

Practical Research on SPOC Mixed Teaching Model in Physics Experiment Class for Students with Hearing-impaired

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Abstract: Under the epidemic situation, SPOC mixed teaching model is an important form of higher education for the students with disabilities. This paper introduced the advantages of this model in the classroom teaching of students with hearing-impaired, and took the college physics experiment class as an example to introduce the specific teaching implementation methods. The results showed that SPOC mixed teaching model can well motivate the learning initiative of students hearing-impaired. Also, SPOC model can significantly improve the learning investments of students and the teaching effects of teachers.

Keywords: SPOC, Blended Learning, Hearing-impaired Students

1. Introduction

People with disabilities enter higher education institutions and receive education together with able-bodied students, reflecting the development level of social civilization. The "Statistical bulletin on the development of the cause of the disabled in 2020" reported a total of 13551 people with disabilities in China became undergraduates in 2020, of which 2253 entered specialized special education colleges to receive higher education [1].

With the expansion of the number and range of specializations of people with disabilities entering colleges and universities, it is an important issue for the majority of teachers involved in special education to improve the quality of teaching for populations with special education needs. Thus, the students with disabilities can achieve the due academic level. The dual improvement of students' academic performance and cognitive development has always been our goals. Since 2020, the complex and changing epidemic situation has also brought significant changes in the teaching modes of colleges and universities. Online teaching has been in an auxiliary position for a long time. However, online teaching with its specific advantages is now becoming a necessary part of the daily teaching process in colleges and universities. Under the new situation, it is an important task to create an effective blended teaching model in the teaching of students with disabilities. Therefore, on the basis of completing the basic learning tasks, the students with disabilities can actively engage and learn to their own strengths.

2. Advantages of the SPOC mixed teaching model

The SPOC mixed teaching model refers to a small-scale restricted online course. It issues micro-lecture videos, simulation presentations, literature materials, and even excellent student assignments on platforms, such as Rain Classroom and Tencent Classroom, for students to preview and learn. Such online course has a relatively small scale and various forms of presentation, and diverse teaching resources on platforms can also be dynamically adjusted[2].

SPOC courses have a specific target audience. In the using process, SPOC courses should be timely adjusted according to the actual situation of the teaching objects. The teaching settings can be compatible with the knowledge accumulation of learners. The outcomes of the interactive session can also generate new teaching content for later learners to refer. By exploring the laws of learners' online learning, we can summarize their learning patterns and preferences. We can help students develop a stronger sense of identity so that the students are more willing to engage in active learning.

Students with hearing-impaired are a minority group in colleges and universities. The congenital inconvenience of these students causes a serious information deficit when they obtain general teaching resources. Thus, students with hearing-impaired always have unsatisfactory learning outcome. The proportion of various online resources with subtitles is very low, which is difficult to meet the learning needs of students with hearing-impaired. Therefore, it is necessary to use the SPOC mixed teaching model as an important auxiliary means of classroom teaching for students with disabilities. Teachers can continuously supplement learning resources according to students' learning conditions, so that the students can feel respected. Meanwhile, the specific teaching designs make the students feel valued, and thus the students have more initiative in learning.

3. Practice of SPOC mixed teaching models

In traditional physics experiment teaching in colleges and universities, one of the most important preview method is for students to write preview reports of the experiments to be done in advance. Then, the teachers conduct experimental teaching presentations in the classroom. The teachers are absolutely dominant in the classroom, and the students' tasks are limited to completing steps specified in the experiment, such as obtaining data and processing calculation. In the whole teaching process, students do not need to consider the causes and consequences. With the fundamental purpose of completing the experiments, the students passively accept and operate the experiments. Thus, the active investigation of students is restrained, and the teaching effect is unsatisfactory.

To improve this situation, we designed SPOC mixed teaching model. This model combines the application of the simulated online platforms and Rain Classroom, which can provide learning resources for students with hearing-impaired. The teaching subjects were undergraduates of the Department of Information Technology of the Faculty of Special Education of the Beijing Union University.

Pre-class stage: Preview content was posted on the Rain Class, including the semester teaching plan, teaching progress, weekly teaching content arrangement, required and optional assignments to be submitted, and discipline competition guide related to the course, etc. Before each class, the students could conduct a comprehensive preview using the online video demonstration and simulated operating system on the simulation experimental platform. After the preview, the students could test their preview effect by the pre-class diagnostic exercises in the preview system. At the same time, the students could also make their own unique study plans at the beginning of the semester. On the basis of completing the required assignments, the students could choose optional assignments that suits their needs, and design and demonstrate feasibility of the tasks.

Mid-class stage: Conduct task-driven learning activities in classroom.

The students began learning activities with the course tasks that they had learned before class. The physical demonstration video with sign language translation window could allow the students to be deeply impressed with the experimental instruments, steps and detailed operation of the experiment. The teachers conducted the important experimental steps during the class, and then guided the students in groups. In addition to helping the students complete the experimental contents and obtain experimental data, the teachers also need actively to guide the students to think and summarize. The students could consider the ingenuity of each experimental design, the various types of errors that may occur in each step, and the feasible improvement scheme to improve accuracy. During this part of the course, the students could actively think and experiment, and the students also had necessary interaction and communication. The thinking development of the students with hearing-impaired was deepened, and their cognitive level was promoted while acquiring knowledge.

The students had an in-depth understanding of the significance of physics experiments while completing the basic experimental contents. Some students with active thinking and strong practical ability could come up with their own experimental ideas and put them into practice. For example, in the "Newton ring" experiment, the students proposed that adding a liquid crystal display at the eyepiece can effectively alleviate eye fatigue in the experiment. This method could obtain more accurate experimental data. The teaching process was mainly based on sign language and oral communication, and it paid attention to teacher-student and student-student interaction. At the same time, the intelligent speech recognition system was used to convert the speech into text in real time and display it on the screen to ensure that the students could obtain complete information. The text were saved as text lectures for future reference

Post-class stage: After each experiment, the teacher asked the students to think for themselves. The

students needed to think what other methods can be used to do the experiment. The students could propose new design ideas or improved methods on the basis of the original experiment. In this way, after a learning cycle, the students had certain inspiration, and then they tried to improve new experiments. Among the optional assignments after class, some students designed a new "Jacob Ladder", and some students designed an "electronic guide dog". Also, some students recorded a video of the error-prone points in each experiment as a "special reminder" to provide reference for other students. All these contents were retained as new SPOC online teaching resources

4. Analysis of practical effect of SPOC mixed teaching model

The evaluation of SPOC mixed teaching mode is diversified. The students were required to evaluate themselves and their classmates according to the evaluation criteria designed by teachers. The teachers provided appropriate comments and guidance. Self-evaluation and mutual evaluation among students could give students a greater sense of participation. The students could learn to objectively judge the performance of others, while achieving self-improvement.

After three semesters of teaching practice (involving three grades), a complete set of online teaching resources for college physics experiments were basically formed. The resources includes micro-lecture videos with sign language interpretation, simulated experiments, online quizzes and tests, and students' excellent assignments. The enthusiasm for learning of the students involved in this practical research was increased constantly, and the students with hearing-impaired won the first prize in the municipal physics experiment competition.

At the end of each semester, the students were required to complete a questionnaire. A total of 62 students with hearing-impaired in three grades submitted valid responses. The results of the questionnaire showed that 19.3% of the students were "very satisfied" with the learning mode of the course, and 59.7% of the students were "quite satisfied". Some students (21.0%) felt "average", but none of students chose "very dissatisfied" (see Figure 1). The key factors determining the final learning outcomes (in order of importance) were: the teachers' guidance and timely feedback, the quality of micro-lecture videos, self-time investment, the cooperation situation of group members, the teachers' lectures in class, and the accuracy of sign language translation in the videos.

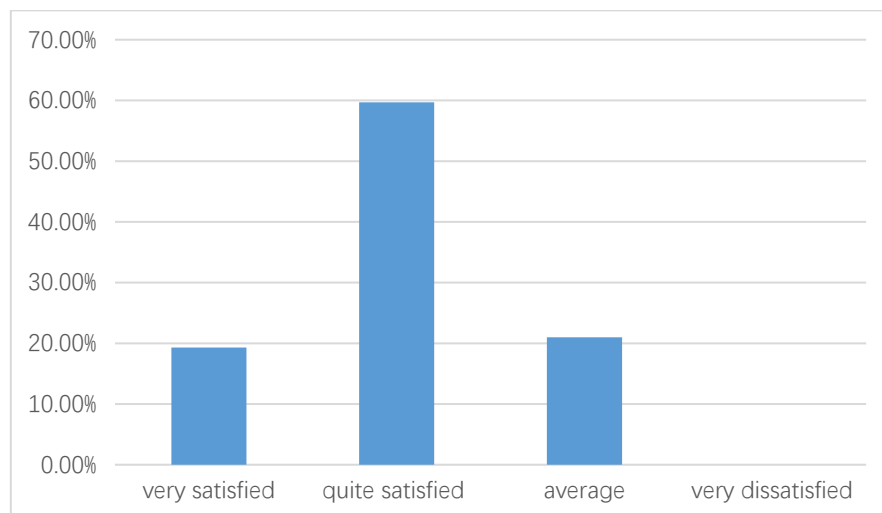


Figure 1: Satisfaction Questionnaire

In the interview, some students said, "In this learning model, there is more interaction than before. Although it sometimes takes some time to unify everyone's thoughts, the joy of achieving results after working together is also very unforgettable." Some students also said, "The teacher's feedback is timely, so that I can find my own problems as soon as possible." "I can see that others are making progress. I also have some pressure and am willing to catch up with others as soon as possible." However, some students also responded that "one such course per semester is enough. It takes up a lot of my spare time. and it is very tired."

The results showed that the students were very enthusiastic about learning, and most of them were willing to invest time and energy to participate in various learning activities. Since students with disabilities are inconvenient to obtain information, many students with excellent performance have strong

self-learning and independent study ability. Students with disabilities need teachers' macro guidance on learning and timely feedback from teachers on learning outcomes, as well as the provision of course resources suitable for their independent learning. Compared with teachers who spend a lot of time explaining experimental principles and procedures in class, the students prefer that the teachers can give timely guidance when they encounter difficulties. At the same time, the mutual help of peers can also play a very important role.

The results also found that sign language translation and real-time subtitles had significantly different effects on students with different hearing-impaired. Thus, the teachers need to take all factors into consideration when making teaching resources.

During the course implementation, two main problems were found. First, with the SPOC mixed learning model, the students spent more time in learning, but the learning efficiency per unit time was not increased. Second, the students with hearing-impaired had significant individual differences, and the learning outcomes of some students was not significantly improved with the SPOC mixed teaching model. In the future, it is important to focus on providing personalized teaching guidance and improving the learning outcomes of each student.

5. Conclusions

In general, the classroom teaching of undergraduates with hearing-impaired requires more personalized teaching resources. The SPOC mixed teaching model has special values in improving the learning outcomes of populations with special education needs. The teaching mode combining online resource delivered and offline group instruction will be the key point of teaching reform in the next few years. Therefore, the teachers engaged in special education are required to be more attentive to select and produce diversified teaching resources. The teachers need to make characteristics and serve students.

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