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AI-powered Reform of the Teaching Model for Engineering Practice Courses

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Abstract: With the rapid development of information technology, artificial intelligence (AI) has been developing quickly, exerting a wide-ranging and profound impact on various industries. It also shows increasing potential in the field of education. With the continuous deepening of teaching reform and the increasingly complex social environment, the market and society have higher requirements for high-level talents. The traditional teaching model can no longer adapt to this development trend and meet the ever-changing teaching needs of college students. Against this background, this paper focuses on the practical courses of engineering majors in colleges and universities, exploring the effective application of AI technology in the reform of teaching models. Starting from the practical significance of reforming the teaching model of engineering practice courses, it delves into the effective application of AI in this reform. By optimizing the teaching model of engineering practice from various teaching elements, it aims to improve teaching quality and effectiveness, provide students with a better teaching experience and personalized learning paths, cultivate students' solid theoretical foundation and practical abilities, enhance the comprehensive quality of engineering students, and supply more high-quality engineering talents to related industries.

Keywords: Artificial intelligence technology; Engineering; Practical courses; Teaching reform

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1. Introduction

Engineering is an important part of higher education. Engineering majors in colleges and universities cover many fields, including machinery, civil engineering, artificial intelligence, new energy, and other aspects, which are closely related to scientific progress, economic development, and social livelihood. Practical courses are the core link in the professional construction and ability development of engineering students, playing an irreplaceable role in cultivating students' practical abilities, innovation abilities, and problem-solving abilities. However, traditional practical courses are relatively backward in teaching concepts, teaching methods, teaching content, and other aspects, failing to truly play their role in cultivating students' comprehensive abilities. Therefore, the reform of the

teaching model is urgently needed.

2. Practical significance of AI-powered reform of the teaching model for engineering practice courses

2.1. Conducive to improving learning outcomes and stimulating students' interest

Traditional engineering practice courses are restricted by time, space, funds, and other factors. When students take these courses, they may face problems such as scarce practical equipment resources and insufficient practical opportunities, which affect teaching effectiveness. At the same time, issues like equipment debugging failures and unshared data may also occur in traditional engineering practice courses, affecting the overall teaching progress and efficiency [1]. There may even be a teaching model that "emphasizes theory over practice," ignoring the fundamental purpose of practical courses. In addition, in traditional engineering practice teaching, there are problems such as poor teacher-student interaction and long information feedback times, which affect the overall teaching efficiency. The application of AI technology in engineering practice teaching can effectively alleviate these problems [2]. For example, the emergence of virtual laboratories allows students to conduct practical exercises anytime and anywhere without being restricted by time and space. This not only saves a lot of time wasted due to operational errors or waiting, but also enables teachers to monitor students' practical progress and operation status in real-time through Internet technology, promptly identifying and correcting problems in students' operations and improving teaching effectiveness.

2.2. Conducive to enhancing practical abilities and cultivating innovation consciousness

The application of AI technology in engineering practice courses can simulate real-world work scenarios, enabling students to face real challenges and problems in such scenarios. This can not only exercise their ability to solve practical problems but also help them accumulate practical work experience and improve their market adaptability [3]. In virtual practice scenarios, students do not need to worry too much about operational risks, so they are more willing to try innovative solutions, which stimulates their innovative thinking. Moreover, without the limitation of equipment wear and tear, students can conduct repeated exercises, effectively improving their operational proficiency and cultivating their practical and hands-on abilities [4]. In addition, AI technology has unique advantages in data processing. It can conduct detailed analysis based on students' learning situations, push personalized exercises targeting students' knowledge weaknesses, provide inspiration for innovation, and help students solidify basic skills while guiding them to think multidimensionally and cultivate innovative thinking awareness, thus cultivating students' good innovation abilities.

3. Teaching approaches for AI-powered reform of the teaching model for engineering practice courses

3.1. Strengthening technical training to improve teachers' and students' digital literacy

The application of AI in practical teaching poses more requirements for teachers and students. Teachers and students need to have a basic understanding of AI technology and master basic operation skills to effectively use AI technology for teaching assistance. First, increase teacher training efforts [5]. Teachers are the main implementers of classroom teaching. Their understanding and application of AI technology largely determine the teaching effect. To achieve the AI-powered reform of the teaching model for engineering practice courses, it

is necessary to first improve teachers' AI literacy. On the other hand, colleges and universities can invite experts and scholars in the field of AI to campus, and through forms such as special lectures, symposiums, and seminars, systematically explain the principles and operation skills of AI technology to teachers, reversing some teachers' biases and resistance to the participation of AI in teaching, innovating teaching concepts, and ensuring that teachers truly understand the principles and operation skills of AI technology, including application, debugging, and simple maintenance. On the other hand, schools can invite other colleges and universities that have successfully applied AI in engineering practice teaching to share their experiences, or arrange for teachers to conduct on-site inspections and studies in relevant institutions, allowing teachers to observe the practical application of AI up close, learned from successful experiences, master usage skills, and effectively improve teachers' AI technology application abilities in engineering practice course teaching. Second, as the main body of learning, students also need to improve their digital literacy [6]. Schools can offer general AI courses to engineering students, teaching them basic theoretical knowledge and application skills of AI, helping them develop a scientific understanding of AI, and master basic operation skills. Subsequently, schools can carry out more targeted special training activities according to the characteristics of different engineering majors and their practical teaching, helping students better understand and apply AI technology in practical teaching, improving the flexibility and innovation of practical operations, effectively giving play to the value and role of AI technology in practical teaching, and cultivating students' good digital literacy and professional practical abilities [7,8].

3.2. Innovation of teaching methods and introduction of online teaching platforms

AI technology brings more possibilities to online teaching. With the assistance of AI technology, teachers can further expand the scope of original online teaching resources and provide students with more personalized and targeted practical teaching forms. Teachers can adopt the online-offline blended teaching method. While retaining traditional offline classroom teaching, they introduce more intelligent online teaching platforms to comprehensively improve the quality of practical teaching. Engineering practice courses attach great importance to the cultivation of students' abilities, including good professional practical abilities, problem-solving abilities, innovative thinking abilities, and teamwork abilities. Therefore, teachers can flexibly use online and offline teaching platforms. Online teaching mainly focuses on knowledge explanation, allowing students to conduct self-study in their spare time, while the limited offline classroom teaching time focuses on practical operations and project implementation. By reasonably allocating teaching time, online and offline teaching can complement each other's advantages, ensuring the synchronous development of students' theoretical foundation and practical abilities. Developing intelligent online teaching platforms [9]. Online teaching platforms mainly serve for students' self-study in their spare time. Teachers of engineering practice courses can use online teaching platforms to upload learning materials, or with the help of micro-courses and MOOCs, break down complex knowledge points into easy-to-understand modules and record explanatory videos for students to watch repeatedly, consolidate understanding, and master knowledge points as much as possible. In addition, teachers can record operation videos for practical skills learning and use augmented reality technology to create three-dimensional skill operation videos for students, enabling students to observe operation details from all angles and master operation essentials [10]. To meet the personalized learning needs of students, teachers can use AI technology to accurately analyze students' learning data, identify their weaknesses in the learning process, generate personalized learning plans based on students' learning situations, and intelligently push relevant learning materials to ensure learning effects. At the same time, the online teaching model emphasizes students' independent exploration in their spare time. Teachers

can use AI technology to dynamically monitor students' learning processes to ensure learning effectiveness.

3.3. Optimizing the teaching experience and enriching offline teaching links

The introduction of intelligent online teaching provides more opportunities for practical operations and interactions in offline teaching. The focus can be shifted from knowledge explanation to practical operations. Teachers can further refine and optimize offline practical content according to students' professional characteristics, giving students more opportunities for practical operations. At the same time, relying on AI technology, teachers can provide students with more diverse teaching resources and tools to enhance the practical experience. In offline teaching links, such as virtual laboratories and simulation software, the practical experience can be enhanced [11]. Taking the electrical engineering major as an example, after students have self-studied online knowledge, teachers can briefly establish a knowledge system and conduct centralized explanations on teaching key points, difficult points, and common problems among students, ensuring that students can deeply master relevant knowledge points of the electrical engineering major and establish the connection between theoretical knowledge and electrical skills operation [12]. Subsequently, the focus can be placed on the practical teaching link. Teachers can refine the practical teaching content. According to the characteristics of electrical engineering practical teaching, the teaching content can be divided into principal operation and maintenance, disassembly and repair, and detection and diagnosis categories. Then, based on the difficulty level of the teaching content, progressive and heuristic education can be carried out for students, guiding them to conduct hands-on operations, learning, understanding, and internalizing electrical engineering knowledge in practice, and continuously improving professional skills through the inspection of theoretical knowledge and practice, cultivating good professional application abilities and practical levels. In the process of practical teaching, teachers can introduce more interactive elements relying on AI technology [13]. For example, using virtual reality technology, immersive practical environments can be created for students. On the one hand, this can simulate real-world work scenarios, allowing students to deal with problems faced in actual work, improving their problem-solving abilities and enhancing their practical experience. On the other hand, for experimental projects with certain risks, complexity, and high costs, virtual reality technology can effectively reduce safety risks and practical costs, enabling students to conduct multiple and repeated operation exercises to ensure that they master operation skills proficiently and comprehensively improve their practical abilities [14]. Another example is that teachers can introduce an intelligent Q&A system supported by AI technology. Students can ask real-time questions about personalized problems that occur during the practical process and get immediate answers, consolidating the learned knowledge. This can also reduce the teaching pressure on teachers and improve teaching efficiency. The intelligent Q&A system can also monitor students' practical operation links in real-time, promptly warning and correcting students' wrong and dangerous operation behaviors to ensure operation safety. It can also record students' learning data, providing meaningful references for teaching evaluation [15].

4. Conclusion

In conclusion, in the process of the in-depth advancement of the digital and intelligent era, AI technology plays an increasingly important role in the field of education and teaching. Engineering practice courses in colleges and universities are directly related to scientific and technological progress and economic development. They should keep pace with the times, deeply understand and apply AI technology, abandon the traditional teaching model mainly based on knowledge infusion, and shift to practical teaching with the cultivation of abilities as the core.

The introduction of AI brings new opportunities for transforming the talent-training model of engineering practice courses, helping to continuously improve the quality of engineering talent cultivation in colleges and universities. Colleges and universities should actively explore the in-depth integration of AI and engineering practice. Through optimizing teaching objectives, enriching teaching content, innovating teaching methods, and other means, they can provide students with a better, more interactive, and personalized teaching experience. At the same time, they should strengthen the training of teachers' and students' digital literacy to ensure that teachers and students can adapt to the effective application of AI technology in teaching. With the joint efforts of multiple parties, students' comprehensive abilities can be promoted to develop in an all-around way, cultivating and supplying high-quality, innovative engineering talents with both solid theoretical foundation and practical abilities to the country, and contributing to the country's economic development.

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