvious lag. On the one hand, the traditional computer teaching content lacks the introduction of cutting-edge AI technologies, resulting in students' insufficient understanding of the latest technological developments; on the other hand, the traditional teaching content is relatively isolated, lacking the connection with practical applications and other disciplines, making it difficult for students to apply the learned knowledge to solve practical problems.

In the AI era, the teaching content of computer education needs to be reconstructed with technology application as the orientation. It should not only add the teaching content of cutting-edge AI technologies such as machine learning, deep learning, and natural language processing, but also strengthen the integration of computer technology with other disciplines such as mathematics, physics, and biology. For example, in the teaching of data structure, it is necessary to combine the application scenarios of AI data processing to explain the practical application value of data structure; in the teaching of programming, it is necessary to introduce the programming methods and tools related to AI development. This kind of reconstruction of teaching content is a severe challenge to the traditional computer education concept centered on the discipline system.

3.3 The Reform Demand from Traditional Lecturing to Intelligent Interactive

Traditional computer education mainly adopts the lecturing teaching method, with teachers as the center, and students passively accept knowledge. This teaching method has the problems of insufficient interaction and single teaching form, which is difficult to stimulate students' learning initiative and enthusiasm. In the AI era, the development of intelligent technology has provided new possibilities for the innovation of teaching methods, and the traditional lecturing teaching method is facing severe challenges.

The intelligent interactive teaching method based on AI technology has the characteristics of personalization and interactivity, which can effectively make up for the deficiencies of traditional teaching methods. It can be seen from the figure that the intelligent interactive teaching method can significantly improve students' learning interest and learning effect.

The challenge posed by AI to traditional teaching methods requires traditional computer education to change the teacher-centered teaching concept, establish a student-centered teaching concept, and actively adopt intelligent interactive teaching methods such as intelligent tutoring systems and virtual simulation teaching to improve the quality and efficiency of teaching.

3.4 The Improvement Demand from Single Result Evaluation to Multiple Process Evaluation

Traditional computer education evaluation system mainly adopts the single result evaluation method, which takes the final examination score as the main evaluation index. This evaluation method ignores the process of students' learning and the differences in their learning abilities, and cannot comprehensively and objectively reflect students' comprehensive quality. In the AI era, the educational objective of computer education has transformed to ability cultivation, which requires the corresponding reform of the evaluation system.

The multiple process evaluation system based on AI technology can realize the comprehensive evaluation of students' learning process and learning effect. By collecting and analyzing students' learning data such as learning time, learning progress, and answer accuracy, AI technology can comprehensively grasp students' learning status and evaluate their comprehensive abilities from multiple dimensions such as knowledge mastery, learning ability, and innovative ability. This kind of multiple process evaluation system is very different from the traditional single result evaluation system, which requires traditional computer education to change the evaluation concept and establish a scientific and reasonable multiple process evaluation system.

4. Transformation Path and Practical Strategy of Computer Education Concepts in the Artificial Intelligence Era

4.1 Constructing Ability-Oriented Educational Concepts in the Intelligent Era

To respond to the challenges posed by AI to traditional computer education concepts, the first thing to do is to realize the transformation of educational concepts, that is, to construct an ability-oriented educational concept in the intelligent era. This concept takes the cultivation of students' comprehensive abilities such as computational thinking, innovative ability, and interdisciplinary application ability as the core, and regards the mastery of theoretical knowledge as the basis for ability cultivation.

To construct this educational concept, it is necessary to do a good job in two aspects: on the one hand, change the traditional knowledge-oriented educational concept, and establish the awareness that ability cultivation is the core of education; on the other hand, strengthen the connection between education and industrial practice, and take the demand for talents in the industry as the guide to determine the content and direction of ability cultivation. Only by establishing a scientific and reasonable ability-oriented educational concept can we provide a correct direction for the reform of computer education.

4.2 Integrating Artificial Intelligence Knowledge and Interdisciplinary Content

In view of the lag and isolation of traditional computer teaching content, it is necessary to optimize the teaching content by integrating AI knowledge and interdisciplinary content. Specifically, it can be carried out from three aspects: first, add the teaching content of cutting-edge AI technologies, set up special courses such as "Introduction to Artificial Intelligence", "Machine Learning", and "Deep Learning", so that students can grasp the latest technological developments; second, integrate AI knowledge into traditional professional courses, for example, integrate the application of AI in data processing into the course of data structure, and integrate the programming methods of AI into the course of programming; third, strengthen the integration of interdisciplinary content, set up interdisciplinary courses such as "AI + Biology" and "AI + Finance", and cultivate students' interdisciplinary application ability.

4.3 Creating an Intelligent-Driven Personalized Teaching Model

To realize the transformation of teaching methods, it is necessary to create an intelligent-driven personalized teaching model. Specifically, it can be promoted from two aspects: on the one hand, build an intelligent learning platform based on AI technology, which can realize functions such as personalized learning plan formulation, intelligent question answering, and learning progress tracking, and provide personalized learning support for students; on the other hand, adopt virtual simulation teaching methods, use AI technology to build virtual teaching scenes, let students carry out practical training in virtual scenes, and improve their practical operation ability and problem-solving ability. At the same time, it is necessary to strengthen the training of teachers' intelligent teaching ability, improve teachers' ability to use intelligent teaching tools, and ensure the smooth implementation of the personalized teaching model.

4.4 Establishing a Diversified and Collaborative Comprehensive Evaluation Mechanism

To improve the traditional evaluation system, it is necessary to establish a diversified and collaborative comprehensive evaluation mechanism. This mechanism takes multiple process evaluation as the core, and combines various evaluation methods such as formative evaluation and summative evaluation. Specifically, it can be carried out from three aspects: first, establish a multi-dimensional evaluation index system, including not only knowledge mastery, but also learning ability, innovative ability, and interdisciplinary application ability; second, use AI technology to collect and analyze students' learning data, realize the automatic evaluation of the learning process, and improve the objectivity and accuracy of evaluation; third, strengthen the participation of multiple subjects in evaluation, including teachers, students, and enterprises, form a collaborative evaluation pattern, and comprehensively reflect students' comprehensive quality.

5. Conclusion

This paper takes the challenges of AI to traditional computer education concepts as the research object, and systematically explores the core connotation of the challenges and the transformation path of education concepts. The research finds that AI has posed severe challenges to traditional computer education concepts from four dimensions: educational objectives, teaching content, teaching methods, and evaluation systems. These challenges essentially require traditional computer education to realize the transformation from "knowledge-oriented" to "ability-oriented".

To respond to these challenges, this paper proposes a systematic transformation path: construct an ability-oriented educational concept in the intelligent era, optimize teaching content by integrating AI knowledge and interdisciplinary content, innovate teaching methods by creating an intelligent-driven personalized teaching model, and improve the evaluation system by establishing a diversified and collaborative comprehensive evaluation mechanism. These transformation paths and practical strategies have important guiding significance for the reform of computer education in the AI era.

This research also has certain limitations. Due to the limitations of research conditions, it has not carried out in-depth empirical research on the proposed transformation path. In the follow-up research, it is necessary to select typical cases to carry out empirical research, verify the effectiveness of the transformation path, and further improve and optimize the research results.

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