

Research on the Innovation of AI-Based Blended Teaching Model for Public Computer Courses: Taking University Programming Courses as an Example

Caili Tian, Pan Pu, Wenliang Wu*

College of Information Engineering, Northwest A&F University, Yangling 712100, Shaanxi, China

**Author to whom correspondence should be addressed.*

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Abstract: Public computer courses in universities are compulsory courses for non-computer majors in many colleges and universities. Guided by the “student-centered” teaching philosophy, this study explores in depth the AI-integrated blended teaching model for public computer courses. Taking university programming courses as the specific research object, it integrates the advantages of AI technology and blended teaching to innovate teaching methods and means, and studies the blended teaching model that combines online learning and offline teaching in the teaching of public computer courses. The ultimate goal is to improve teaching quality and cultivate students’ computational thinking, programming ability, and innovative thinking.

Keywords: AI; Online learning; Offline teaching; Blended teaching

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1. Introduction

Artificial Intelligence (AI) has become one of the core technologies of the current era, profoundly influencing people’s ways of working and learning. In the field of higher education, the integration of AI technology has brought new opportunities and challenges to teaching, prompting teachers to explore new teaching models to adapt to the development needs of the times.

Public computer courses are compulsory for non-computer majors in universities. As an important part of public computer courses, university programming courses enable students to master the basic methods of solving problems with computers and acquire the ability to solve practical problems using programming technology. The traditional teaching of this course adopts a “teacher-centered” model, where teachers play a dominant role and teaching is mainly based on lectures. This model has several problems: students lack learning initiative; due to the high difficulty of the course, students have a low utilization rate of after-class learning resources; teachers

cannot answer questions in real time, leading to the accumulation of students' problems and thus undermining their learning confidence.

This study aims to integrate AI into university programming courses to provide diversified teaching support for teachers and bring new learning experiences and methods for students. By combining the advantages of AI technology and blended teaching ^[1], it intends to innovate teaching methods, optimize the teaching process, and improve teaching quality.

2. Analysis of the current situation of computer public course education and the application of AI in teaching

2.1. Analysis of the current situation of computer public course education

As an important course for cultivating students' computational thinking and programming skills, university programming courses are in wide demand in the interdisciplinary integration of artificial intelligence, big data, and other fields. The problems existing in current teaching are mainly reflected in three aspects: teaching content, teaching methods, and teaching evaluation. In terms of teaching content, it involves a large number of grammatical rules, algorithm design, and programming concepts. These contents are inherently abstract and complex, making it difficult for students who are exposed to programming for the first time to understand and master. In terms of teaching methods, the teacher-centered lecture model is adopted ^[2], where students passively accept knowledge and lack opportunities for active thinking and exploration. In terms of teaching evaluation, emphasis is placed on students' memory and understanding of knowledge, which makes it difficult to flexibly apply the learned knowledge to solve practical problems and comprehensively evaluate students' comprehensive qualities, such as programming ability, practical problem-solving ability, and teamwork ability.

2.2. Analysis of the application of AI in teaching

In recent years, research on the application of AI technology in the field of education has been in full swing. In terms of AI-assisted teaching, AI can provide teachers with diversified teaching support: from organizing teaching content, designing teaching activities, to recommending teaching resources, it helps teachers quickly screen and integrate high-quality teaching resources, saving time and energy on lesson preparation. AI also provides support for students' learning: it offers personalized resource recommendations for students at different levels and with different learning progress, enabling personalized learning. Various intelligent agents can answer students' questions at any time and provide real-time feedback and guidance. When applied to university programming courses, AI provides multiple forms of support in aspects such as teaching content, teaching methods, and teaching evaluation.

3. Design of a blended teaching model combining “Online Learning and Offline Teaching” based on AI

3.1. Design philosophy

Blended teaching and learning is “a learning environment that combines face-to-face teaching with teaching mediated by technology” ^[3]. It integrates teachers' in-person instruction with online teaching, emphasizing both the leading role of teachers in guiding, inspiring, and monitoring the teaching process, and fully reflecting the initiative, enthusiasm, and creativity of students as the main body of the learning process. The blended

teaching model emphasizes “student-centeredness”, where students play a dominant role in teaching activities. “Student-centeredness” requires that: the setting of course teaching objectives should be centered on students’ development; the implementation of teaching activities should be centered on students’ learning; and teaching evaluation should be centered on learning effects^[4]. Students’ learning objectives, learning behaviors, and learning assessments are consistent, interact with each other, as shown in **Figure 1**. In the blended teaching model, teachers use AI tools to set teaching objectives for students^[5,6], screen teaching materials, organize students’ learning behaviors, provide feedback on learning activities, and evaluate students’ learning behaviors^[7,8].

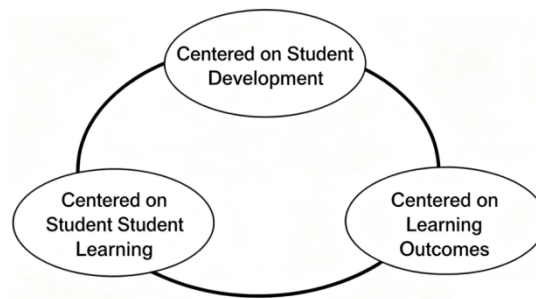


Figure 1. Student-centeredness.

3.2. Construction of teaching model

The AI-based hybrid teaching model for university programming courses can be designed to consist of three complementary modules: the online learning module, the in-class teaching module, and the AI-assisted teaching module.

3.2.1. Online learning module

This module leverages AI to provide students with diverse learning resources and personalized learning experiences. It uses knowledge graphs to organize learning resources, which include course chapter structures, student study guides, knowledge point-related videos, chapter quizzes, assignments, and discussion topics. By constructing relationships between knowledge points through knowledge graphs, the module accurately pushes the most suitable learning resources to each student based on multi-dimensional data such as their learning history, study habits, knowledge mastery, and real-time learning status. Students can independently choose learning content and methods according to their own schedule and learning progress.

3.2.2. In-class teaching module

In the teaching preparation phase, AI tools are used to set teaching objectives, organize and optimize course content, design teaching plans, and enrich teaching cases that integrate programming courses with students’ majors. Teachers can also use AI tools to more efficiently carry out teaching activities such as attendance checking, voting, student selection, quick-response quizzes, topic discussions, tests, and questionnaires. These tools can display the interaction process in real time and intelligently analyze results, thereby stimulating students’ learning interest and improving in-class teaching efficiency.

3.2.3. AI-assisted teaching module

From the student perspective, AI tutors can understand students’ questions and quickly retrieve accurate answers

from a vast knowledge base. In programming courses, this module can not only provide real-time debugging guidance for faulty programs but also generate code on demand, enabling students to solve more complex problems. From the teacher's perspective, it can analyze students' learning behaviors, progress, and knowledge mastery, identify existing problems and potential risks in the learning process, and help teachers adjust teaching strategies and methods in a timely manner. Additionally, it can detect students with academic difficulties in advance and provide early warning information to teachers, facilitating timely intervention measures.

3.3. Design of teaching evaluation system

The university's public computer courses adopt a multi-dimensional evaluation approach, and the course assessment can be divided into two parts: regular assessment and final assessment.

In the regular assessment phase^[9–11], AI tools are used to quantify the assessment of teaching activities. This phase is further divided into three parts: pre-class assessment, in-class assessment, and post-class assessment. The specific evaluation contents and methods are shown in **Table 1**, which are used to measure students' understanding and mastery of the basic knowledge of programming courses.

Table 1. Regular evaluation methods of the course

Teaching stage	Teaching activities	Evaluation purpose	Evaluation methods
Pre-class	1. Learning task sheet 2. Mind map 3. Knowledge video	1. Mastery of knowledge objectives 2. Knowledge connection 3. In-class knowledge content	1. Video view count 2. Unit self-test
In-class	1. Classroom activities 2. Group activities	1. Students' in-class learning effect 2. Problem feedback and resolution	1. Classroom activity points 2. Group activity points
Post-class	1. Discussion topics 2. Chapter exam 3. Group assignment	1. Degree of objective achievement 2. Group collaboration	1. Discussion topic points 2. Chapter exam 3. Group points

For the final assessment, students may choose either the examination or the project defense. The examination mainly assesses students' mastery of basic concepts of programming, syntax rules, algorithm design, etc., covering various question types such as fill-in-the-blank questions, short-answer questions, and programming questions. The project defense evaluates students' programming ability and problem-solving abilities. Students are required to design a project that uses application programming to solve problems related to their major, write code with the help of AI tools, independently complete a programming project with certain functions and complexity, and finally obtain the assessment result through the project defense^[12–14]. Through multi-dimensional evaluation and a student-centered approach, diversified assessment for students with different learning levels and abilities is realized.

4. Conclusions and prospects

This study focuses on the research of an AI-based hybrid teaching model for public computer courses. Adhering to the "student-centered" teaching theory, it constructs an innovative teaching model. This model organically integrates online learning modules, classroom teaching modules, and AI-assisted teaching modules, realizing the intelligence and personalization of the teaching process^[15]. In practical teaching, questionnaire surveys show that students have a high satisfaction with the AI-based hybrid teaching model. Their learning interest and enthusiasm

have been significantly improved, and classroom participation and learning activity have been obviously enhanced, indicating that this model can stimulate students' learning enthusiasm and promote their active and autonomous learning. Currently, AI technology is in a stage of rapid development, and its application in teaching still needs to be expanded in terms of depth and breadth. With the advancement of technology, it will be applied to more and more complex teaching scenarios.

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