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Research and Practice of Online and Offline Blended Teaching Mode in College Physics

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Abstract: College Physics is a basic course of natural science, which plays an important role in laying a solid scientific foundation for students, cultivating students' scientific literacy and developing their innovative potentials. This study analyzes and summarizes the teaching experience of the College Physics in the reform of teaching model, application of information technology and teachers' professional training and development. This paper takes the course of College Physics of Dalian Polytechnic Technology as an example, introduces the online and offline teaching system of College Physics, analyzes the online and offline blended teaching mode that runs through the links before class, during class and after class, and proposes a quantitative learning outcome evaluation system. Through the implementation of specific measures, the quality of teaching has been effectively improved, benefiting more students majoring in science and engineering, and providing suggestions for the construction of other curricula.

1. Introduction

College Physics is an important course for college students majoring in science or engineering, and it is an important basis for their follow-up professional experiments and scientific research training [1-4]. First of all, at the level of knowledge learning, students should understand the development process of the physics knowledge system; master the basic concepts, laws, and principles of physics; and have a deep understanding of physics-related knowledge and applications. Secondly, at the level of ability goals, students should master the research methods of physics, be able to flexibly use physics knowledge in their life, and have the ability to think independently and solve practical problems. Finally, in terms of quality and goals, this course focuses on cultivating students' scientific thinking methods and ability to analyze and solve problems; cultivating students' scientific work and learning attitudes with innovative spirit.

2. Teaching Practice

The content of College Physics teaching includes the basics of mechanics, electromagnetism, wave optics, relativity and quantum theory. The basic idea of online and offline blended teaching of College Physics is: posting teaching arrangement online—offline teaching—online exam—online

note sharing—online exam explanation—feedback/tutorial—online homework—online discussion — offline summary. This process follows the principle of the teaching process and can help achieve good teaching results.

The offline teaching of College Physics is mainly for the teaching of new knowledge, and the online teaching is for exercises, exams, homework, Q&A and other relevant links for supplementary teaching materials. The exercise class is to summarize the key and difficult points of the chapter. A large amount of information will be delivered and the teacher usually lists too many key points on the blackboard. Using online teaching and recorded videos is more conducive to students' absorption of knowledge and difficult points. The specific implementation is as follows.

2.1. Posting Teaching Arrangements Online

The teacher posts class arrangements before class, which can remind students to prepare before class and let students know more about the teaching activities to be carried out in class.

2.2. Offline or Online Live Lectures

The advantage of traditional offline teaching is that teachers can have face-to-face communication and interaction with their students, and adjust the teaching content according to students' feedback on the content, level of difficulty and acceptance [5-7]. However, students are of different levels and have different academic performance. For this kind of situation, online teaching can help solve the problem, especially in exercises and review classes, online live broadcast, simultaneous recording of course and blackboard writing with PPT, and students can watch these materials repeatedly to further understand them.

2.3. Assigning Exams, Homework, and Thinking Questions Online

In order to know how well the students have mastered the knowledge in the class, an online test is given at the end of each class, which can not only examine the students' learning outcome, but also urge the students to listen carefully to the class. At the same time, homework assignments and questions for self-study are assigned online, allowing teaching and learning to transcend the constraints of time and space.

2.4. Sharing Notes Online

At the end of the class, students submit their class notes online within ten minutes to cultivate students' good study habits. Sharing notes also allows students to learn from each other and make progress together.

2.5. Online Q&A Session

After the exam, according to the psychological characteristics of the students, the pre-recorded exam question explanation video is shared, so that students can find and solve problems in time.

2.6. Summary of Offline Exams and Homework

In the next class, the teacher will summarize the exams, homework and thinking questions, and point out the problems that students have, and help students avoid making unnecessary mistakes.

At present, most colleges and universities in China are developing around the goal of constructing Golden Courses of various subjects [8-10]. This kind of teaching reform focuses on the

expansion and integration of knowledge, and the curriculum training objectives reflect the teaching characteristics. What's more, the teaching reform cultivates talents with practical abilities by formulating teaching content with professional development characteristics. In addition, the teaching methods are diversified, and students have more freedom in learning. Teachers teach new lessons, give exams, explain the key points, share notes, and summarize the teaching content on the same day. This kind of teaching mode has achieved ideal teaching results. Finally, teachers and students discuss their experience through QQ groups or WeChat groups, and teachers carry out teaching activities such as exams and homework through the Chaoxing platform, fully embodying the concept of taking students as the center, giving full play to the role of students as the main body, and achieving expected teaching results.

3. Construction of Course Content and Teaching Resources

This teaching reform focuses on how to find the balance between online and offline teaching to improve students' learning efficiency, rationally arrange online and offline blended teaching content, form and proportion, and then formulate new offline teaching, online exercises and review, discussion, examination, and homework.

In the teaching practice of this semester, through carrying out online and offline blended teaching mode, 22 class hours of online teaching were given, which accounted for 30% of the total class hours, and there are 50 class hours of offline teaching. Online teaching uses Chaoxing Teaching Platform to carry out a teaching mode combining self-construction and introduction. The currently established curriculum system includes 23 classes with online courses; the introduction of high-quality courses and more than 80 self-built course videos; an exam question bank and more than 90 exams; a homework library and more than 60 homework assignments; more than 90 discussion topics; and more than 40 self-built course materials.

As an important part of the training of undergraduate students in colleges and universities, experimental teaching carries the task of cultivating students' engineering quality, innovative spirit and ability. Teachers post homework, exams, and discussions, questionnaires by using different media or platforms. They can use QQ groups, WeChat group Q&A interaction, online and offline teaching complement each other to achieve good teaching results. Among them, the seminar mainly cultivates students' independent thinking, help them form critical spirit, lay a good foundation in physics, and improve students' scientific literacy, innovative awareness and innovation ability.

As a key part of online and offline blended teaching, teachers should give full play to the advantages and value of offline classrooms, play a leading role in the classroom, and use more exploratory experimental projects to guide and promote students to carry out group discussion and activities. The online virtual simulation software provides students with opportunities to prepare before class, review after class, consolidate and expand their exploration, so that students can gain something before, during and after class, and effectively improve classroom efficiency.

4. Teaching Effects and Special Features

4.1. Implementation of Ideological and Political Courses

As a basic discipline, College Physics contains abundant ideological and political elements. The whole teaching process runs through the ideological and political curriculum, adheres to the student-centered principle, and cultivates students' innovative spirit and practical ability in an all-round way.

For example, when talking about the momentum theorem of the particle system, the teacher will first introduce the concept of Covid-19 to the class since the particle system is like our country and

every Chinese is a particle in the particle system. The students will learn that only the whole country is united and cooperative, and they can try their best to build the national particle system and contribute positive energy.

4.2. Course Grading Method

The final score of this course is composed of formative assessment and summative assessment. The proportion of each part is as follows (see Table 1). Online learning, online discussion, homework, examination, attendance and classroom interaction are the main assessment forms. The final sit-in exams is organized by the Academic Affairs Office of the university.

Table 1: Proportion of different assessment forms.

Assessment Form	Percentage
Online learning	5%
Online discussion	10%
Homework	40%
Examination	30%
Attendance	10%
Classroom interaction	5%

4.3. Effects of the Teaching Reform

The students' evaluation of the teacher's overall teaching effects is an affirmation of the online and offline blended teaching model. For instance, last semester the teacher received a high score of 98.1 in the students' anonymous online evaluation. The supervision team of the university also gave the positive feedback the teaching effects of the College Physics teaching team. The person in charge of this team was rated as an excellent teacher in online teaching, and selected as an excellent case of online teaching twice, and won the excellent teaching award offered by the university. In addition, a questionnaire survey was conducted at the end of the project, and the participation of students in the questionnaire survey reached 90%. The statistical results show that students have given a high degree of recognition to the online and offline blended teaching mode. Finally, the excellent rate of the final score of last semester reached 26.44%, and the average score reached 70 points, which indicated that the blended teaching mode has achieved the expected teaching effect.

5. Conclusions

This teaching reform will help improve the effectiveness and effectiveness of teaching. In future, we will strive to make greater progress in the following areas. First of all, the teachers will continue to find the best balance between online teaching and offline teaching. Online teaching cannot completely replace offline teaching and the two should be closely integrated and be complementary to each other. Second, we will continue to carry out ideological and political construction and actively explore the ideological and political elements in the course. Finally, offline teaching focuses on cultivating students' logical thinking ability, and online teaching focuses on cultivating students' ability to think and learn independently. Through refining the assessment methods for students of different academic performance, the reform of teaching mode will fully stimulate stimulate students' enthusiasm for learning.

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