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Research on Teaching Reform of College Physics and Experimental Courses Based on Learning Communication

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Abstract: *Biochemistry experiment course is one of the important basic courses in medical colleges, and it is an important bridge connecting biochemical theory with scientific research and clinical practice. With the implementation of educational informatization and the rapid development of biochemical technology, the traditional teaching mode of biochemical experiments can no longer meet the needs of students. This article constructs an online experimental course based on the Super Star Learning Platform, shifting some of the confirmatory experiments to the Learning Platform, and appropriately adding offline comprehensive strengthening experimental courses. Through the platform, students can timely grasp the operating points and precautions of each experimental project, and the repair rate of experimental instruments significantly decreases. For experiments such as momentum conservation and Millikan oil droplet measurement that are prone to operational errors, the teaching platform has played a good protective role, significantly reducing instrument damage and consumables usage.*

Keywords: *Learning Communication, College Physics, Experimental Courses, Teaching Reform*

1. Introduction

As a compulsory basic course for students majoring in science and engineering, College Physics is the foundation of natural science and engineering technology. College physics mainly guides students to master the knowledge of mechanics, heat, vibration and wave, electromagnetism, optics and modern physics, and promotes students' physical thinking. College physics aims at cultivating students' scientific outlook, world outlook, dialectical materialistic world outlook, seeking truth from facts and exploring spirit, so College Physics is a compulsory and irreplaceable course for science and engineering majors [1-2]. Based on the theoretical knowledge of biochemistry, biochemical experiments build a bridge between theory and scientific research and clinical research, which plays an important role in cultivating students' rigorous scientific research attitude, innovation and ability to analyze and solve problems [3]. However, the traditional biochemical experiments mainly focus on confirmatory experiments, and the teaching method is single. Students complete the experimental operations step by step, and their interest in learning is not high and their initiative is poor, which is not conducive to the internalization and absorption of experimental contents, and it is even more difficult to make innovative attempts and extended explorations [4].

At present, college physics experiment courses in most universities are open to students majoring in science and engineering. In addition, in some comprehensive universities or normal universities, in order to comprehensively improve students' scientific quality and practical ability, college physics experiment courses are open to all students, including liberal arts majors. By studying college physics courses, students' abilities of scientific observation and speculation, problem analysis and problem solving, and innovation and entrepreneurship can be cultivated, which lays a solid foundation for the follow-up study of professional core courses [5]. According to their own professional direction, students collect subject knowledge, put forward new problems, and seek solutions to problems in combination with college physics courses to expand their knowledge. A college physics competition class was set up in the whole school, including students majoring in science and engineering and physics, and all the teachers in the physics teaching and research department participated in it and actively discussed it, so as to achieve a great promotion in winning the physics competition and expanding students' knowledge. In this paper, an online experimental course based on the superstar learning platform was built, some confirmatory experiments were moved to the learning platform, and an offline comprehensive and intensive experimental course was appropriately added to realize the multi-level experimental teaching content,

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and a supporting systematic assessment and evaluation system was established, aiming at giving full play to students' leading role and cultivating rigorous scientific research literacy, so as to improve the teaching efficiency of biochemical experiments [6-7].

2. The Current Situation and Problems of Teaching Models for College Physics Experiments

2.1 Inconsistent experimental sequence

Like other theoretical courses, the arrangement of knowledge points in college physics experimental courses follows the principle of from simplicity to difficulty. The impact of college physics on college students is very low. In an era where the general public is educated, most schools have expanded their enrollment scale, and universities have a large number of science and engineering majors, while there are relatively few or severe shortages of physics teachers. Therefore, large classes are often used for teaching, and the number of listeners is relatively large. Teachers generally cannot grasp the learning situation of the entire class. For some courses that require preliminary experimental foundations, teachers should pay more attention to the order of time arrangement [8]. However, as a school wide public basic course, it is difficult to achieve coordination and unity with other theoretical courses in teaching time.

2.2 Teaching methods are outdated

At present, many college physics experiment courses still follow the traditional theoretical courses. In class, the teacher first explains the experimental contents and steps, then operates the instrument and tells the experimental principle. This teaching method requires students to concentrate on the whole class. Once they are distracted or don't understand a certain knowledge point, it is easy to make mistakes in the subsequent experimental operation [9]. Most teachers use traditional blackboard writing and multimedia to teach. Teachers always talk on the stage and students listen below. After a class, it is difficult for students to keep listening carefully and absorb knowledge. There are still many problems in the traditional teaching method, such as it takes time to arrive and correct homework, and it is not convenient for statistics. For some complicated or long-term experiments, students can't remember all the operation methods or precautions in a short time, which is likely to damage the experimental instruments and lead to the failure of the course. Less class hours correspond to more course content, so it is difficult for teachers to take into account the learning effect of all students, and the course answering may be a few minutes before class or QQ WeChat, and there is no unified way to answer questions, which leads to the delay in answering students' questions, which leads to the decrease of students' interest or the difficulty of learning subsequent knowledge [10].

2.3 Incomplete teaching evaluation system

Many universities still follow the evaluation standards for theoretical courses, and evaluate students' learning effectiveness in the form of test papers during the final exam. The course 'College Physics' may not achieve the expected teaching objectives in some local undergraduate colleges. Due to various reasons, such as the total credit limit of 172 credits in the talent cultivation plan, the 128 class hours of college physics have been reduced to 56 or 48 class hours. Therefore, college physics only lasts for one semester, making it difficult for science and engineering students to establish physical thinking and the entire physics framework system. In addition, there are also regular experimental reports as the basis for evaluating students' grades. A comprehensive evaluation of an experimental project is based on students' preparation, experimental operation process, data processing, etc. The comprehensive evaluation of all experimental projects in a semester is the student's experimental grade. In addition, there is no feedback link after the course assessment. The students still do not understand the questions they answered incorrectly, and there is no way to learn and further correct them. These methods are difficult to truly evaluate students' ultimate learning outcomes, nor can they reflect the degree to which experimental courses enhance students' hands-on and brainpower abilities.

3. Teaching Reform of College Physics and Experiment Course Based on Learning Communication

3.1 Guide students to study independently before class

Teachers send preview materials in advance through the learning platform, including thought guide

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maps, popular science knowledge, micro-videos, preview thinking questions and preview discussion questions. Students can watch and answer questions at any time through mobile phones, computers and other equipment. Students need to complete the corresponding task points before class, so that they can enter the classroom with a good knowledge base, providing more time and better learning effects for offline classes to carry out high-level, innovative and challenging teaching content, and improving teaching quality. Before class, let students complete task-driven autonomous learning according to the pre-task list released by teachers in advance, and check the relevant resources, so as to improve students' active learning ability, enhance students' participation, have a preliminary understanding of the teaching content to be studied, and master the key and difficult knowledge in class will become easy and easy, and learning will not be boring. The boring classroom has changed and students' academic performance has improved obviously. According to the requirements of college physics experiment teaching materials and teaching syllabus, this paper introduces six experimental items, and the experimental topics are shown in Table 1.

Table 1 College Physics Experiment Topics

Serial Number	Name
1	Solid density measurement
2	Air specific heat capacity
3	Use of Oscilloscope
4	Modification and Calibration of Electric Meters
5	Hall effect
6	Spectral analysis

Based on the characteristics of each experiment, write experimental project documents, draw tables, and record experimental operation videos. Upload the above electronic materials through Learning Pass to effectively and reasonably build online courses for college physics experiments. Students can think and discuss related questions based on the pre class preview content and related questions released by the teacher in advance, and ask questions that they do not understand. This can cultivate students' autonomous learning and thinking abilities. Students can ask questions in the Learning Communication discussion area, and both students and teachers can discuss and respond below, which also plays a positive role in promoting some students' unclear knowledge points.

3.2 Teaching design in class

15 minutes before class, the teacher randomly selects one of various sign-in methods such as ordinary sign-in, gesture sign-in, position sign-in and QR code sign-in to check the attendance of students. If there are students who sign in by sending information to the students who have not arrived, they can also find out the students who have not arrived through classroom testing and counting the number of people. In the classroom, teachers and students, students and students discuss and explore first, and the teaching interacts with students to internalize knowledge. Students are task-driven. After completing the learning tasks before class, students have a certain understanding of what they have learned, and the roles between teachers and students have changed in class. According to the pre-task list, students voluntarily form several groups, and each group is responsible for explaining the knowledge points of a content. The content of online course is divided into the following parts: experimental survey, operation video, data processing and thinking expansion. The specific contents of each part are shown in Table 2.

Each part is set with corresponding learning assessment, and the next part of learning can only be carried out after the assessment is completed: in the experimental overview part, multiple-choice questions are set after reading to examine students' mastery of key contents; The video part will set up thinking questions; The data processing part must download the form document; Thinking expansion will have extra-curricular knowledge links to record academic performance with the length of study. In order to enhance the team consciousness and cooperation spirit, we can arrange by studying the function of grouping tasks in Tongli, and adopt the evaluation method of grouping lectures for participatory learning exchange and discussion. Students in the group will make PPT, collect data, lecture and drill, and revise and improve it respectively.

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Table 2 Composition of Online Courses

Curriculum combination	Content	Purpose
Experimental survey	Experimental purpose, experimental principle and equipment	Understand the purpose of the experiment, master the principle of the experiment, and be familiar with the equipment and matters needing attention.
Operation video	Operation demonstration	Demonstrate the operation process and explain the experimental principle.
Data processing	Data record form and data processing formula	Standardize data recording and processing
Thinking expansion	Thinking questions and knowledge outlook	Relying on experiments to expand knowledge

3.3 Consolidate the foundation after class

After class, homework training is conducted on key and difficult problems in classroom learning, mainly through multiple choice questions, true or false, fill in the blank questions, calculation questions, and other methods to test students' mastery and consolidate their basic knowledge. Students collect subject knowledge based on their professional direction, propose new problems, and combine them with university physics courses to find solutions to problems, achieving knowledge expansion. Establish university physics competition classes throughout the campus, including students majoring in science, engineering, and physics. Teachers from all departments of the physics teaching and research department actively participate in discussions to achieve a significant improvement in physics competition awards and students' knowledge expansion. Based on the characteristics of students' majors, we will explore new applications by grouping and discussing the collected relatively new materials in combination with practical engineering, and conduct further experiments and practices. You can raise questions in the discussion section of Super Star Learning, allowing students to discuss with each other. Teachers can also leave messages or bring the questions to the group discussion before the next class to lay the groundwork for the new lesson. After each class, the teacher sets exam questions for each class and chapter in the Super Star Learning Pass. The exam questions are arranged in a disordered order, and the options in the questions are arranged in a disordered order. Students submit their answers for the class and are allowed to view their scores and rankings.

4. Conclusions

Based on the superstar learning communication network platform, the online course teaching of college physics experiment is realized. Breaking the time and space limitation of traditional teaching mode, providing students with online learning space, and making full and reasonable use of time for experimental course preview are helpful to cultivate students' autonomous learning ability. The application of learning platform can effectively stimulate students' interest in learning biochemical experiments, and increase comprehensive experiments to promote students' active research and discussion of problems; Online learning of confirmatory experiments enables students to make full use of the convenience brought by network resources to make their own learning plans and break the limitations of time and space. Online teaching video saves teachers from taking up classroom time to explain experimental operation, and leaves more time for students to fully exercise their practical ability. In addition, online teaching video frees teachers from repeated experimental explanations, and only focuses on and individual guidance in the classroom, which is helpful to carry out innovative teaching in the classroom. Learning platform runs through the whole process of college physics experiment teaching, and at the same time, it fills in the missing links in the past, which plays a very important role in promoting the teaching effect of experimental courses. Through autonomous learning on the platform, students have greatly improved their self-learning ability, which is very helpful for the next experimental and theoretical courses to be studied.

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