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Exploration and Practice of Teaching Reform in Digital Electronic Technology Course Driven by Artificial Intelligence and OBE

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Abstract: With the rapid development of science and technology, the field of digital electronics technology is changing rapidly, which puts forward higher requirements for talent training. This paper addresses the urgent need for digital electronics technology course reform and proposes a reform implementation strategy under the dual-drive model of artificial intelligence and OBE. By updating the teaching content to introduce new technologies, adopting flipped classrooms and task-driven teaching methods to enhance learning interest, building training centers to strengthen practical teaching, and establishing a diversified evaluation system to pay attention to the learning process, curriculum reform is comprehensively promoted. The implementation of these strategies not only improves the quality of teaching and students' learning effectiveness but also lays a solid foundation for cultivating digital electronic technology talents with innovative spirit and practical ability. This teaching reform adapts to the development trend of the industry and promotes the organic convergence of the education chain, talent chain, and industrial chain, innovation chain.

Keywords: digital electronics; curriculum reform; artificial intelligence; OBE; practical teaching; diversified evaluation

Introduction

In the teaching process of electronic information engineering technology, the course Digital Electronics Technology is a bridge connecting theory and practice, hardware and software, which lays a solid foundation for students to master the core skills of modern electronic system design, analysis, and troubleshooting. With the rapid changes in information technology and the escalating demand for professionals in the industry, the digital electronics technology course is in urgent need of teaching reform to innovate the talent training mode. In this context, exploring the teaching reform of digital electronics technology courses driven by artificial intelligence (AI) and outcome-oriented education (OBE) helps to build a new teaching system that can keep pace with the development of technology and effectively improve students' comprehensive ability and innovation ability, and injects new vitality and kinetic energy into the education of electronic information engineering technology majors.

1. Background and Direction of Digital Electronics Technology Course Reform

1.1 The dilemma of traditional teaching mode

In the teaching practice of digital electronic technology courses, the traditional teaching mode gradually reveals its limitations and becomes a key factor restricting the improvement of teaching quality and effect. First, the traditional teaching mode often focuses on the instillation of theoretical knowledge, while ignoring the cultivation of practical skills. In this mode, although students can master a certain theoretical foundation, in the face of the actual electronic system design, debugging, and problem-solving, they often seem to be incompetent. Secondly, the teaching content often lags behind the development of industry technology, the lacks of close convergence with the latest technological developments, resulting in a disconnect between what students learn and the needs of society (Deng et al., 2024). Third, the traditional teaching method is single, lacks interactivity and personalization, makes it difficult to meet the learning needs of different students, inhibiting the development of students' innovative thinking and independent learning ability. Therefore, the reform of digital electronic technology courses should focus on breaking the dilemma of

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traditional teaching mode, through the introduction of advanced teaching concepts and methods, to build a new type of teaching system that is student-centered, focuses on the cultivation of practical ability, and keeps up with the development of technology. This can not only enhance the comprehensive competitiveness of students, but also deliver more high-quality talents with innovative spirit and practical ability for the field of electronic information engineering technology, and promote the continuous progress and development of the industry.

1.2 Digital electronics technology program reform objectives

In the face of the dilemma of the traditional teaching mode, the goal of digital electronic technology course reform is particularly clear and urgent. The core lies in a series of innovative initiatives to completely change the teaching paradigm and realize a fundamental shift from knowledge transfer to ability cultivation. The reform aims to build a teaching system that emphasizes a theoretical foundation and attaches great importance to practical skills, while closely tracking the technological frontier of the industry. This goal requires that the course content not only cover the classical theories and methods of digital electronics technology but also integrate the latest technical achievements and application cases, to ensure that the knowledge students learn is closely linked to the needs of society (Wang et al., 2024). At the same time, the reform emphasizes student-centeredness, focuses on stimulating students' active learning consciousness and innovative thinking, and improves students' practical ability and problem-solving ability through project-driven, problem-oriented, and other diversified teaching methods. In addition, the establishment of a scientific and reasonable evaluation system to comprehensively assess students' knowledge mastery, skill application, and innovation ability based on learning outcomes is also one of the important goals of the reform. These reform initiatives, it is expected to cultivate digital electronic technology professionals with both solid theoretical foundations and strong practical and innovative abilities and to inject new vitality and power into the sustainable development of the field of electronic information engineering technology.

2. The Role of Artificial Intelligence + OBE Dual Drive on the Reform of Digital Electronics Technology Courses

2.1 The role of the OBE education concept

OBE (Outcome-Based Education) education concept plays a pivotal role in the reform of digital electronics technology courses. Its core concept is to emphasize learning outcomes, a shift that has shifted the focus of teaching from pure knowledge transfer to the cultivation of students' comprehensive and vocational abilities. By clearly defining the specific competence level that students should achieve after completing the course, the OBE concept guides teachers to adopt the method of reverse instructional design, planning the teaching content, teaching methods, and assessment strategies in the reverse direction from the expected learning outcomes, ensuring that every teaching activity is closely centered on the realization of the objectives, thus effectively ensuring a high degree of consistency between the teaching content and the expected learning outcomes (Zhang & Liu, 2024). The concept also actively advocates diversified evaluation methods, breaking the limitations of the traditional single examination evaluation, encouraging the use of homework analysis, project presentation, oral report, peer assessment self-reflection, and other evaluation means, to more comprehensively and objectively understand the student's learning progress, skill mastery and the development of innovation ability. This diversified evaluation system can not only more accurately reflect the real learning level of students, but also stimulate students' interest in learning and promote their overall development. In short, the OBE education concept provides scientific guidance and an effective path for the reform of the digital electronics technology curriculum, which helps to cultivate digital electronics technology professionals with a solid theoretical foundation as well as strong practical ability and innovation ability, and meets the urgent demand for high-quality talents in the field of electronic information engineering technology.

2.2 The role of artificial intelligence

In the reform of digital electronics technology curriculum, the integration of artificial intelligence technology provides students with an unprecedented personalized learning experience. Through in-depth analysis of students' learning behaviors, interest preferences, and knowledge mastery, AI technology can accurately identify the learning needs of each student, to customize a personalized learning plan (Luo, 2024). This customized learning path not only improves the relevance of learning but also greatly stimulates students' learning motivation. At the same time, AI, as an intelligent assistant, shows great potential in assisting teaching. When students encounter difficult problems, AI assistants can quickly provide answers or guidance, effectively lowering learning barriers and improving learning efficiency. This instant feedback mechanism makes students no longer feel alone in the learning process and enhances the interactivity and fun of learning. More importantly, the application of artificial intelligence technology in experimental simulation and emulation has revolutionized the digital electronics technology course. While traditional experimental teaching is often limited by equipment,

space, and safety, AI technology can simulate complex circuit environments so that students can perform experimental operations under risk-free and low-cost conditions. This not only lowers the threshold of experimental teaching but also greatly improves the feasibility and safety of experiments, enabling students to explore the mysteries of electronic technology more freely. In the future, artificial intelligence in digital electronics technology course reform will enrich the teaching means, improve the teaching effect, and lay a solid foundation for cultivating digital electronics technology talents with innovative spirit and practical ability.

2.3 The significance of the dual-drive of AI + OBE

The dual-drive model of artificial intelligence and the OBE concept show far-reaching significance in the reform of the digital electronics technology curriculum. This innovative combination not only promotes the modernization of education methods but also realizes a high degree of compatibility between education goals and education means. The OBE concept focuses on learning outcomes and emphasizes the cultivation of students' comprehensive abilities, while AI technology provides a powerful tool to achieve this goal. Through the deep learning and data analysis capabilities of AI technology, educators can more accurately grasp the learning status and needs of students, customize teaching plans that are more in line with individual differences, and ensure that each student can achieve the established learning outcomes. At the same time, the intelligent auxiliary teaching functions of AI technology, such as automated question and answer, personalized recommendation of learning resources, etc., have greatly improved teaching efficiency and students' learning experience. In the experimental and practical aspects, the application of AI simulation and emulation technology reduces the cost of experiments, improves safety, enables students to practice under conditions closer to the real environment, and further strengthens the cultivation of practical ability in the concept of OBE. Therefore, the dual-drive model of AI and OBE not only promotes the updating of the content of digital electronics technology courses and the innovation of teaching methods but also fundamentally changes the relationship between educators and learners, making education more student-centered and more focused on practical results and long-term development. The promotion and application of this model will provide strong support for the cultivation of digital electronic technology professionals who are adapted to the needs of the future society and have the spirit of innovation and practical ability, and promote the continuous progress and prosperity of the field of electronic information engineering technology.

3. Teaching Reform Path of Digital Electronics Technology Course under the Dual Driving of Artificial Intelligence + OBE

3.1 Update the teaching content

Under the dual-drive mode of AI and OBE, the teaching reform path of digital electronics technology courses is particularly clear. To keep students' knowledge synchronized with the development of modern electronic technology, the updating of teaching content has become the first task. Teacher teams need to pay close attention to industry dynamics and introduce the latest technology achievements, design methods, and tools into the classroom promptly, such as advanced integrated circuit design technology, embedded system applications, artificial intelligence algorithms, etc., to ensure the timeliness and cutting-edge of the teaching content. At the same time, these new technologies are not only taught as theoretical knowledge but also need to be practiced through well-designed teaching projects. In the design of teaching projects, focusing on practicality and advancement, selecting cases that are closely related to the actual needs of enterprises, such as intelligent home control systems, intelligent traffic signal system design, etc., so that students can comprehensively apply the knowledge they have learned in the process of solving practical problems and improve their practical ability. During the implementation of the project, students are encouraged to cooperate in groups, simulate the real work environment, and participate in the whole process from demand analysis, program design, and circuit construction to system testing, which not only exercises their technical skills but also cultivates professionalism such as teamwork and project management (Han et al., 2024). In addition, the use of artificial intelligence technology to assist project teaching, such as circuit simulation through artificial intelligence simulation software, not only reduces the cost of the experiment but also improves the safety and flexibility of the experiment. This double innovation of teaching content and method not only makes the digital electronics technology course closer to the industry reality, but also lays a solid foundation for the smooth development of students' future careers.

3.2 Reform of teaching methods

Driven by the dual-drive model of AI and OBE, the reform of the teaching method of digital electronics technology courses is particularly critical. To stimulate students' learning interest and initiative, advanced teaching modes such as flipped classrooms and task-driven should be actively adopted in teaching. In the flipped classroom, students learn basic knowledge independently through videos and reading materials before class, and classroom time is

mainly used for discussion, puzzle solving, and in-depth investigation, which not only improves classroom interaction but also cultivates students' independent learning ability (Tian & Yu, 2024). At the same time, the task-driven teaching method enhances the practicability and purpose of learning by setting specific and practical task objectives and guiding students to learn new knowledge in the process of solving problems. To realize personalized teaching, the teaching process should make full use of artificial intelligence technology for intelligent recommendation and data analysis. The artificial intelligence system can intelligently recommend suitable learning resources and paths based on students' learning behavior, performance feedback, and interest preferences, helping each student find the most suitable learning rhythm for him or her. Through data analysis, teachers can accurately grasp the learning status of students, identify learning difficulties promptly, adjust teaching strategies, and provide targeted counseling. This personalized teaching method not only improves teaching efficiency but also ensures that each student can achieve the best learning results at a pace that suits him or her. By adopting teaching modes such as flipped classrooms and task-driven, and combining intelligent recommendation and data analysis with artificial intelligence technology, we can create a dynamic and highly personalized teaching environment for the digital electronics technology course, cultivate students' independent learning ability, practical ability and innovative thinking, and lay a solid foundation for their future career development.

3.3 Strengthening practical teaching

Led by the dual-drive model of AI and OBE, strengthening practical teaching has become an important part of the teaching reform of digital electronics technology courses. To achieve this goal, firstly, the construction of an on-campus digital electronics technology training center should be initiated, which needs to be equipped with advanced experimental equipment, simulation software, and testing tools, providing students with a comprehensive practical environment integrating teaching, experimentation, and research and development. Secondly, the training center should not only meet the needs of basic experimental teaching but also set up an innovation laboratory to encourage students to design and develop electronic projects independently and transform theoretical knowledge into practical results (Sun et al., 2024). Again, students are carefully organized to participate in experimental teaching and project practice, such as digital circuit design and simulation, embedded system development, signal processing, and application, etc., so that students can deepen their understanding of theoretical knowledge in practice and enhance their ability to solve practical problems. Finally, project practice needs to focus on teamwork and engineering practice, organizing students to complete specific projects in groups, from demand analysis, solution design, hardware selection, and software programming to system testing, the whole process of participation, simulating the real engineering environment, not only exercise technical skills but also cultivate project management, teamwork, and other professional qualities. Strengthening practical teaching, not only enhances students' practical ability and innovation ability, but also promotes the deep integration of theoretical knowledge and practical skills, and lays a solid foundation for cultivating high-quality talents who can adapt to the future development needs of electronic technology. This teaching reform path, which is in line with the learning outcome orientation emphasized in the OBE concept and gives full play to the auxiliary role of artificial intelligence technology in the field of education, has injected new vitality into the teaching reform of digital electronics technology courses.

3.4 Establish a diversified evaluation system

Under the guidance of the dual-drive model of AI and OBE, the traditional single examination and evaluation method should be abandoned in favor of a variety of evaluation methods, such as theoretical examination, project production assessment, and a combination of self-evaluation and group evaluation, to comprehensively and objectively assess the learning effectiveness of students. Among them, the theoretical examination focuses on testing students' mastery of basic knowledge, while the project production assessment evaluates students' ability to apply theoretical knowledge to practice through their independently completed or teamwork electronic projects (Liu et al., 2024). In the self-evaluation and group evaluation part of the evaluation system, students should be encouraged to carry out self-reflection to assess their progress and shortcomings in the learning process, and at the same time, through mutual evaluation in the group, to cultivate students' teamwork ability and critical thinking. The new evaluation system emphasizes the importance of process evaluation, focusing not only on students' learning outcomes but also on their learning and growth process. Through regular checkpoints, project progress reports, and classroom participation records, teachers can track students' learning status in real time, identify and solve learning problems promptly, and ensure that every student can grow in the learning process. This diversified evaluation system not only improves the accuracy and comprehensiveness of the evaluation, but also stimulates students' learning motivation and creativity, and promotes their overall development. The efficiency and effectiveness of evaluation are

further enhanced through the assistance of artificial intelligence technology, such as the use of artificial intelligence to analyze students' learning data and provide teachers with more accurate feedback. This reform practice not only reflects the student-centered education idea in the OBE concept but also gives full play to the potential of artificial intelligence technology in education evaluation, providing new ideas and directions for the teaching reform of digital electronics technology courses.

Conclusion

Driven by the dual-drive model of AI and OBE, the teaching reform of digital electronics technology courses will achieve remarkable results. By updating the teaching content, reforming the teaching methods, strengthening the practical teaching, and establishing a diversified evaluation system, we can not only improve the students' theoretical knowledge but also strengthen their practical ability and innovation ability. Looking ahead, the teaching reform will continue to deepen and further explore the in-depth integration of AI and education and teaching, such as using AI for more accurate learning path planning and personalized tutoring to create a more intelligent learning environment. At the same time, institutions should actively strengthen cooperation with industrial enterprises, introduce more actual project cases, cultivate students' engineering practice ability and professionalism, and contribute to the cultivation of high-quality talents who can adapt to the future development needs of electronic technology.

Conflict of Interest

The authors declare that they have no conflicts of interest to this work.

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