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Research on the Innovative Development Path of Computer Education in Colleges and Universities in the Era of Artificial Intelligence

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Abstract: In the contemporary era, artificial intelligence (AI) is developing at an unprecedented rate and profoundly reshaping every aspect of society. Computer technology, as the cornerstone of AI, is becoming increasingly important. Universities, as the main battleground for cultivating professional talents, have a direct impact on the comprehensive quality and future development of talents through the quality of their computer education. However, there are gaps between the current university computer education and the needs of the AI era in terms of curriculum design and teaching methods. Therefore, it is urgent to explore innovative development paths for university computer education. This study focuses on the context of the AI era, deeply analyzes the existing problems in university computer education, and discusses the necessity of innovative development. Through comprehensive research, a series of innovative development paths are proposed, aiming to improve the quality of university computer education, cultivate high-quality computer professionals who meet the needs of the times, and promote new breakthroughs in university computer education in the wave of AI.

Keywords: artificial intelligence era, university computer education, innovative development paths

1. Introduction

In the age of artificial intelligence, scientific and technological development is rapid. Artificial intelligence technology, driven by computer technology as the core, is widely applied in various fields. University computer education is responsible for providing professional talents to society. However, the traditional educational model is no longer able to meet the needs of the times in terms of teaching content and methods. Therefore, exploring the innovative development path of university computer education has practical significance and strategic value.

2. Challenges Posed to University Computer Education by the Era of Artificial Intelligence

2.1 Outdated teaching content

In the age of artificial intelligence, the speed of technological iteration is increasing exponentially, with new algorithms, frameworks, and tools emerging constantly. However, the content of university computer education is often slow to keep pace with these rapid changes. The process of textbook writing and publication is time-consuming (Zhuang, 2025), and by the time they are used, some content may already be outdated. In terms of curriculum design, traditional basic courses still occupy a large proportion, while the allocation of courses in frontier areas such as artificial intelligence, big data, and cloud computing is insufficient, and the depth of course content is limited. Universities face difficulties in integrating the latest research findings in artificial intelligence technology into teaching, which requires teachers to spend a lot of time

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identifying and organizing the latest content suitable for teaching. Yet, due to constraints such as teaching plans and class hours, it is difficult to provide students with comprehensive and in-depth teaching. As a result, a gap arises between what students learn and the actual industry requirements, and they may not be able to meet the job requirements of artificial intelligence-related positions upon graduation.

2.2 Insufficient innovation in teaching methods

At present, university computer education still mainly relies on traditional classroom lectures, with teachers at the center of instruction and students passively receiving knowledge. This teaching method focuses on the teaching of theoretical knowledge, neglecting the training of students' practical abilities and innovative thinking. In the era of artificial intelligence, the application of computer technology emphasizes the resolution of practical problems and innovation, which the traditional teaching method finds hard to meet (Hu, 2025). Although some institutions have introduced experimental teaching, the experimental content is usually limited to verification experiments, lacking comprehensive and design-oriented experiments that would allow students to deeply understand the principles of artificial intelligence technology and its applications. Moreover, higher education institutions lack innovative thinking in teaching methods and have not fully utilized modern information technology, such as online teaching platforms and virtual laboratories, to enrich teaching content and improve teaching quality. There is also a lack of interaction between students and teachers, and problems encountered by students in the learning process cannot be solved in a timely manner, which in turn affects students' motivation and learning outcomes.

3. The Value of Innovative Development of University Computer Education in the Era of Artificial Intelligence

3.1 Conforming to the trend of technological development

Artificial intelligence has already emerged as a key driving force for global technological progress and industrial transformation, with its application scope continuously expanding across multiple industries, including healthcare, transportation, finance, and education. As the primary base for cultivating high-quality computer professionals, universities must keep pace with the trend of scientific and technological development and continuously innovate in computer education (Zhao, 2025). By introducing courses and teaching methods related to artificial intelligence, students can understand the basic concepts, principles, and applications of artificial intelligence and master the relevant technologies and tools, thereby developing their technological sensitivity and innovation capabilities. Only in this way can students stand firm in the future wave of technology and promote the development and application of artificial intelligence technology. At the same time, the innovative development of university computer education is also conducive to improving its technological level and academic influence, thereby attracting more outstanding talents and resources to promote the sustainable development of universities.

3.2 Meeting the social demand for talents

In today's world where artificial intelligence technology is widely applied, the requirements for computer talents in society have also undergone profound changes. Enterprises need compound talents who are proficient in traditional computer technology and possess artificial intelligence knowledge and skills to engage in the development of artificial intelligence systems, algorithm design, and data analysis. In order to meet the social demand for talents, university computer education must undergo innovative development. By adjusting the teaching content and methods, universities can cultivate innovative and practical artificial intelligence talents to meet the needs of enterprises and promote their technological innovation and industrial upgrading. In addition, the innovative development of computer education can also cultivate more outstanding scientific and technological leading talents and innovative teams for society, promote the widespread application of

artificial intelligence technology in various fields of society, and enhance social productivity and quality of life.

4. Innovative Development Paths of University Computer Education in the Era of Artificial Intelligence

4.1 Establishing AI - integrated curriculum systems

To achieve innovative development in university computer education in the age of artificial intelligence, creating an AI - integrated curriculum system is a crucial step. Traditional computer course systems generally focus on the teaching of basic knowledge and skills, with limited coverage of emerging artificial intelligence technologies. In today's environment of rapid scientific and technological development, where artificial intelligence has penetrated various fields, university computer science students must possess solid knowledge and skills to better meet societal demands for artificial intelligence. This involves a comprehensive review and optimization of existing computer courses. Outdated and redundant content is removed, and core artificial intelligence courses such as machine learning, deep learning, and natural language processing are added. These courses help students better grasp the fundamental principles and methods of artificial intelligence, laying a solid foundation for their future studies and careers in related fields (Liu, 2025).

Subsequently, emphasis is placed on the integration and connection between courses. As an interdisciplinary field, artificial intelligence technology incorporates knowledge from various subjects, including mathematics, statistics, and computer science. Therefore, in the curriculum design, disciplinary barriers should be broken down to integrate different disciplines' knowledge organically. For example, interdisciplinary courses can be set up so that while students learn computer knowledge, they can also understand the mathematical and statistical concepts applied in artificial intelligence.

Finally, a dynamic course - updating mechanism must be established. With the rapid development of artificial intelligence technology and the continuous emergence of new algorithms and models, course content needs to be updated in a timely manner to ensure that what students learn stays current with industry developments. Universities can collaborate with enterprises and research institutions to stay abreast of the latest industry trends and demands and adjust and optimize the courses accordingly.

4.2 Applying virtual simulation to practical teaching

In the era of artificial intelligence, the application of virtual simulation in practical teaching is an important way for higher education institutions to continuously innovate and develop computer education. Traditional practical teaching is often limited by space, equipment, and time, and students rarely have the opportunity to engage with large - scale complex systems and cutting - edge technological equipment (Gu, 2025). Virtual simulation - based practical teaching can overcome these limitations and provide students with a more realistic, efficient, and flexible practical environment (Zhang & Sun, 2025).

Leveraging computer and virtual reality technologies, virtual simulation creates a virtual environment similar to real - world scenarios. Within this environment, students can conduct a variety of experiments and operations to simulate actual working conditions. For example, when studying computer networking, students can use virtual simulation platforms to construct their network topology and carry out network configuration and troubleshooting experiments. This allows them to gain a more intuitive understanding of network principles and operation methods, enhancing their practical abilities.

Moreover, virtual simulation - based practical teaching provides a wealth of teaching resources and examples for educators. Teachers can design diverse virtual experimental projects and cases based on teaching content and objectives for students to practice and analyze. These projects and cases can

cover all areas of computer science, such as software development, database management, and artificial intelligence applications. Through the study and practice of these projects and cases, students deepen their understanding of theoretical knowledge, improve their problem - solving and innovation capabilities, and gain practical experience in real - world scenarios.

Additionally, virtual simulation - based practical teaching offers flexibility and repeatability. Students can practice anytime and anywhere according to their learning progress and needs. If they make mistakes or have doubts during their assignments, they can repeatedly attempt until they master the correct methods. This flexibility and repeatability enable students to learn more deeply and effectively, reinforcing their grasp of the content and improving learning outcomes.

4.3 Supporting precise teaching management with big data

In the context of the artificial intelligence era, precise teaching management supported by big data is an inevitable trend for the continuous innovation of university computer education. Big data technology can comprehensively and deeply analyze students' learning processes and behaviors, providing accurate basis for teachers' teaching decisions to improve teaching quality and efficiency (He et al., 2025).

Through big data analysis, teachers can understand each student's learning characteristics and progress. For example, by analyzing students' homework completion, exam scores, and classroom performance, teachers can identify which knowledge points are difficult for students and which areas need more attention and guidance. Based on these analysis results, teachers can develop personalized learning plans and targeted teaching services for students to help them better grasp the content.

Big data can also be applied to the evaluation of teaching effectiveness. Traditional teaching effectiveness evaluation mainly relies on exam scores, which has limitations. In contrast, big data can evaluate teaching effectiveness from multiple dimensions, such as students' learning interest, learning motivation, and learning methods. By analyzing this information, teachers can recognize problems and shortcomings in the teaching process and adjust teaching strategies and methods in a timely manner to improve teaching quality.

Moreover, big data can assist in the optimization of teaching resource allocation. Teachers can allocate and adjust teaching resources reasonably according to students' learning needs and teaching objectives. For example, if students generally struggle with a certain knowledge point, related teaching resources such as video tutorials and online exercises can be added. Conversely, if students have already mastered a knowledge point well, teaching resources for that point can be reduced to improve the efficiency of resource usage.

4.4 Promoting interdisciplinary project - based learning

In the artificial intelligence era, promoting interdisciplinary project - based learning is an important measure for the continuous innovation and development of university computer education. The cross - disciplinary integration and development of computer science is an important trend in contemporary technology. Through interdisciplinary project - based learning, students can break disciplinary boundaries to develop comprehensive literacy and innovation capabilities. Interdisciplinary project learning exposes students to diverse disciplinary knowledge and methods (Duan, 2025).

In the field of computer science, many problem solutions require the combination of knowledge from multiple disciplines. For example, in the development of an artificial intelligence medical diagnosis system, students need to master algorithms and technologies in computer science as well as professional knowledge and clinical experience in the medical field. By participating in interdisciplinary projects, students can learn different subjects' ways of thinking and research methods, broadening their horizons.

Interdisciplinary project - based learning is usually conducted in a team - based collaborative manner. Team members, with different professional

and disciplinary backgrounds, can leverage their strengths to jointly undertake project tasks. In this process, students develop teamwork and communication skills. For example, in an interdisciplinary project on smart city planning, computer science students are responsible for developing related software systems, civil engineering students undertake the design of urban infrastructure, and environmental science students assess the environmental impact of the project. Through team collaboration, students learn how to work with people from various backgrounds to solve complex problems.

Moreover, interdisciplinary project - based learning can inspire students' innovation. The collision of different disciplinary knowledge and methods often generates new ideas and creativity. For example, combining computer science with art can create innovative digital artworks, and integrating computer technology with biology can promote the development of bioinformatics. Participating in interdisciplinary projects enables students to practice and develop their innovative thinking and capabilities in practical activities.

4.5 Developing international exchange and cooperation

In the age of artificial intelligence, international exchange and cooperation are vital for the continuous innovation and development of computer education in Chinese universities. With the constant progress of globalization, international exchange and cooperation in computer technology have become increasingly frequent.

International exchange and cooperation in university computer education expose students and teachers to cutting - edge research findings and educational concepts at the international level, thereby promoting the internationalization of university computer education. These exchanges provide students with broader learning and development opportunities. Universities can collaborate with renowned foreign institutions to implement student exchange and joint - degree programs. Through these initiatives, students can spend a period studying abroad, experiencing different educational models and cultural atmospheres. During their overseas studies, they can access advanced computer technologies and research methods, expanding their academic horizons. For instance, students can participate in research projects at foreign universities and collaborate with top - notch international research teams to enhance their research and innovation capabilities.

Moreover, international exchange and cooperation help teachers improve their teaching and research levels. Universities can send teachers to study and exchange experiences at foreign institutions, learning advanced teaching methods and research practices from abroad. Teachers can also attend international academic conferences and engage with international peers to keep up with the latest research in the computer field. The knowledge and experience gained from these exchanges can be applied to teaching and research, thereby enhancing the quality of education and research.

International exchange and cooperation also promote the internationalization of university computer science disciplines. Universities can collaborate with foreign institutions on research projects, co - publish academic papers, and jointly cultivate graduate students. Through these collaborations, universities can enhance their international reputation and influence in the computer field. Additionally, universities can introduce high - quality educational resources from abroad, such as foreign textbooks and curriculum systems, to enrich their own teaching content.

4.6 Building a dynamic quality - assessment mechanism

In the era of artificial intelligence, establishing a dynamic quality - assessment mechanism has become a strong support for the innovation and development of university computer education. Traditional assessment methods are usually static and singular, making it difficult to comprehensively and timely reflect the true state of educational quality. A dynamic quality - assessment mechanism can adjust the assessment indicators and methods in real - time

according to changes in the educational environment and needs, ensuring the accuracy and effectiveness of the assessment results.

In addition to focusing on students' exam scores, the assessment should also cover several aspects, including practical ability, innovative thinking, and teamwork. For example, in the evaluation of practical ability, the assessment can examine students' performance in real - world projects, focusing on problem - solving skills and code - writing standards. The measurement of innovative thinking can be based on students' participation in research projects and the publication of academic papers.

Moreover, the assessment process itself should be dynamic. The traditional practice of conducting assessments only at the end of the term should be changed to a whole - process tracking and assessment system. The teaching

5. Conclusion

The era of artificial intelligence presents both new opportunities and challenges for university computer education. By optimizing the curriculum system, innovating teaching methods, strengthening practical teaching, enhancing the capabilities of the faculty, and deepening cooperation between universities and enterprises, university computer education can be expected to cultivate more talents that meet the needs of the times. In future development, universities need to continuously monitor the dynamics of scientific and technological development and constantly adjust and improve their educational models. Only in this way can computer education stay in step with the times and play a greater role in promoting the development of society.

Conflict of Interest

The author declares that he has no conflicts of interest to this work.

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