

Research on Modular Teaching of College Physics Based on SPOC Platform in Application-Oriented University

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Abstract—The modular teaching of college physics is introduced in this paper, which is based on Small Private Online Course (SPOC) and classification teaching according to the requirements of different majors. The application of SPOC to college physics teaching will realize the optimization of the teaching contents, which is a meaningful teaching reform of college physics teaching.

Keywords: *application-oriented university, modular teaching, SPOC, college physics*

I. INTRODUCTION

The quality of education has become a prominent problem in the transition period of the higher education of China from elite education to public education and applied education. With the development of the applied talent training, as well as the development of new teaching concepts, informatization and networking, the status of college physics teaching has also undergone significant changes. With the reform of college courses, the teaching hours of college physics have been greatly reduced in many colleges. College physics teaching has encountered bottlenecks and severe challenges. The problem is that college physics is a basic compulsory course for science and engineering students. Learning college physics well has a great promotion to the study of the specialized courses and the future development of science and engineering students. However, in the case of reducing the teaching hours of college physics, in order not to affect the study of specialized courses, the modular teaching of college physics is adopted. The teaching objective of college physics is to support the study of specialized courses, provide thinking methods for the study of specialized courses, enlighten the students' scientific thinking, cultivate the students' innovative awareness, and improve the students' practical abilities and scientific literacy, which can

make the students become qualified applied talents [1-3].

II. BASIC CONCEPTS AND CHARACTERISTICS OF MODULAR TEACHING

It can be seen from [1-3] that modular teaching is a teaching method which divides a course into several modules of teaching contents. The basis of module division is mainly based on the students' future employments. The students should not only master the theoretical knowledge with certain depth and width, but also possess the practical abilities which have promotion to the study of specialized courses and future developments. The division of teaching modules must meet the requirements of the knowledge integration of general knowledge and specialized knowledge. In modular teaching, the knowledge module can be a fragment of a course. The purpose is to enable the students to obtain excellent general knowledge and strong abilities to solve problems, and then to reduce the gap between school-based teaching and social requirements. The students in the same module can be students with different future occupations in the same major. The aim of the module of students is to accomplish the various training objectives of different majors. Regardless of the module used, it is always student-oriented in teaching. The strengthening of the construction of teachers' morality can improve the students' learning initiative, so that the physical concepts can be applied to the real life and work. These can improve the students' working abilities and well meet the actual requirements of the society.

III. THE PRESENT STATUS OF COLLEGE PHYSICS TEACHING

With the rapid development of the popularization of higher education, the number of students in our university increases. The students have different learning foundations, and there are also individual differences among the students, which have made the failure rate of college physics examinations more and

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more high. At the same time, the college enrollment expansion has caused employment difficulties and the sense of learning uselessness, which have resulted in excessive exam-oriented education in the college physics teaching. The pragmatic teaching mentality of focusing on examinations more than practice and results more than processes has greatly affected the teaching efficiency and the cultivation of high-quality applied talents. Firstly, the college physics teaching in our university is still limited to traditional teaching methods, which emphasize the learning process of students and ignore the cultivation of the students' physical thoughts and abilities. Secondly, the teaching of physics frontiers and the number of academic lectures are very few, which result in the students lack of frontier of knowledge. Thirdly, the combination of multimedia teaching and traditional teaching is adopted in our university. However, due to the coherence of physical logic thinking and the complicated derivation of physical laws, the effective usage of modern teaching methods and intelligent classroom in college physics teaching is still the striving direction. In recent years, the teaching hours of public courses have been reduced in the process of specialty constructions, resulting in less teaching hours and heavy teaching tasks in college physics teaching. How should we do to make the students to learn college physics actively and also learn well in the limited numbers of teaching hours? It is particularly urgent to perform the teaching reform.

IV. INTRODUCTION TO SPOC LEARNING PLATFORM

A. Characteristics of SPOC Learning Platform

A large number of teaching resources can be openly displayed through Small Private Online Course (SPOC) teaching platform [4-6], which cannot be restricted by space and time. Through SPOC learning platform, the teaching contents can be exhibited in different forms, and the combinations of various teaching media and mobile Apps reflect a mixed intelligent teaching mode. Using SPOC learning platform in the teaching process, the teachers can guide the students to conduct targeted and in-depth discussion, highlight the teaching key points, and fully stimulate the students' interest.

B. Advantages of SPOC Learning Platform

The students can preview the follow-up courses and learn the general knowledge of the teaching contents by self-study through various forms of teaching resources on SPOC platform. In the classroom teaching, the teaching contents in the syllabus that are closely related to the specialized courses are mainly completed. However, through the classroom teaching, it is not always possible for all students to fully understand the difficult physical concepts and physical laws, as well as the applications of these laws. Therefore, the students can choose the corresponding learning contents to review on SPOC platform after class and consolidate the knowledge learned in the classroom.

The teachers can learn about the extent of the students understanding the knowledge through the assignments and quiz on SPOC platform. The teachers can also explain the teaching contents that the students do not understand well in time. In

particular, the online discussion on SPOC platform can effectively supplement the discussion that cannot be carried out in classroom due to the limited teaching hours.

The SPOC platform possesses the information analysis and teaching management functions, which can give the students reasonable assessments, help the teacher to strengthen the targeted guidance, and provide the students with powerful support for personalized learning. Therefore, it is of positive practical significance to carry out targeted SPOC teaching experiments.

V. EXPLORATION OF THE MODULAR TEACHING OF COLLEGE PHYSICS UNDER THE BACKGROUND OF APPLIED TALENTS

A. Main Contents of Modular Teaching

The main contents of modular teaching of college physics is to divide the course into several modules of teaching contents according to the requirements of different majors. The teachers in the course group carefully communicate with the specialty leaders of various majors. Starting from the supports of college physics teaching to the follow-up courses of various majors, the teaching contents of college physics is modularized firstly. Secondly, according to the training objectives of different majors, the students are modularized, and thus the modularized syllabus is made. Finally, different teaching methods and assessment methods are used to different teaching modules to achieve the best teaching results and ensure the teaching quality. The teaching contents can be divided into six teaching modules: classical mechanics, thermodynamics, electromagnetics, vibration and wave motion, wave optics and modern physics. The modular teaching in our university is classified in Table I.

B. Development of Multimedia Coursewares

The development of multimedia coursewares and micro-lectures that meet the actual requirements of teaching can make necessary supplements for the self-study of students. We should make full use of the multimedia technology and network resources to develop and innovate the multimedia coursewares of college physics teaching. This can change the previous status that the multimedia coursewares can only play the slideshows, and integrate the videos of physical experiments and simulated experiments into the coursewares. According to the syllabus of each teaching module, the typical teaching contents are selected and recorded as teaching videos about 10 minutes together with other related teaching resources (including teaching plans and teaching reflections). All these teaching resource as shown in Fig. 1 can be implemented networking management.

C. Integrating the Physical Knowledge into the Mathematical Contest in Modeling

In the process of college physics teaching, an individual module related to the mathematical classic theory will be established, and the relationship between the physical models and mathematical models can be introduced to the students. How can we well relate the physical models to the mathematical modeling? For students in different teaching

modules, we should effectively guide the students to actively participate in the mathematical modeling activities and cultivate the students' innovative spirit. The students with active learning interests will be organized to set up study

groups, then participate in the mathematical modeling groups of College of Science, and finally participate in China Undergraduate Mathematical Contest in Modeling.

TABLE I. CLASSIFICATION OF MODULAR TEACHING

College	Teaching Modules					
	Classical mechanics	Thermodynamics	Electromagnetics	Vibration and wave motion	Wave optics	Modern physics
College of Electronic Information Engineering	√				√	√
College of Mechanical and Automotive Engineering	√		√			
College of Computer Science and Technology	√		√			√
College of Science	√		√			
College of Food Science and Engineering	√	√			√	
Sino-Russian Institute	√	√	√	√	√	√

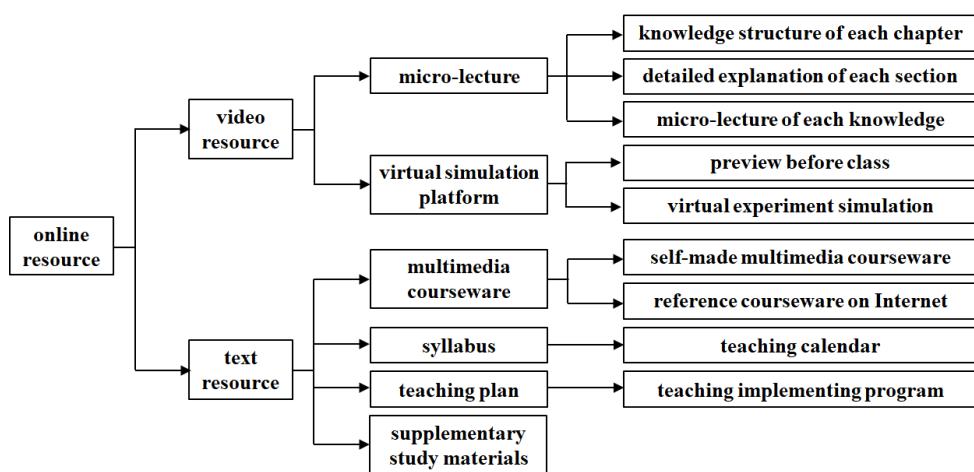


Fig. 1. All the online teaching resource of college physics teaching.

D. Development of Course Assessment Method

The course assessment method should be further reformed and improved to combine the learning process evaluation with the final examination [7]. The comprehensive assessment score can be divided into three parts. (1) The regular score (20 %) includes attendance, classroom question, and homework, which mainly assesses the students' learning attitudes. (2) The test score (60 %) includes classroom tests, mid-term exam, and final exam, which mainly assesses the understanding of the basic knowledge and basic skills of physics. (3) The application score (20 %) mainly assesses the abilities of applying the mathematical knowledge to solve practical physical problems in the "Mathematical Practice and Physics Application" teaching module.

VI. SUMMARY

After two years of teaching practice, we find that SPOC-based college physics modular teaching can arouse the students' learning interest and ensure the qualities of teaching and learning, which can also highlight the student-oriented

teaching and explore the learning potential of different students. On the other hand, it can well reflect the leading role of the teachers in guidance. The teacher's guidance can extend from the classroom to outside the classroom, which is no longer limited by the time and space. This kind of teaching process can effectively support the deep learning of college physics. As the increase in the number of discussion and the improvement of the students' participation, the innovative thinking has been cultivated, and the training objective of college physics teaching has turned to innovative, high-level and challenging quality education. In summary, multi-dimensional and diversified teaching methods can bring significantly improved teaching effects, promote the further development of teaching reform, and finally effectively improve the teaching level of college physics.

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