

Research on Innovative Teaching Methods of Probability Theory and Mathematical Statistics under the Background of Internet

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Abstract: Probability theory and mathematical statistics is an important basic course of science and technology, economics and management, and has close contact with industry, agriculture, military and science and technology, so it is particularly important for students to study probability theory and mathematical statistics. The learning effect of students largely depends on the teaching methods of teachers. Under the background of the Internet, the emerging development of Internet education, in order to conform to the development of The Times and improve the quality of teaching, the innovative teaching methods of probability theory and mathematical statistics should also be studied. Based on the analysis of the characteristics and advantages of Internet education, combined with the characteristics of probability theory and mathematical statistics and the shortcomings of current teaching, this paper designs an innovative teaching method based on the application of flipped classroom teaching mode under the Internet. Taking the rain classroom as an example, the teaching method is designed from three links: preview before class, teaching in class and feedback after class. Under the background of Internet education, it is of great significance to improve the teaching quality of probability theory and mathematical statistics courses.

Keywords: Probability Theory and Mathematical Statistics; Teaching Method; Internet Education; Flipped Classroom; Rain Classroom.

1. Introduction

Probability theory and mathematical statistics are important basic courses for engineering and economics and management majors in colleges and universities. Its theories and methods have been widely used in industry, agriculture, military and science and technology, and are closely related to other disciplines. It is an important part of modern mathematics. Learning probability theory and mathematical statistics is of great significance for cultivating students' ability to analyze and solve practical problems by using probability and statistics methods.

Previously, the education department stressed the need to deepen the reform of undergraduate education and teaching, and comprehensively improve the quality of talent training. Teaching quality is one of the important factors affecting the effectiveness of talent training in colleges and universities. The Action Plan for Deepening the Teaching Reform of Basic Education Courses issued by the General Office of the Ministry of Education in May 2023 clearly pointed out that it is necessary to "promote the improvement of digitally enabled teaching quality [1]. Actively promote the digital transformation of education, improve the quality of education and teaching and management level through the use of information technology. Under the background of "Internet + education", it is of great significance to improve the quality of teaching by using Internet information technology. Yang Chong studied the blended teaching of probability theory and mathematical statistics based on the resources of MOOC [2]. Liu Huigang took the course of probability theory and mathematical statistics as an example to explore the method of online and offline hybrid teaching [3]. Under the background of the Internet, the application of flipped classroom is particularly prominent for the aid of teaching.

Han Tianhong studied the teaching of probability theory and mathematical statistics based on the flipped classroom teaching method [4]. Yi Yanchun et al. [5] studied the flipped classroom teaching mode of Probability Theory and Mathematical Statistics based on the platform of Xuetong. There are various researches on the teaching methods of probability theory and mathematical statistics. However, under the background of Internet plus, there are few researches on the methods of using information technology to improve the teaching quality of probability theory and mathematical statistics.

Through the investigation and analysis of the current situation of Internet education and the analysis of the current situation of probability theory and mathematical statistics teaching, this paper designs an innovative teaching method based on the background of the Internet, mainly taking the rain classroom as an example to explore an innovative teaching method with high efficiency and high quality.

2. Internet Education

2.1. Definition of Internet Education

Internet education is the deep integration of Internet technology and related technologies with the field of education to realize the innovation and reform of education models. Give full play to the advantages of Internet education resources, use various information technology means and forms, carry out digital education content dissemination for users with different needs, and provide high-quality education services anytime and anywhere [6]. Its essence is to promote the balanced distribution of educational resources and the improvement of educational quality by means of technology. It is not just a simple extension or replacement of traditional teaching methods, but a new form of education, which

emphasizes the organic combination of information technology and education and teaching process, aiming to create a more open, flexible and personalized learning environment.

2.2. Characteristics and Advantages of Internet Education

Internet education (1) has cross-border connectivity. Internet education can integrate different educational resources, which plays an important role in realizing the leap of education level and level quality; (2) Innovation-driven, innovating the whole and part of education through Internet thinking and technology, so as to promote the reform and upgrading of education and teaching mode; (3) Ecological, Internet education can provide diverse learning content according to each student's different differences, making learning more personalized and nuanced, so as to better improve students' learning ability and learning quality; (4) It is open. Internet education can break the restrictions of regions and countries, making education more open.

"Internet + education" is in a fresh field in the field of education in China. It has many advantages: (1) free time and place, you can learn online anytime and anywhere; (2) The Internet is rich in learning resources; (3) learning conditions are not high, with a mobile device or computer; (4) Students can be taught in accordance with their aptitude [7].

2.3. Comparison between Traditional Education and Internet Education

The traditional education classroom has a "1+n" model of one teacher and multiple students in the classroom. The teacher prepares lessons first. In class, the students use chalk to explain on the blackboard, and the students learn knowledge through the teacher's blackboard and explanation. After class, the teacher assigns the corresponding paper homework, and the students practice, so as to strengthen the consolidation. The traditional education mode is relatively fixed and single. Due to the lack of communication between teachers and students, teachers' courses and teaching methods are not necessarily suitable for students.

Internet education enables students to acquire knowledge in a variety of ways. Students can preview in advance through the course resources on the Internet before class. During class, teachers can teach through PPT, flipped classroom, video teaching and so on. After class, teachers can assign homework in the flipped classroom APP and other ways. The application of the Internet can make personalized learning plans by analyzing the data of students' homework. Students can learn the knowledge they do not understand in class through the Internet after class to check and fill the gaps. The teaching mode of Internet education reflects the idea of teaching students in accordance with their students' abilities, which greatly improves the efficiency and quality of teaching and the learning efficiency and quality of students.

In the context of the Internet, the use of Internet education is the general trend, but traditional education cannot be obliterated. We should combine traditional education and Internet education, and further improve the education level and teaching quality by using their respective characteristics. The way of Internet education is more diverse than the single traditional education. Learning resources are more abundant. However, the use of PPT and other teaching tools will make students skip the knowledge. We also need the chalk and board writing of traditional education. The integration of

traditional education and Internet education improves the quality of education.

3. Probability Theory and Mathematical Statistics Teaching Status Analysis

Probability theory and mathematical statistics is an important basic mathematical course for science and engineering and economics and management majors in colleges and universities, but there are some problems and challenges in its teaching situation. The following is a detailed analysis of the current teaching situation of the course [8]:

The teaching is single and the teaching materials are outdated: compared with the Internet education, the teaching mode of probability theory and mathematical statistics is single, and the course is lack of pertinence, which greatly reduces the interest and motivation of students at different levels of learning. For the teaching materials used in learning, many colleges and universities still use the old edition of teaching materials, which focus on theoretical knowledge and are not closely related to real life.

Emphasis on theory, light practice: Probability theory and mathematical statistics are courses that integrate theory and practice, but most teachers attach great importance to the theoretical part and ignore the practical training part. Many textbooks also ignore the practical training content, and the number of topics is not enough. Only more practice can consolidate theoretical knowledge, which is a serious problem in the teaching of probability theory and mathematical statistics.

Limited teaching resources: In many colleges and universities, probability teachers rely on textbooks for the teaching of probability theory and mathematical statistics, and the teaching resources are limited. There is no good use of the rich teaching resources under the Internet. Lack of reasonable use of teaching resources.

improper use of teaching methods: teachers with deeper qualifications do not have a high grasp of the use of Internet information technology, so the use of traditional teaching methods is relatively single, and students' learning motivation is not positive. Young teachers rely on information technology teaching, the use of PPT and other tools, teaching speed is too fast, students are difficult to truly accept knowledge.

4. Innovative Teaching Method Design based on Rain Classroom

Under the background of the Internet, flipped classroom teaching mode is common, such as learning platform, micro teaching assistant platform, rain classroom platform is widely used. Flipped classroom is a product that ADAPTS to the information-based teaching advocated by the state. Flipped classroom highlights student-centered, emphasizing students' pre-class learning and teachers' classroom guidance. Taking the rain classroom as an example, this paper uses the rain classroom platform to carry out the flipped classroom teaching of Probability Theory and Mathematical Statistics, improve students' interest in learning, and improve the teaching effect of the course. Based on the previous analysis of the characteristics and advantages of Internet education and the analysis of the current situation of Probability Theory and Mathematical Statistics course teaching, Rain classroom is

used for teaching design under the background of the Internet.

The Rain classroom platform includes a teacher management platform and a student mini program. Teachers and students can use Rain Classroom to prepare lessons and learn at anytime and anywhere. The application of flipped classroom is mainly through two stages of teaching and feedback to complete teaching. Based on the rain classroom platform, the teaching method design of the course of Probability Theory and Mathematical Statistics is carried out from three stages before class, in class and after class.

4.1. The Design of Preview Session before Class

Pre-class preview link is an important process of learning, only through the advance understanding of knowledge, in the process of class can better understand the master of the teacher's concepts, principles and so on. In terms of teachers, it is necessary to use the rain classroom platform to prepare teaching resources, including courseware learning task lists, knowledge point mind maps, etc. Strive to realize the transformation from a single micro-class video to interactive learning resources, so as to meet the personalized development needs of students. The second is to use the rain classroom platform to master the situation of students 'pre-class preview, assign learning tasks, and classroom discussion and other interactive links. This part is divided into the following steps:

1. Create a new class. Students can enter the class invitation code or scan the QR code to join the class directly.
2. Prepare teaching materials. Prepare corresponding learning materials for students according to their learning situation.
3. Upload teaching materials, and teachers release courseware and learning videos through the Rain Classroom platform to provide preview resources for students.
4. Establish a learning task list and publish the learning content of different chapters. Establish a question bank, set different types of questions according to the content of the chapter, to meet the needs of students after class.
5. Release learning tasks, check the preview situation of students, and better carry out teaching in class.
6. Online Q&A. In the preview process, you can contact teachers through QQ or wechat to answer questions.

4.2. Design of Teaching Links in Class

During in-class learning, teachers can use rain classroom check-ins to give feedback on student attendance. It can also use functions such as random selection of people in rain classroom to test students 'pre-class preview. This increases the interaction between teachers and students and also better motivates students to learn. In the teaching process, PPT can be used to explain, and you can also publish questions in class for in-class tests. The completion of classroom test questions and data can better reflect the listening situation of students, so that students can focus their attention on the class. Rain classroom also has a grouping function, which is convenient for students to discuss and solve difficult problems in class. Specifically, this part is divided into the following steps:

1. The classroom opens the rain classroom check-in function, so that students can scan the code to sign in, so as to obtain the attendance of students in time.
2. Teachers use the function of random roll call to check students' pre-class preview and understand the problems in the process of students' preview. So as to solve some problems

and better carry out the following teaching. Also do a review of the last lesson.

3. Use PPT to teach according to the preview of the class, as well as the learning objectives and key points of the chapter.

4. In the course of class, publish the exercise questions in class, so that students can consolidate the knowledge points just taught. Can also be through random spot check, point students to answer questions, timely understand the students' listening situation, and make students focus on the class. Teachers can not only rely on PPT in the teaching process, but also have the process of chalk and blackboard writing and derivation in the traditional mode, so that students can better understand and master the knowledge points.

5. In the last part of the class, you can ask questions, review the class, review and sort out the students through mind mapping and other ways, so that students can better master the knowledge points.

4.3. The Design of After-class Feedback Link

First of all, students will receive the learning feedback of this class after the class, and evaluate the students' learning in the form of scores. Better motivate students to learn. Because the course of Probability Theory and Mathematical Statistics is more abstract, it requires a lot of exercises after class to understand the concepts and formulas, etc. So, the after-class session is also very important. Teachers assign homework, exercises and so on in the rain classroom platform. The Rain classroom also has a discussion area function, students can discuss problems with each other in the rain classroom discussion area. Teachers can design the lecture content of the next class through the situation and data of students 'completion of the exercises, so as to better check and fill in the gaps for students. This part is divided into the following steps:

1. After the class, students will receive the feedback of this class immediately, which will be displayed in the form of scores to better motivate students to learn.
2. Teachers use the homework function of the Rain Classroom platform to release homework or exams to test classroom learning results. Check students' learning status and set homework deadlines to motivate students to complete homework better.
3. In the process of completing homework, students can discuss the problems they encounter with their classmates in the rain classroom discussion area, and teachers also answer the questions for students.
4. After the completion of homework, teachers check the completion of homework through the rain classroom platform and select excellent homework cases. The platform will inform each student for study and reference. There are also multiple evaluation models to evaluate students, breaking the traditional teaching mode, which mainly relies on the final test and homework situation to evaluate the evaluation system of students, so that the performance evaluation is more scientific and standardized. The classroom can grasp the student's classroom learning situation in time, and better prepare for the next class.

5. The Application of This Teaching Method in Teaching Practice

5.1. Object of Study

In this paper, 39 students from Class 2 of Data Science and Big Data Technology Grade 2023 in the School of

Information Engineering of Wuhan Business University are selected as experimental objects, and 38 students from Class 1 of Data Science and big Data Technology grade 2023 are selected as reference objects. The reference class implemented the traditional teaching mode to teach "Probability Theory and Mathematical Statistics", and the experimental class applied the rain classroom teaching mode to teach "Probability Theory and Mathematical Statistics".

5.2. Specific Application of Teaching Methods

In the pre-class preparation, students in the first class joined the Rain classroom class through the class invitation code created by the teacher, as shown in Figure 1. Teachers can upload learning materials for students to preview before class, as shown in Figure 2.

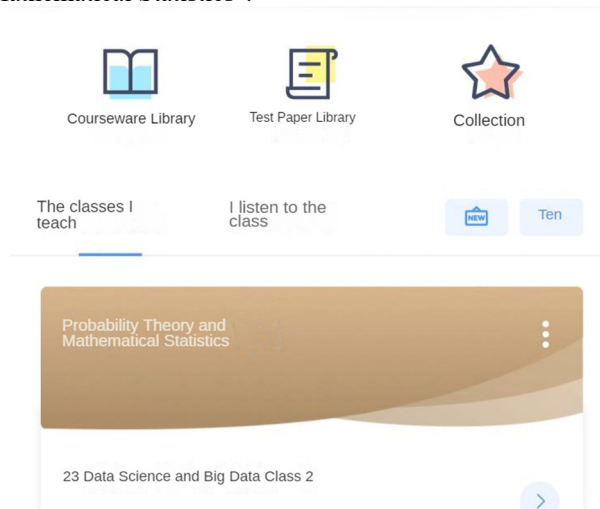


Figure 1. Class management interface of Rain Classroom

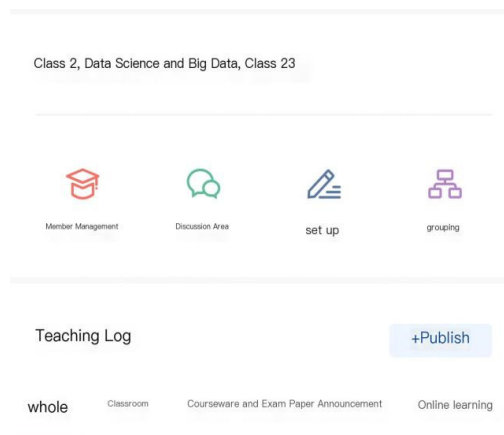


Figure 2. Rain Classroom publishes teaching materials interface



Figure 3. Rain Classroom check-in interface

In the teaching phase of the class, the teacher first signs in by releasing the sign-in students to enter the rain classroom, as shown in Figure 3. In the course of class, students can look back at the PPT played by the teacher to check and fill the

gaps. This is shown in Figure 4. The teacher releases questions during class to consolidate the knowledge in class, as shown in Figure 5.

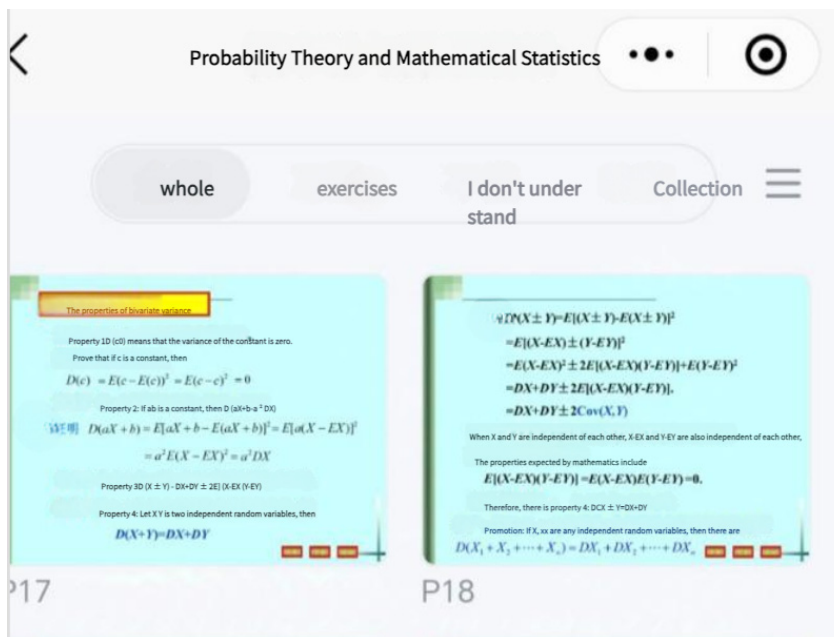


Figure 4. Rain Classroom courseware interface

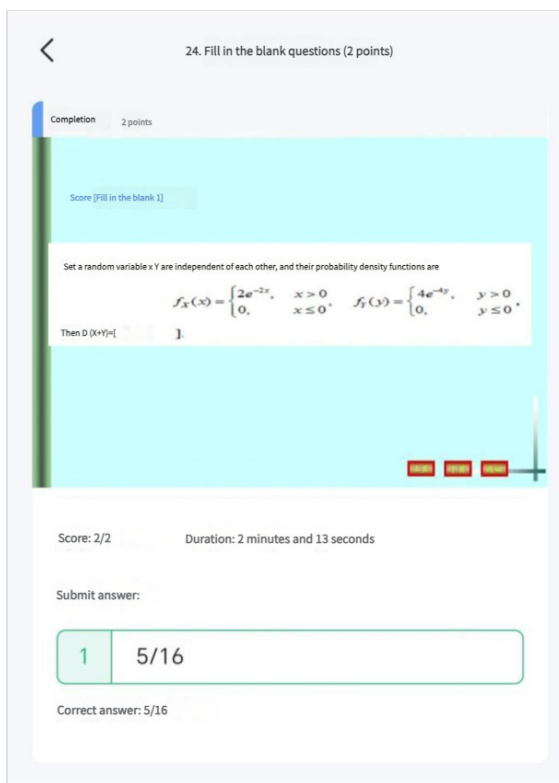


Figure 5. Rain Classroom Classroom exercise interface

In the feedback stage after class, when the teacher closes the rain classroom, the students will receive the teaching feedback of this class, as shown in Figure 6, so as to promote better learning of students. Teachers assign corresponding homework to consolidate the knowledge points in class.

After half a semester of experimental teaching, the score data of the two classes of Probability Theory and Mathematical Statistics are shown in Figure 7

Under the background of Internet education with the application of rain classroom, the experimental class has higher average score, pass rate and excellence rate in half a semester than the control class by using this teaching mode. In summary, under the background of Internet education, the innovative teaching mode of the integration of flipped classroom and traditional teaching mode can better improve the teaching quality of probability theory and mathematical

statistics courses.

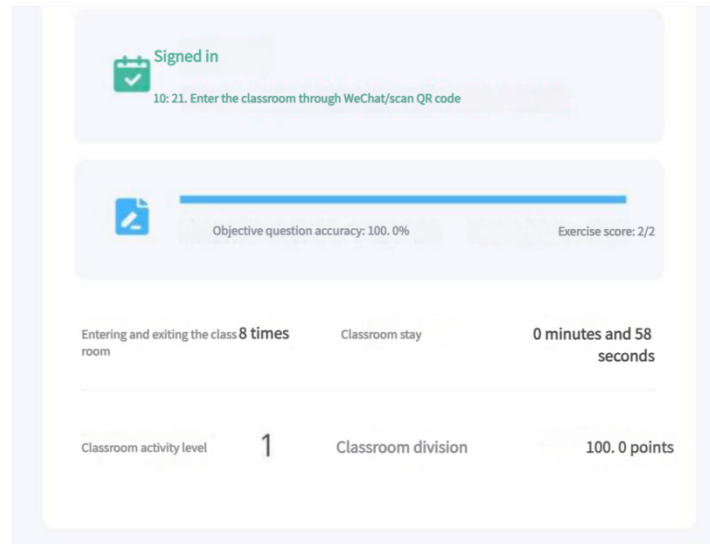


Figure 6. Rain Classroom after-class feedback interface



Figure 7. Comparison of results between experimental class and control class

6. Summary

Probability theory and mathematical statistics, as the core courses in colleges and universities, play an important role in the ability training of college students. There is a close relationship between teachers' teaching of probability theory and mathematical statistics and students' learning. This paper studies the teaching methods of probability theory and mathematical statistics. Under the background of the Internet, Internet teaching is rising, and Internet teaching is used in many courses. Combined with the characteristics of probability theory and mathematical statistics, the Internet education teaching mode is used to design innovative probability theory and mathematical statistics teaching methods.

Firstly, through the analysis of the characteristics and advantages of Internet education, as well as the teaching status and teaching methods of probability theory and mathematical statistics are studied. Through their characteristics, combined with the traditional teaching mode, using the teaching mode of flipped classroom under the Internet, taking the rain classroom as an example, the teaching scheme is designed from three links: preview before class,

teaching in class and feedback after class. This teaching method keeps pace with The Times, meets the needs of students, facilitates teachers 'teaching, improves teachers 'teaching quality, and improves students 'learning ability.

With the progress of The Times, many fields develop rapidly, and there is no end to the research of education and teaching methods. We need to combine the characteristics of the subject and the students' reality under the big background, to explore the teaching method that conforms to the students, the subject and the characteristics of the school level, so as to improve the quality of teaching and meet the requirements of the education department, and promote the progress and development of our country's education.

Acknowledgments

This paper was supported by the Teaching Research Project Fund of Wuhan Business School, No.2023N012.

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