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Research and Practice on the Interaction between Modern Educational Technology and University Physics Teaching

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Abstract: With the rapid development of information technology, modern educational technology is playing an increasingly important role in improving teaching quality and optimizing teaching models. For university physics, a basic course for science and engineering majors, teaching effect directly affects students' subsequent learning in professional courses. However, there are certain difficulties in the current university physics courses in teaching content, teaching methods, and the updating of teaching resources. It is urgently necessary to achieve innovation and transformation in the teaching model through the introduction of modern educational technology. This article explores the interactive docking mode between modern educational technology and university physics teaching, aiming to optimize the allocation of teaching resources, update teaching content, and innovate teaching methods by constructing the interactive docking links such as preview, course guidance, in-class teaching, after-class review, and testing, thereby improve students' interest and effectiveness in learning.

Keywords: Modern educational technology; University physics teaching; Interactive teaching

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1. Realistic dilemma of university physics course teaching

1.1. Slow updating of teaching content

As a fundamental professional discipline, university physics has always been in a state of continuous development and progress. New theories, experimental techniques, and research methods are constantly emerging, providing new perspectives and tools for humanity to understand the natural world. However, the update of the teaching content of current university physics courses is progressing relatively slowly [1]. On the one hand, this is due to the need for the stability of the curriculum system. That is, to ensure that students can systematically and coherently master the basic concepts and principles of physics, the curriculum content often needs to maintain a certain degree of continuity and stability, avoiding frequent changes that may confuse students' learning and difficulties in teachers' teaching caused by frequent changes. On the other hand, the update of teaching content requires strict examination and verification to ensure the scientific and reliable knowledge, which undoubtedly increases the difficulty and time cost of the update [2].

1.2. The teaching method is relatively traditional

The traditional teaching methods of university physics courses mostly focus on teachers' lectures, supplemented by blackboard or PPT demonstrations. Under this teaching mode, teachers are the main transmitters of knowledge, while students are in a passive state of receiving knowledge [3]. In class, teachers usually explain physical concepts, theorems, and formulas one by one according to the established curriculum and teaching plan, while students need to take notes and try their best to keep up with the teachers' explanation. This one-way of knowledge transmission leads to a lack of interaction and thinking opportunities for students in class, making it difficult to stimulate their learning interest and initiative. At the same time, in the traditional teaching models, teachers often pay too much attention to the systematicness and integrity of knowledge, ignoring individual differences and the learning needs of students. There are significant differences in the basic knowledge level, comprehension ability, and learning interest of different students. However, teachers usually adopt a "one-size-fits-all" teaching method, which cannot provide personalized guidance for each student's characteristics [4]. This not only limits students' learning effectiveness but also makes the classroom atmosphere monotonous and lacking in vitality.

1.3. The updating of teaching resources lags behind

In the context of the rapid development of information technology, the teaching equipment and means of university physics courses have not been updated synchronously. Some universities still rely on traditional textbooks and PPT presentations. Although these tools can meet basic teaching needs to some extent, they cannot achieve effective interaction with students [5]. For example, some complex physical phenomena and experimental processes are difficult for students to intuitively understand through text descriptions and static pictures. However, modern educational technologies such as virtual laboratories, 3D simulations, and interactive software etc., can provide more vivid and intuitive learning experiences. But these technologies have not been widely applied in many universities. On the other hand, the lag in the update of teaching resources is also reflected in the acquisition and management of teaching resources [6]. Some universities lack an effective teaching resource database. Teachers need to spend a lot of time searching for suitable teaching materials when preparing courses. This not only increases their workload but also affects teaching effectiveness. At the same time, the sharing mechanism of teaching resources is not perfect, and there is insufficient resource sharing and communication among teachers, resulting in the fact that excellent teaching resources cannot be fully utilized.

2. The design and construction of teaching interaction and docking mode

2.1. Preview and guide

In the era of "Internet +" and "Intelligence +," online course platforms and intelligent learning systems have created conditions and an environment where students can learn at any time, anywhere, and everyone can access learning resources [7]. In the preview stage, teachers can release preview tasks and requirements through the online platform to guide students to watch teaching videos purposefully. Students can pause and replay videos at any time to ensure a full understanding of every concept and formula. At the same time, teachers can also set up online quizzes to check students' preview knowledge, and promptly identify and solve the problems that students encounter during the preview process. This interactive preview method not only improves students' learning enthusiasm but also enhances teachers' understanding of students' learning situations. In the course introduction stage, teachers can use multimedia teaching equipment such as projectors, electronic whiteboards, etc., to display the key content of the preview videos, and further consolidate students' preview achievements [8]. Through this approach, complex physical phenomena and principles can be explained more intuitively, helping students establish a clear knowledge framework. In addition, teachers can organize classroom discussions, encourage students to share their gains and confusions during the preview process, and promote interaction and communication between teachers and students. This interactive teaching method can not only stimulate students' interest in learning but also increase classroom and teaching effectiveness.

2.2. Teaching in class

In classroom teaching, teachers need to transform their roles from traditional knowledge transmitters to guides and supporters of learning. In this process, teachers not only need to impart knowledge but also guide students to actively explore and practice and learn to solve problems on their own [9]. Through various forms such as classroom discussions, group cooperation, teacher explanations and teacher-student interaction, every student can participate in the learning process, stimulate their interest and initiative. Classroom discussion is an important way to stimulate students' thinking and expression. Teachers can design some challenging and open-ended questions to guide students to have in-depth discussions. For example, when explaining electromagnetics, asking questions like "Why can electromagnetic waves propagate in a vacuum while sound waves cannot?" can stimulate students' thinking. During the discussion process, encourage students to express their own opinions, respect different views, and promote communication and cooperation among students [10]. Through discussion, students can not only deepen their understanding of knowledge points but also cultivate critical thinking and communication skills. Group cooperation is another effective teaching method. Teachers can divide students into small groups, with each group responsible for a specific task or project. For example, when studying optics, each group is required to design a simple optical experiment to verify a certain optical principle. Group members need to divide the work and cooperate to complete the task together. At the same time, teachers need to provide necessary guidance and support to ensure that each group can complete the task successfully.

2.3. Review and quiz sessions after class

During the after-class review stage, the intelligent system can automatically recommend suitable learning resources based on students' performance in class and their practice after class. For example, for students who perform poorly in the electromagnetics section, the system can recommend more relevant videos, simulation experiments, and exercises to help them enhance their understanding [11]. At the same time, the intelligent system can also automatically adjust the difficulty and depth of the review content according to students' learning progress, ensuring that every student can learn at their own pace. In the testing phase, artificial intelligence technology can also play an important role. Through the intelligent question generation system, it is possible to generate test questions that match the students' current learning level, which not only ensures the fairness of the test but also improves its pertinence. The intelligent grading system can quickly and accurately correct the assignments and tests submitted by students, providing them with instant feedback. More importantly, the intelligent system can conduct a detailed analysis of students' mistakes, identify the types and causes of the errors, and provide teachers with more targeted teaching suggestions for teachers.

3. The practice of teaching interaction and docking mode

3.1. Practice of innovative teaching methods

The improvement of the traditional teaching method is mainly reflected in the comprehensive optimization of the teaching content, teaching methods, and teaching evaluation system. In terms of teaching content, teachers should focus on tracking the cutting-edge developments of physical knowledge, and timely incorporate the latest scientific research achievements into teaching, and enable students to be exposed to the latest physical knowledge [12]. At the same time, modular design of the curriculum content is carried out according to the different foundations and needs of students, diversified learning paths are provided to meet the learning needs of students at different levels. In terms of teaching methods, the traditional "cramming" teaching model is gradually being replaced by more flexible and diverse teaching methods. For example, adopting the Problem-Based Learning (PBL) mode. By raising specific questions, guiding students to explore independently, and cultivating students' critical thinking ability and practical problem-solving ability. To improve classroom interaction, teachers can apply the flipped classroom model to combine pre-class preview with in-class discussions, allowing students to independently learn basic knowledge through watching videos, reading materials and other methods. before class. In class, in-depth discussions and practical operations are mainly carried out, which not only improves teaching efficiency but also stimulates students' interest in learning. In terms of the teaching evaluation system, a diversified evaluation system can be established. In addition to the traditional written examination, process evaluations, such as classroom performance, group discussions, and experimental operations, should be added to comprehensively evaluate students' learning processes and achievements. At the same time, students are encouraged to conduct self-evaluation and peer evaluation, cultivate students' self-reflection ability and team spirit.

3.2. Teaching practice of online courses

Through the online platform, students can freely choose the learning content and engage in personalized learning without being limited by time and space [13]. In this mode, with the use of multimedia technology, complex physical concepts and principles can be presented more intuitively and vividly, improving students' interest and efficiency in learning. In practical operation, the design of online courses should focus on interactivity and participation to stimulate students' learning enthusiasm. For example, setting up an online discussion area to encourage students to discuss the course content, share their learning experiences, and promote communication and cooperation among peers. To ensure the learning effect, online courses should also be equipped with sufficient auxiliary resources, such as video tutorials, simulated experiments, e-books, etc., to meet the learning needs of students at different levels. In addition, the application of artificial intelligence technology has also brought new possibilities for online course teaching. By using AI technology, it is possible to achieve intelligent analysis of students' learning behavior, customize learning plans for each student, and provide personalized tutoring suggestions. For example, by analyzing the behavioral data of students' online learning, an AI system can identify the difficulties and weak links in students' learning process, timely push relevant materials, and help students overcome learning obstacles [14]. At the same time, AI can also assist teachers in course design and provide teaching effect evaluation, thereby improving teaching quality and efficiency.

3.3. The teaching practice of virtual experiments

As an important part of modern educational technology, virtual experiments provide a new perspective and means for the teaching of university physics. Virtual experiments can not only simulate physical phenomena in reality, but also provide complex environments and conditions that are difficult to achieve in traditional experiments, enriching students' learning experience. Introducing virtual experiments into university physics courses can effectively solve problems such as limited laboratory resources, high experimental costs, and relatively high safety risks in some experiments, providing students with a wider range of learning opportunities [15]. In practical applications, virtual experiment platforms usually have high interactivity and operability. Students can conduct experimental operations, observe experimental phenomena, collect experimental data, and analyze them through computers or mobile devices. For example, in the study the electromagnetics, students can build circuits, adjust parameters such as voltage and current, observe the changes in the circuit, and thus deeply understand the basic principles of electromagnetics through the virtual experiment platform. This intuitive and interactive learning method helps to improve students' interest in learning and participation, and promotes the internalization of knowledge. Moreover, virtual experiments can also support interdisciplinary learning and provide students with an interdisciplinary learning experience. For example, in the context of wave optics, virtual experiments can integrate with computer graphics technology, enabling students to observe the propagation path, interference, and diffraction phenomena of light in a three-dimensional environment, thereby better understanding the basic concepts of wave optics. In this way, it can not only broaden students' knowledge but also stimulate their innovative thinking and cultivate their ability to solve complex problems.

4. Conclusion

In conclusion, the interaction and integration of modern educational technology and university physics teaching can effectively solve the problems existing in the traditional teaching mode. By introducing multimedia teaching methods and optimizing the structure of teaching content, it can effectively stimulate students' interest and improve classroom interactivity in learning. The teaching practice of online courses involved building a high-quality online teaching resource database, providing rich learning materials, and interactive platforms to help students learn independently. The teaching practice of virtual experiments uses virtual simulation technology to provide students with a realistic experimental environment, enhancing the operability and safety of experimental operations. It offers new ideas and methods for university physics teaching and has important theoretical and practical values for promoting the application of modern educational technology in university physics teaching.

Disclosure statement

The author declares no conflict of interest.

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