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Teaching Innovation of Programming Courses Based on Artificial Intelligence

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Abstract: Aiming at the problems existing in the teaching of computer programming courses in higher vocational colleges, such as poor connection of progressive difficulty course content, significant differences in student academic levels and a single evaluation mechanism, this paper proposes an online-offline blended teaching model based on artificial intelligence technology, which reconstructs the curriculum content system based on classic Web front-end framework technology projects. Through teaching scenarios such as AI-assisted programming, project-driven group assignments, and a differential group assignment evaluation mechanism, the model enriches students' learning experience and promotes the in-depth integration of cutting-edge technologies with curriculum teaching. Verified by one semester of teaching practice, the excellent rate and pass rate of the course have been significantly improved, and students have also made certain breakthroughs in competition and scientific research achievements. This teaching model effectively enhances students' professional skills for Web front-end positions and their team collaboration abilities, providing a referable implementation path for the reform of computer programming courses.

Keywords: Artificial intelligence; Computer programming courses; Higher vocational education; Innovation of teaching content and methods

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1. Introduction

With the advent of the digital age, computer technology has been applied in all walks of life. Therefore, cultivating students' programming ability and computational thinking has become one of the important goals of higher vocational education [1]. However, the current teaching of computer programming courses often faces many challenges. For example, the course "Web Front-end Framework Technology" features strong progressivity of programming knowledge and operations, rapid technological iteration, and high requirements for programming ability [2]. At present, however, the traditional teaching methods of programming courses in domestic vocational colleges have such problems as poor connection of progressive difficulty course content [3], significant differences in student academic levels [4], and a single evaluation mechanism [5].

The rapid development of artificial intelligence technology has brought new possibilities to the field of

education. Among them, the progress of natural language processing and generation technology provides new ideas and methods for improving programming teaching, with excellent performance in contextual understanding and logical coherence of text generation, and particularly inherent advantages in generating specific program codes. This paper aims to explore how to use artificial intelligence technology to empower the teaching of computer programming courses in higher vocational colleges, so as to improve teaching effects and learning experience.

2. Research status

At present, preliminary research has been conducted on the application of artificial intelligence in the field of teaching assistance at home and abroad: Huang Huiting [6] explored methods for curriculum construction using artificial intelligence digital tools in higher vocational education; Vásquez et al. [7] discussed the potential educational applications of artificial intelligence in AI-assisted diagnostic teaching under the blended learning model; Ye Yu et al. [8] explored the application strategies of implementing artificial intelligence AI teachers in smart teaching. Some colleges and universities have cooperated with enterprises to actively explore project-based and task-based teaching processes, which have alleviated the drawbacks of the one-size-fits-all evaluation system for programming courses to a certain extent [9].

Such researches provide a multi-dimensional perspective on the application of artificial intelligence in the field of teaching assistance, but most of the current studies only focus on the role of artificial intelligence in assisting traditional teaching models, with few applied researches on AI-assisted programming teaching in the education field: Zheng et al. [10] proposed CodeGeeX, a multi-programming language code generation model based on artificial intelligence technology, which is powerful and capable of completing code generation, code completion, code explanation and code translation tasks; Lu Jun [11] took the Python programming course as an example, combined with teaching cases of intelligent programming assistants, to discuss the specific application and practice of artificial intelligence technology in the teaching of computer programming courses in higher vocational colleges.

Through the research and summary of existing work, this paper combines the existing researches of artificial intelligence in the fields of teaching assistance and programming assistance, and takes the course “Web Front-end Framework Technology” as an example to realize the composite application in the “programming + teaching” field, so as to adapt to the teaching needs of practical computer programming courses in higher vocational colleges.

3. Construction of an online-offline blended course of the “Web Front-end Framework Technology” based on artificial intelligence

The construction of the online-offline blended course of “Web Front-end Framework Technology” based on artificial intelligence proposed in this paper reconstructs the various knowledge points in the knowledge domain of the course teaching, and constructs an online-offline blended teaching framework supported by an offline information-based curriculum teaching system and an online practical ability training system. It empowers the whole teaching cycle with artificial intelligence and achieves innovative breakthroughs.

3.1. Overall framework design

Comprehensively utilizing online learning platforms and offline classroom environments to build online-offline

blended courses for optimizing teaching forms [12], the curriculum teaching system is designed by considering the difficulty of programming knowledge points of Web front-end framework technology and the connection and dependency between knowledge points. The teaching of theoretical knowledge is divided into three modules: basic, advanced and expanded, namely Vue basic programming syntax (ES6 syntax and V-directive syntax), Vue computation and listening, and Vue components. Matching the theoretical knowledge modules, the cultivation of students' programming ability is also divided into three links: basic syntax example programming practice, computation and listening example programming practice, and component-based project development practice. Each part is explained theoretically and demonstrated practically by teachers. The whole-process teaching evaluation is realized through the "X+2" model of 3 formative practical assessments + regular theoretical learning performance + final practical assessment, enriching the "integration of theory and practice" teaching.

3.2. AI-assisted programming system

Traditional online teaching is usually dominated by video resources, supplemented by exercises and graphic materials. Although rich in content, it is still difficult to get rid of the cramming teaching mode. To enrich online teaching content, on this basis, this paper uses the currently popular artificial intelligence large language model to realize an AI-assisted programming system. To avoid students over-relying on artificial intelligence for writing entire sections of code, the local system screens and controls code generation by adding a prompt library, restrictive fields and code length limits. At the same time, more code knowledge points are gradually unlocked with the deepening of the course.

3.3. Differential group assignment evaluation method

This paper carries out a reasonable reform on the traditional egalitarian group assignment scoring mechanism in task-driven teaching and proposes a differential group assignment evaluation method. First, a combination of 3 formative evaluations and a summative evaluation is adopted to promote students' whole-process learning. Then, a group assignment contribution table mechanism is added to the evaluation of each formative assessment project task. After the project presentation, teachers will ask students at different levels questions of varying difficulty according to the ranking of the contribution table, and add points according to students' answers. This mechanism keeps track of each student's learning progress, urges students to self-improve and promotes personalized education.

4. Teaching effects and teaching reflection

To verify the effect of the construction of the AI-based online-offline blended course of "Web Front-end Framework Technology," the course assessment, competition, and scientific research results before and after the teaching implementation were counted, as shown in **Table 1**. The effectiveness of the curriculum construction proposed in this paper is demonstrated through a comparative analysis of students' learning outcomes, and teaching reflections are summarized.

4.1. Verification of teaching effectiveness

In terms of course evaluation, driven by the AI-assisted programming system and group learning, underachieving students have more learning motivation and greater enthusiasm to complete assignments. The number of absent students and failing students in each class has decreased significantly, with the total number of failing students

reduced by about 30% to less than 30. According to the school regulations, offline make-up courses are not required, which greatly reduces the impact of sophomore make-up courses on junior students' further education and job hunting. In addition, due to the addition of the contribution incentive mechanism, the atmosphere of breakthrough and innovation among top students has been enhanced, and they are more motivated to complete extended learning content. The excellent rate and good rate have increased by an average of about 10%.

In terms of competitions and scientific research, after the curriculum construction, the major has made several zero-to-one breakthroughs in Web front-end framework technology-related competitions and scientific research: for the first time, students of the major won national awards in the Blue Bridge Cup Web Application Development Competition, breaking the upper limit of the major in this competition, and also made a breakthrough in the award level of the Application Software System Development Competition in the provincial vocational skills competition. In addition, students completed the application for software copyright by writing programs using the learned Web front-end framework.

Table 1. Comparison of learning outcomes before and after the teaching reform

Comparison of Students' Outcomes	Before the Reform	After the Reform
Failing Situation	More than 30 students (offline make-up classes required)	Less than 30 students (only online make-up classes required)
Excellent & Good Rate	About 20%	About 30%
National Awards in Blue Bridge Cup Web Application Development	0	2
Second Prize and Above in Provincial Vocational Skills Competition (Application Software System Development)	0	1
Software Copyrights for Web Front-end Framework Technology Projects	0	2

4.2. Teaching reflection

Artificial intelligence integrates the time and space of teaching and learning, breaking the boundary between traditional classroom teaching and students' independent learning [13]. Students can interact with artificial intelligence for learning anytime and anywhere, obtain teaching resources and get answers to questions, thus realizing the seamless integration of time and space for teaching and learning. In the process of carrying out AI-empowered curriculum teaching, due to the powerful capabilities of AI, students, to some extent, show signs of AI dependence, habitually relying on AI when encountering difficulties, which has a certain impact on their subjective initiative and independent thinking ability and reduces them. Teachers need to fully integrate ideological and political education related to artificial intelligence in curriculum construction and instill correct concepts of scientific and technological application in students. Cutting-edge technologies such as artificial intelligence serve people, and students need to improve their abilities through technology, rather than using it as a tool to cope with assignments. The focus of offline classroom teaching is to help students construct a systematic knowledge system, inspire their critical thinking and innovative application abilities, and guide students to form a good view of science and technology and values through teacher-student emotional communication, project process design, knowledge interactive feedback and ideological and political education.

5. Conclusion

This paper conducts an in-depth discussion on how artificial intelligence empowers computer programming courses in higher vocational colleges, demonstrating the potential and application prospects of generative artificial intelligence technology in the field of education. As an intelligent teaching assistant tool, artificial intelligence can provide new ideas and methods for the teaching of computer programming courses in higher vocational colleges. However, the application of artificial intelligence technology in the field of education is still in the initial stage and needs continuous improvement and perfection, especially when it involves ideological and ethical and legal issues [14], it should be viewed prudently. In the future, it is necessary to further explore the application scenarios, methods, and construction of ethical and legal systems of artificial intelligence in the field of education, and combine teachers' professional knowledge and experience to jointly promote the development and progress of education and teaching.

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