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Online Teaching Practice and Analysis of "Electromagnetic Fields and Electromagnetic Waves" Course

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Abstract

Against the background of epidemic prevention and control, the Ministry of Education requires that under the conditions of ensuring the health of teachers and students, do a good job of teaching "no suspension of teaching, no suspension of learning". Taking the course "Electromagnetic Fields and Electromagnetic Waves" as an example, the paper uses information technology to promote the reform of teaching methods and teaching modes. The choice of online teaching methods and online teaching platforms are comparatively analyzed, as well as the content organization and assessment methods of online teaching are introduced. The quality of online and offline teaching are analyzed and compared.

Keywords

Electromagnetic field and electromagnetic wave; Online teaching; Rain classroom; Teaching quality.

1. Introduction

In response to the impact of the new coronavirus infection pneumonia on the normal school opening and classroom teaching in colleges and universities, the Ministry of Education issued the "Guiding Opinions on Doing a Good Job in the Online Teaching Organization and Management of Colleges and Universities During the Epidemic Prevention and Control Period" [1], requiring "no suspension of teaching, no suspension of learning".

In the context of epidemic prevention and control, it is very important to choose the appropriate online teaching platform based on the characteristics and academic characteristics of the "Electromagnetic Fields and Electromagnetic Waves" course [2] [3], which is an important professional core course in electronic information engineering major. In particular, the basic concepts and theories of this course are very abstract [4] [5], and the formulas are complex and changeable. How to use information technology to improve students' learning enthusiasm has become a huge challenge for teachers in online teaching.

Based on the analysis of the characteristics of the course "Electromagnetic Fields and Electromagnetic Waves", the thesis comparatively analyzes the characteristics of different online teaching methods and online teaching platforms, and introduces the process of teaching content organization and course evaluation using the super star learning and rain classroom. Online and offline teaching quality are compared, and the feasibility of online teaching to improve teaching quality in the future are discussed.

2. Online Teaching Practice

In the context of " no suspension of teaching, no suspension of learning ", the teaching of the "Electromagnetic Fields and Electromagnetic Waves" course must be based on the

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characteristics of the course, selecting a suitable online teaching platform and teaching method, and organizing a reasonable teaching content, so that students can master the main content to complete the goal of talent training.

2.1. Course Characteristics

The course "Electromagnetic Fields and Electromagnetic Waves" mainly describes the basic theories and applications of electromagnetic fields and electromagnetic waves, focusing on the training of problem analysis and problem solving methods. In the traditional teaching process, most of them focus on theoretical teaching. The 45 minutes of the classroom cover a large amount of formula theory and calculation. It is difficult for students to increase their enthusiasm for curriculum learning. At the same time, classroom time is limited, and it is difficult for students to form good interactions with teachers. The lack of classroom discussion links makes it difficult for teachers to master the students' learning situation, and it is impossible to adjust the course teaching content in a timely manner according to academic conditions.

According to the characteristics of such courses, we have carried out teaching reform exploration in the teaching content, teaching methods, teaching methods and assessment methods in the teaching process to improve the teaching effect to a certain extent [6]. In the entire teaching process, the use of information technology is still insufficient. In the context of epidemic prevention and control, to fully achieve online teaching, it is also necessary to fully understand the characteristics of various online teaching platforms and teaching methods to choose the appropriate way to complete teaching.

2.2. Choice of Teaching Platform

With the continuous development of information technology, a large number of online teaching platforms have emerged, including rain classroom, super star learning, tencent classroom, tencent conference, QQ group classroom, etc. These online education platforms are able to make full use of the advantages of information technology, realize different levels of interaction with students, and complete teaching activities online. According to the classroom characteristics of "Electromagnetic Fields and Electromagnetic Waves" and the results of the teaching reform practice, rain classroom and super star learning were chosen as the main platform for this online teaching.

Rain Classroom is jointly developed by School Online and the Tsinghua University Online Education Office. It aims to connect the smart terminals of teachers and students, giving each link before class, class, and after-class a brand new experience to maximize the release of teaching and learning, to promote teaching reform [7]. Rain Classroom can integrate sophisticated information technology methods into PowerPoint and WeChat, establish a communication bridge between extra-curricular preview and classroom teaching, and make classroom interaction never go offline. Teachers can push videos, exercises, courseware to the mobile phones of students. Teachers and students can provide timely feedback, which provides a perfect solution for strengthening teacher-student interaction.

Super star learning is a brand-new product of the exam bar education open platform, which builds an online virtual interactive space for all users. In this virtual school, there are multiple network multimedia classrooms for students to use, and different courses are set up in these teachers according to different needs. All students and teachers who choose this course can enter the classroom for teaching activity at the set time. In this virtual classroom, students can not only hear the content of the teacher's lectures, but also have questions and discussions with the teacher [8]. At the same time, teachers can distribute pre-prepared courseware, videos and other content to all students. This very practical data sharing function makes online teaching functions more convenient and powerful than actual classroom teaching.

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2.3. Organization of Teaching Activities

The biggest challenge of online teaching is how to present the teaching content to the students, so that the students can quickly clarify the learning points and learning rhythm. The course "Electromagnetic Fields and Electromagnetic Waves" has a total of 48 school hours and contains 6 chapters. Students are required to master the basic equations of the electromagnetic field, the solution of the electrostatic field problem, the constant electric field and the constant magnetic field, the time-varying electromagnetic field and the reflection of electromagnetic waves after having the mathematical knowledge of vector analysis.

Therefore, in the process of teaching content organization, a large amount of learning content must be fragmented in a limited period of time, and knowledge points should be replaced by chapter explanations to allow students to start from the knowledge point and understand the source, essence and application of the knowledge point. After comprehensive analysis and thinking, according to the syllabus and students' learning ability, extract 3 to 4 knowledge points from each chapter, and make these knowledge points into a video, which will be placed in the virtual classroom of Super star learning. Each knowledge point video contains an average of 2 sub-sections, and the duration is about 15-20 minutes. The teacher mainly explains the source and use of knowledge points, weakens the derivation of related formulas, and allows students to clarify the purpose of learning in a limited time.

In the online teaching process, students will receive the learning requirements and learning objectives of the next course before the class. The students will conduct relevant previews according to the learning requirements, and they can also see the video made by the teacher in advance. During the class time period, students can watch the video repeatedly or interact with the teacher to solve the problems encountered during the pre-class preview. At the same time, teachers use the rain classroom to conduct simple tests to master the students' learning in real time, thereby continuously adjusting the teaching rhythm.

2.4. Course Assessment Method

The course evaluation of this online teaching activity is divided into two parts: the online teaching platform's homework, discussion, participation and offline closed-book exam.

Traditional classroom assessment methods are mainly attendance, homework, and final exams. Students simply think that as long as they sit in the classroom, they can get good grades by handing in the homework on time. Previous teaching reforms also evaluated students' participation in classroom discussions, but lacked an objective evaluation mechanism. The biggest difference in this online teaching is that each student's classroom participation can be objectively evaluated, and the class participation is highly weighted in the calculation of assessment results.

In the process of evaluating student participation, it mainly analyzes the time length of watching videos, counts the number of student-teacher exchanges, and counts the enthusiasm of students to hand in homework. Through the analysis of the exported data from the teaching platform, it was found that most students were able to watch the video on time according to the requirements of the pre-class preview, and completed the basic learning purpose.

In summary, in the context of epidemic prevention and control, Rain Classroom and Super star learning are used as online teaching platforms. The knowledge points are made into videos to help students for preview. Based on the requirements of pre-class learning and the purpose of learning, teachers can learn the learning situation of students; constantly adjust the teaching rhythm and teaching content organization. Online classroom participation and offline closed-book exams are used for course evaluation.

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3. Practical Results Analysis

Through the online teaching practice and the previous offline teaching reform practice, students can actively participate in the classroom discussion, and the completion of homework is better than the traditional classroom. In this online teaching process, students can watch the video seriously and participate in the classroom discussion process, which has increased the degree of freedom and enthusiasm for learning.

Curriculum scores are still the main basis for teaching reform practice. The distribution of the knowledge points assessed by the online and offline students' exam can cover the requirements of the syllabus, and the proportion also meets the requirements of the course syllabus. The closed-book exam use three types of questions: fill in the blank, short answer, and calculation to test to evaluate the basic content, comprehensive application and innovation ability, which can reflect the students' knowledge mastery and ability to solve practical problems.

In the offline teaching process, students in Class A are more able to actively participate in the class discussion than students in Class B, and the completion of the homework is better. Simply looking at the results of the rolls, there is little difference between the students in Class A and B, as shown in Figure 1. As can be seen from the figure, the students' scores are mainly concentrated between 60 and 79, and the number of students with scores above 80 is very small, indicating that most students can only master the basic teaching content and meet the basic teaching requirements.

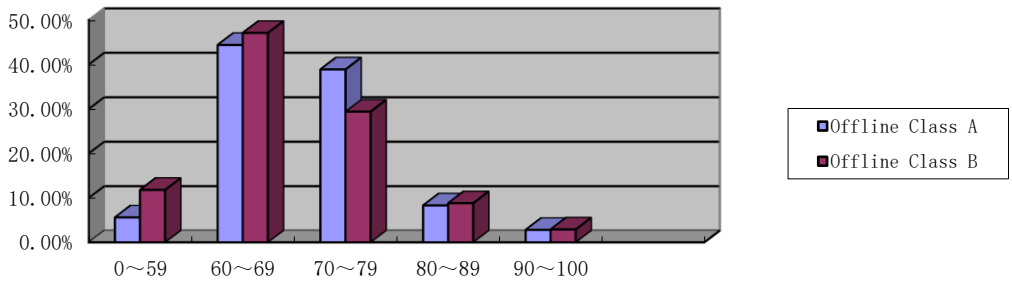

Fig 1. Roll score distribution of Class A and Class B in offline teaching

The distribution of scores of online teaching is shown in Figure 2. Overall, the quality of online teaching is better than that of offline. The scores of students are concentrated in the three ranges of 60-69, 70-79 and 80-89, and the proportion of students with 80-89 points is higher than the offline teaching results. It shows that most students can adapt to the online teaching method, and by repeatedly watching the learning video and strengthening the interaction process with the teacher, they can enhance the learning enthusiasm to a certain extent and have a good grasp of basic concepts.

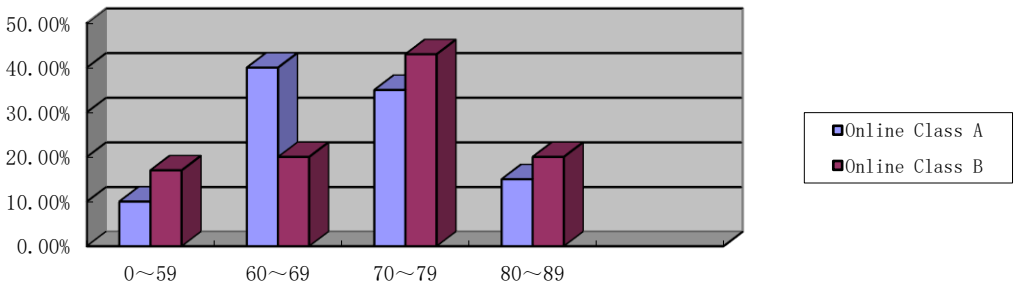

Fig 2. Roll score distribution of Class A and Class B in online teaching

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Through the practice of online and offline teaching reforms, the comparison of the total scores of the two A and B classes is shown in Figure 3 and Figure 4. The results in the figure can show that, no matter the online teaching or offline teaching, the difference between the highest score, the lowest score, and the average score of the students is not large, indicating that the online teaching method can ensure the teaching quality.

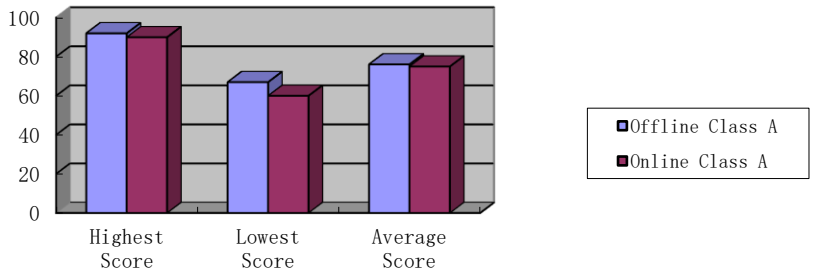

Fig 3. Comparison of the total scores of offline Class A and Online Class A

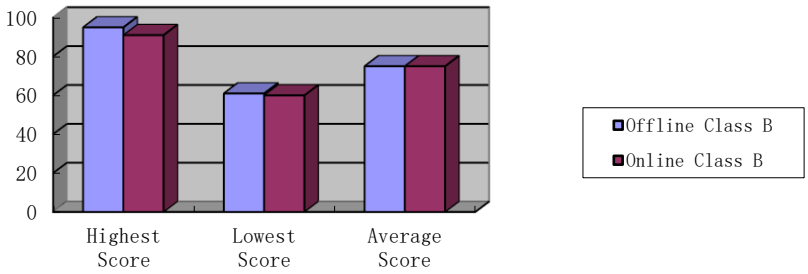

Fig 4. Comparison of the total scores of offline Class B and Online Class B

4. Conclusion

Against the background of epidemic prevention and control, the author conducts online teaching practice on the course "Electromagnetic Fields and Electromagnetic Waves". By analyzing students' classroom participation and course performance, it fully shows that online teaching can fully guarantee the teaching quality and learning effect. After the epidemic is over, how to fully integrate the learning video resources of online teaching construction with the offline teaching process [9] [10], further improving the quality of teaching is a question that the author needs to ponder.

Acknowledgements

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