
Original Research Article

Practical research on artificial intelligence empowering computer teaching

Fentian Li*The Tourism College of Changchun University, Changchun, Jilin, 130607, China*

Abstract: With the rapid iteration of artificial intelligence technology, the digital transformation of education has entered a new stage, providing core technical support for the reform of traditional discipline teaching. As a core basic discipline in the digital and intelligent era, computer science integrates theory, practice and application. The traditional teaching mode has many pain points such as insufficient personalized teaching, single practical scenarios and solidified evaluation system. Based on the current situation of computer teaching, this paper explores the internal logic of the in-depth integration of artificial intelligence and computer teaching. From four dimensions of teaching resource reconstruction, teaching mode innovation, practical teaching upgrading and evaluation system optimization, it explores the practical paths of AI empowering computer teaching. Combined with specific teaching practice cases, this paper analyzes the application effects, sorts out the existing problems in the current integration process, and puts forward targeted optimization strategies. The research aims to promote the transformation of computer teaching from traditional one-way indoctrination to intelligent, personalized and precise teaching, and comprehensively improve the teaching quality and talent training efficiency of computer majors.

Keywords: artificial intelligence; computer teaching; teaching reform; personalized teaching; practical empowerment

1. Introduction

Against the background of the in-depth integration of digital economy and artificial intelligence, the digital and intelligent reform of education has become the core direction of higher education and vocational education reform. The Ministry of Education has repeatedly emphasized that it is necessary to promote the in-depth integration of new-generation information technologies such as artificial intelligence and big data with education and teaching, reshape the form of education and teaching, and optimize the talent training model^[1]. As a basic and core discipline in the field of information technology, computer science covers multiple core modules including computer foundation, programming language, data structure, software development and artificial intelligence foundation, serving as a key carrier for cultivating digital technical talents^[2].

Traditional computer teaching has long adopted the solidified model of "theoretical lecture + unified practical training". Its teaching content lags behind the development of industrial technology, and the homogenized teaching method fails to adapt to the learning rhythm of students with different foundations. Meanwhile, prominent problems such as limited practical teaching scenarios, insufficient practical guidance and single teaching evaluation lead to the disconnection between students' theories and practice, making their innovative ability and engineering practical ability unable to meet industrial job requirements. With the core advantages of big data analysis, intelligent interaction, automatic generation and precise judgment, artificial intelligence technology can effectively solve the pain points and difficulties of traditional computer teaching and empower the upgrading of the whole teaching process^[3]. Therefore, carrying out practical research on artificial intelligence empowering computer teaching has important practical significance and practical value for promoting computer teaching reform, improving talent training quality and adapting to the demand for digital talents^[4].

2. Core problems existing in traditional computer teaching

2.1. Homogenized teaching mode and lack of personalized education

Traditional computer teaching adopts unified teaching progress, content and teaching methods, ignoring individual differences among students. Students majoring in computer science have great differences in academic foundation; some students have pre-programming foundation and learn quickly, while zero-based students struggle to keep up with the classroom rhythm. Under the unified teaching mode, teachers cannot implement stratified teaching. Students with weak foundations accumulate learning loopholes, while outstanding students lack opportunities for ability improvement, resulting in serious polarization and making it difficult to achieve the educational goal of teaching students in accordance with their aptitude^[5].

2.2. Weak practical teaching and limited scenarios and guidance

Computer science is a highly practical discipline, with programming practice, project development and algorithm debugging as the core learning contents. Traditional practical teaching has obvious shortcomings. On the one hand, classroom training time is limited, and students cannot obtain real-time guidance when encountering code errors and logical loopholes in after-class practice, leading to accumulated problems and poor learning effects. On the other hand, practical scenarios are single, mostly based on basic textbook exercises, lacking real enterprise project scenarios, so students cannot master engineering development thinking and their practical ability is disconnected from industrial needs. At the same time, manual correction of codes and practical training homework is inefficient, making it difficult for teachers to provide refined error correction and guidance^[6].

2.3. Lagging teaching resources and slow content update

The information technology industry features rapid technological iteration, with new programming languages, development frameworks and intelligent technologies emerging constantly. However, traditional computer textbooks and supporting teaching resources have a long update cycle and solidified content, with outdated knowledge points and cases. Classroom teaching mainly focuses on classic theories and traditional technologies, lacking coverage of cutting-edge technologies such as generative AI, intelligent development and big data processing. This makes students' knowledge system lag behind industrial frontiers and restricts the quality of talent training^[7].

2.4. Solidified evaluation system and inaccurate learning situation judgment

Traditional computer teaching evaluation mainly relies on final written examinations and final practical assessments, supplemented by usual homework scores, featuring single evaluation dimension and lagging results. This summative evaluation model can only reflect students' phased learning achievements, but cannot capture process data such as classroom learning status, practical process loopholes and knowledge weaknesses. Teachers are unable to accurately grasp the learning situation, adjust teaching strategies targeted, or comprehensively evaluate students' practical ability, innovative thinking and problem-solving ability^[8].

3. Core advantages and integration logic of AI empowering computer teaching

3.1. Core empowerment advantages

Artificial intelligence technology has multiple capabilities including data collection, intelligent analysis, real-time interaction, content generation and automatic evaluation, which are highly adapted to computer teaching. Firstly, AI^[9] can realize real-time collection and analysis of learning situation data, accurately locate students' knowledge weaknesses, learning difficulties and ability differences, and provide data support for stratified teaching and personalized tutoring. Secondly, generative AI and intelligent programming assistants can provide 24-hour on-site practical guidance, code error correction and thinking guidance, making up for the lack of after-class teaching guidance^[10]. Thirdly, AI can dynamically update teaching resources and generate personalized exercises and project cases to adapt to technological iteration and enrich teaching content. Finally, AI can build a full-process and multi-dimensional evaluation system, realizing the transformation from "result-oriented evaluation" to "process + result" comprehensive evaluation^[11].

3.2. In-depth integration logic

The empowerment of artificial intelligence in computer teaching is not a simple superposition of technology, but a reconstruction of the whole process and all elements of teaching, constructing a "teacher-student-AI" ternary interactive teaching model. In this model, AI undertakes three roles: Cognitive tool, interactive carrier and decision support. It assists teachers in completing repetitive work such as lesson preparation, teaching, tutoring and evaluation, allowing teachers to focus on core educational work such as teaching design, thinking guidance and innovative cultivation^[12]. Students rely on AI intelligent tools to carry out independent exploration, personalized learning and practical training, changing the passive learning state. The teacher-student relationship has transformed from traditional one-way knowledge teaching to a collaborative relationship of "human-computer collaboration and two-way empowerment", which fully activates teaching vitality^[13].

4. Practical paths of AI empowering computer teaching

4.1. Reconstruct intelligent teaching resources to adapt to cutting-edge teaching needs

Breaking the solidification limitations of traditional teaching resources with artificial intelligence technology, a dynamic, personalized and cutting-edge teaching resource system can be constructed^[14]. On the one hand, AI content generation technology is adopted to update teaching courseware, handouts and case materials in combination with curriculum syllabus and industrial cutting-edge technologies, integrating emerging technologies such as generative AI programming, intelligent algorithms and big data development into classroom teaching to make up for the lag of traditional textbook content. On the other hand, an AI intelligent resource library is built to push basic exercises, advanced cases and enterprise project materials according to students' learning levels, realizing accurate adaptation of teaching resources for zero-based beginners and advanced learners^[15]. Meanwhile, the combination of open-source ecology and AI tools integrates real engineering scenario resources to make teaching content closer to actual enterprise job requirements.

4.2. Innovate human-computer collaborative teaching mode to implement aptitude education

Based on AI learning situation analysis technology, a stratified and personalized teaching mode is constructed to realize precise teaching. Before class, the AI preview platform pushes preview tasks and collects students' preview data and knowledge mastery status to accurately divide students' learning levels and locate common class difficulties and individual weaknesses, providing basis for teachers' targeted lesson preparation. In class, the AI intelligent teaching platform carries out interactive teaching, grasping students' classroom learning status through intelligent questioning, real-time answering and practical monitoring, focusing on explaining common problems and solving individual problems through real-time AI terminal Q&A. After class, the AI one-on-one intelligent tutoring mode is launched. When students encounter problems in programming and algorithm practice, AI tools provide real-time code error correction, logic sorting and thinking guidance instead of directly giving answers, so as to cultivate students' independent thinking ability. At the same time, the "AI + project-based learning" mode is implemented to assist students in project selection, scheme design, code debugging and project optimization, improving their engineering practice and innovation ability.

4.3. Upgrade intelligent practical teaching to strengthen practical ability training

Aiming at the weaknesses of traditional computer practical teaching, the practical teaching system is fully upgraded with the help of intelligent programming assistants, virtual simulation platforms and AI training systems. In basic practical teaching, intelligent programming tools such as GitHub Copilot are used to provide code completion, syntax error correction and performance optimization suggestions, helping students quickly master programming specifications and practical skills. In comprehensive practical training, the AI virtual simulation platform builds diverse training scenarios to simulate enterprise real working scenarios such as software development, system operation and maintenance, and data processing, solving the problems of insufficient offline training scenarios and equipment limitations. In project training, AI records the whole process of students' project development, monitors code standardization, logical integrity and project completion in real time, feeds back problems in a timely manner and guides iterative

optimization. In addition, AI automatically counts students' practical error questions and high-frequency problems to form personalized error sets, helping students make targeted improvements.

4.4. Build a full-process intelligent evaluation system to realize precise education

Relying on big data and artificial intelligence technology, the traditional summative evaluation mode is broken, and a trinity intelligent evaluation system of "process evaluation + summative evaluation + literacy ability evaluation" is constructed. In terms of process evaluation, the AI system collects full-dimensional data including preview status, classroom interaction, after-class homework, practical training and project practice, and automatically analyzes students' learning attitude, knowledge mastery and practical weaknesses to generate dynamic learning situation reports. In terms of summative evaluation, AI intelligent question generation, automatic marking and intelligent scoring realize accurate evaluation of programming and algorithm questions, avoiding subjective errors in manual scoring and improving evaluation efficiency. In terms of literacy evaluation, comprehensive judgment is carried out combining students' project innovation ability, problem-solving ability and independent learning ability to fully reflect students' comprehensive literacy. Teachers adjust teaching strategies accurately based on intelligent evaluation reports to implement personalized and precise education.

5. Teaching practice cases and effect analysis

This study takes the college course Python Programming as the practical carrier, selecting two parallel classes for comparative teaching experiments. The experimental class adopts the AI-enabled intelligent teaching mode, while the control class adopts the traditional teaching mode. After one semester of teaching practice, the teaching effects are compared and analyzed from three dimensions: Academic performance, practical ability and learning initiative.

The practical results show that the average final assessment score of the experimental class is significantly higher than that of the control class, with a greatly reduced failure rate and obviously improved excellent rate. In terms of practical ability, students in the experimental class perform better in code standardization, algorithm debugging ability and project development integrity, and can independently complete small and medium-sized program development projects with significantly improved engineering thinking and practical ability. In terms of learning status, benefiting from AI personalized tutoring and diversified practical scenarios, students' after-class independent learning time increases greatly, and their awareness of active questioning and independent exploration is significantly enhanced, which effectively alleviates the phenomenon of student polarization. At the same time, AI intelligent lesson preparation and automatic marking greatly reduce teachers' repetitive work burden, enabling teachers to focus more on teaching design, students' thinking cultivation and personalized Q&A, realizing dual improvement of teaching quality and talent training efficiency.

6. Conclusion

The in-depth integration of artificial intelligence and computer teaching is an inevitable trend of discipline teaching reform in the digital era, as well as a core path to solve the pain points of traditional teaching and improve talent training quality. Artificial intelligence technology can effectively reconstruct computer teaching resources, innovate teaching modes, upgrade practical systems and optimize evaluation mechanisms, promote the transformation from homogenized teaching to personalized and precise teaching, effectively improve students' practical ability, innovative thinking and independent learning ability, and greatly enhance teaching efficiency and talent training quality.

Fundings

Changchun University School of Tourism's 2024 Vocational Education and Adult Education Teaching Reform Research Topic^[1]("Research on the Reform and Practice of Computer Course Teaching in Vocational Colleges under the Background of Digital Transformation").

Jilin Province's key self-funded higher education research projects in 2025 [JGJX25C313](Research on the reform of hybrid teaching model of basic computer courses based on OBE concept under the

background of artificial intelligence).

Scientific research project of Jilin Provincial Department of Education[JJKH20260528SK](Practical research on the ideological and political construction of computer courses under the "BOPPPS+ divided classroom" teaching model).

References

- [1] Chen L, Gao X. Adaptive personalized teaching system of computer courses based on big data and AI[J]. *Computers & Education*, 2022, 189: 104567.
- [2] Liu J, Zhang H. Intelligent programming assistant application in engineering computer practical teaching[J]. *IEEE Access*, 2023, 11: 45892-45901.
- [3] Zhang Y, Wang Q. Generative AI empowered reform of university programming teaching[J]. *Education and Information Technologies*, 2024, 29(5): 5689-5706.
- [4] Brown T, Miller S. The application of large language models in computer programming instruction[J]. *Journal of Educational Computing Research*, 2024, 62(3): 512-536.
- [5] Wang Z, Xu L. Research on the integration path of generative AI and computer engineering education[J]. *IEEE Transactions on Education*, 2025, 68(1): 78-85.
- [6] Zhu Z T, Hu J. Core logic and practical path of artificial intelligence empowering digital transformation of education[J]. *China Educational Technology*, 2021(9): 1-8.
- [7] Miao F C. Construction and cultivation strategy of college teachers' artificial intelligence teaching competence framework[J]. *Open Education Research*, 2022, 28(3): 66-74.
- [8] Huang R H, Zhang J L. Teaching reform and innovative path of college computer courses in intelligent era[J]. *E-education Research*, 2022, 43(7): 92-99.
- [9] Lu Y, Chen P H. Research on the reconstruction of computer practical teaching mode from the perspective of human-computer collaboration[J]. *Modern Educational Technology*, 2023, 33(4): 112-119.
- [10] Li Y Y, Wang X C. Construction of process evaluation system for computer courses based on learning big data[J]. *China Distance Education*, 2023(6): 45-53.
- [11] Guo L F, Xing Z H. Practical dilemmas and optimization strategies of generative AI empowering programming teaching[J]. *China Information Technology Education*, 2024(5): 15-20.
- [12] Wang D Q, Liu M. Practical research on stratified computer teaching supported by intelligent programming tools[J]. *E-education Research*, 2024, 45(2): 88-95.
- [13] Zhang L G, Ma J. Reform logic and implementation path of artificial intelligence empowering college practical teaching[J]. *Research in Higher Education*, 2024, 45(8): 85-92.
- [14] Chen A Q. Research on the cultivation path of AI literacy for computer majors in digital intelligence era[J]. *Modern Education Science*, 2025(3): 78-84.
- [15] Liu G P, Zhou Q. Research on risk governance and teaching application norms of educational artificial intelligence[J]. *China Educational Technology*, 2025(1): 33-40.