

Online and offline hybrid teaching analysis of probability theory and mathematical statistics based on learning cycle theory

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Abstract: *Relying on the learning cycle theory, an online and offline hybrid teaching mode of "three goals, three stages, four cycles and eight links" is constructed in the courses of probability theory and mathematical statistics. From the development of online resources, to the integration of offline resources, and the development of dynamic resources, in order to improve the quality of course teaching, the curriculum reform of probability theory and mathematical statistics has been considered from multiple angles.*

Keywords: *Learn cycle theory; online and offline hybrid teaching; probability theory; mathematical statistics*

1. Introduction

With the development of the times, especially the advent of the era of big data, statistics has received more and more attention and occupies a very important position in science, engineering, agriculture and medicine. Probability theory and mathematical statistics, as two introductory courses in statistics, are basically the status of core basic courses in the talent training program of corresponding majors, providing the necessary mathematical tools for the study of many subsequent courses of corresponding majors. The advantages and disadvantages of the teaching effect of probability theory and mathematical statistics courses restrict the learning effect of many follow-up courses of science, engineering, agriculture, and medicine, and are of great significance to the overall talent training and course teaching of related professional universities. In order to complete the teaching reform of these two courses, this paper analyzes the teaching mode of the course with the help of the learning cycle theory and the combination of online and offline hybrid teaching mode, and also provides corresponding reference for the teaching reform of other courses.

2. Learn the teaching connotations and characteristics of circular theory and probability theory and mathematical statistics courses

2.1. Learn the meaning of cycle theory

The founder of the learning cycle theory was David-Cooper. The theory is an experience-based learning model that is summarized in Dewey-Lewin and Piaget based on the empirical learning model proposed a new theory of learning. This learning model divides learning into four stages: concrete experience, reflective observation, abstraction of concepts, and active practice, and these four stages are circular, cyclical operation, so this theory is also called the learning circle theory. David-Cooper proposed the theory, but many educators have studied it further. According to the characteristics of people's learning, Henney and Mumford proposed four styles of learning cycle theory from four different stages, namely active learning, reflective learning, theoretical and practical. The study of university knowledge is often not only the acquisition and transmission of knowledge content, but also the creation of knowledge through internal experience and external practice, learning cycle theory is more suitable for university course teaching, and university students are the four styles mentioned in learn cycle theory.

2.2. Characteristics of courses on probability theory and mathematical statistics

Probability theory and mathematical statistics is a mathematical discipline that studies the statistical

regularity of random phenomena, is the introductory basic course of statistics, the two courses have their own unique language and expression, thinking methods have a strong randomness, is to find the inevitable side from the accident. Probability theory and mathematical statistics knowledge points are more closely connected to each other, interlocking, more suitable for learning cycle theory, starting from the knowledge reserve, discovering problems, reflecting on observation, abstracting concepts, and then practicing, and then entering the next cycle. Although probability theory and mathematical statistics are a mathematical discipline, they are many different from other mathematical disciplines. Relatively speaking, the course is quite closely integrated with life, and many of the sources and applications of theories come from practical cases in life. This causes that when talking about the source flow of knowledge, students accept it easily, but when they rise to the theoretical height, many students cannot understand it and cannot use it flexibly. Students often feel that the course content is very close to life and is very easy to understand, but it is not easy to learn. The two courses are in the postgraduate examination, for mathematics students, the initial examination does not need to test the content of the two courses, but the re-examination will generally involve the knowledge points of the two courses. For non-mathematics students, it only appears in the mathematics 1 of science and engineering examination and the mathematics 3 of the economic management examination. This creates an awkward position for the probability theory and mathematical statistics course, which is a basic core course, but often does not directly involve much.

3. Construct a circular teaching model for probability theory and mathematical statistics courses

The study of knowledge is also the accumulation of experience, when we encounter new problems and cannot be solved with existing knowledge reserves, we must explore new knowledge, with the new knowledge obtained to solve the problems in front of us, but there is no end to learning, so we will encounter new problems later, and then we will explore new knowledge again, solve problems, acquire and reserve knowledge. Therefore, the learning of knowledge is actually in this cycle of continuous progress, and the same is true for the study of probability theory and mathematical statistics course knowledge. To this end, in this paper, the course learning of probability theory and mathematical statistics is determined as a three-goal, three-stage, four-cycle, and eight-link teaching learning mode, as shown in Figure 1.

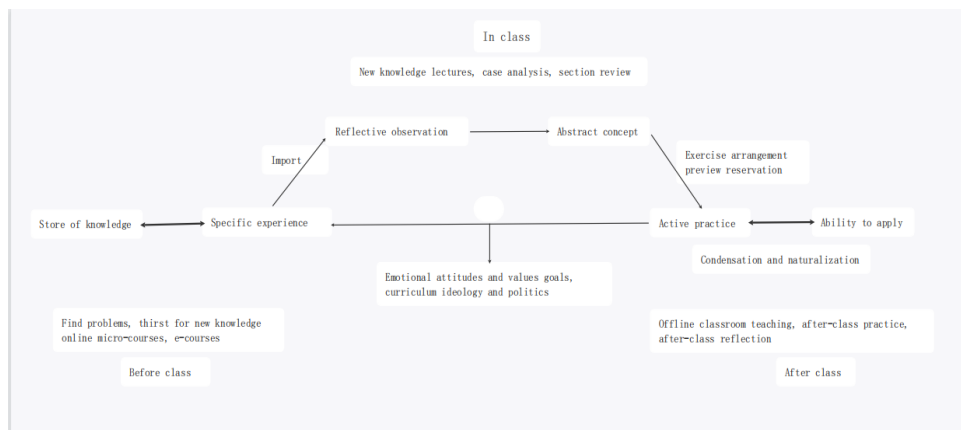


Figure 1: Online and offline hybrid teaching mode based on "three goals, three stages, four cycles, and eight links"

Three goals, namely knowledge goals, ability goals, emotional attitudes and values goals. University knowledge especially university science in order to acquire knowledge, it is necessary to spend a lot of extracurricular time to learn. These three goals also correspond to the three cognitions and realms of knowledge. The acquisition of knowledge goals is the first level, and it is necessary to draw out the connection between old knowledge and new knowledge through the reserve of one's own knowledge, so as to acquire new knowledge and reserve new knowledge. For basic science courses such as probability theory and mathematical statistics, the knowledge goals are often some definitions and theorems and formulas. The goal of ability is how to use the acquired knowledge to practice, which is the goal of the second level. Because it's about getting it all, it is often necessary to have a more familiar and solid grasp of knowledge, and many people's understanding of probability theory and mathematical statistics courses and even basic courses in science is that they have no practical use, which is wrong. In the case of teaching quality assessments, student achievement analysis, and even any place where data is dealt with,

a skillful use of knowledge of probability theory and mathematical statistics is required. Only memorizing knowledge and not having the ability to apply what you have learned is the embodiment of not really learning to understand. Learning must have a certain emotional attitude and values, probability theory and mathematical statistics in many examples, such as betting, coin tossing, dice, etc. often have gambling and other components in it. However, teaching probability theory and mathematical statistics is not teaching gambling, and when teaching courses, we must especially do a good job in students' ideological and political education, and the study of science is not only to establish scientific literacy, but also to have the education of curriculum thinking and politics, which is actually the highest level of the goal. Of course, this is also a more difficult module, many science teachers simply cannot do the combination of the knowledge taught and ideological and political education and the value of life, which is precisely the advantage of probability theory and mathematical statistics courses, the two courses are more closely related to life, you can design some classic import and leave some thought-provoking after-class thinking, so that students can not only receive ideological and political education in the classroom, but also continue to sublimate after class. These three goals can only be organically combined, step by step to complete the teaching of the course, and there is also a circular drive between these three goals.

The three stages are the three stages before, during and after class. The course is generally divided into these three stages. The pre-class is for the preview, which is the self-exploration of probability theory and mathematical statistics. The lesson is for learning, analysis, and the acquisition and condensation of knowledge such as probability theory and mathematical statistical theorems and definitions under the guidance of the teacher. After the class, it is for practice, which is the application of the knowledge learned in probability theory and mathematical statistics, and the problems are found in the application, so as to enter the next step of the preview again. These three phases correspond to the four sections of learning cycle theory.

The four cycles are the four sections of learning cycle theory, that is, specific experience, reflection and observation, abstract concepts, and active practice, and the four cycles are the basic framework for learning cycle theory, which are analyzed together with eight links here. Specific experience can be obtained through micro-courses or electronic courses on probability theory and mathematical statistics online, and problems can be found in self-study and new knowledge is desired. Then enter the course introduction link, you can stimulate students' interest in learning through some small stories of probability theory and mathematical statistics or some case studies, or you can review the introduction of old knowledge. Then, in the lectures on new knowledge and the analysis of example problems, students are asked to reflect on how the theorems and formulas discussed in probability theory and mathematical statistics are derived and how they are reflected in the example problems. In the subsection review link, students are led to abstract the concept together to complete the condensation of the essence of knowledge, and after the assignment of exercises and the reservation of pre-study, let students enter the active practice, apply the knowledge of probability theory and mathematical statistics, consolidate what they have learned and discover new problems in practice, and enter the specific experience of a new cycle. Of course, the regular fluency is based on specific experience, but there are also some students who learn cycle theory from such as practice, application, classroom learning, etc., which is also in line with the four modes of learning cycle theory mentioned at the beginning of the article.

Relying on this teaching mode of "three goals, three stages, four cycles, and eight links", we will complete the reform of the traditional probability theory and mathematical statistics course teaching, of course, the practice of this new teaching model is inseparable from the intervention of online and offline hybrid teaching.

4. Online and offline hybrid teaching based on learning cycle mode

4.1. Characteristics of blended teaching

The traditional teaching of probability theory and mathematical statistics courses is basically to complete the inheritance of knowledge in the offline classroom, the form has a singleness, and there are many new characteristics compared with the traditional single offline teaching combined with online and offline teaching.

4.1.1. Targeted

Targeted is easy to hit the target, the online and offline hybrid teaching based on the teaching cycle theory designed in this article is to be targeted, the micro-lessons produced at a key knowledge node can allow students to overcome difficulties in learning, and the electronic tutorial recorded in the course can

also be aimed at students with weak foundations, so that their preview is not just reading, but can hear the teacher's explanation again in advance or after class, and can check and fill in the gaps. Some of the more difficult knowledge points encountered by students in learning will in turn prompt teachers to produce more sophisticated micro-lessons, electronic courses or teaching designs, which are targeted at both teachers and students.

4.1.2. Openness

The traditional teaching of probability theory and mathematical statistics courses can only be presented in the form of offline courses, and the audience is relatively limited. Online and offline hybrid teaching, online teaching part of the electronic resources, micro-lessons, electronic tutorials, electronic exercises, etc. are open and shared, not only for students who are learning the course, but also for any student interested in this course. In particular, in many non-mathematical science and engineering examinations, the knowledge of probability theory and mathematical statistics is involved in the examination questions of Mathematics 1 and Mathematics 3, and these students can also gain knowledge from this open-ended teaching.

4.1.3. Flexibility

The implementation of the online and offline hybrid course teaching model makes the teaching more flexible. Students' acquisition of knowledge is not limited to the classroom, and the classroom teacher's attendance test of students can also be completed in the form of a combination of online and offline. The learning of students and the teaching of teachers are flexible compared with the traditional teaching mode of probability theory and mathematical statistics courses.

4.1.4. Mixability

Online and offline hybrid teaching can learn from each other's strengths and give full play to the advantages of $1+1>2$. Online teaching, in the students' pre-class preview, after-class review can play a greater role, offline teaching in the acquisition of students' knowledge, the completion of practice, emotional connection is also indispensable. If you only rely on one of the teaching modes online or offline, it is often difficult to play a good learning effect. Only the online and offline hybrid teaching mode can give full play to the teacher's teaching and students' learning.

4.2. Reserves of blended teaching resources

4.2.1. Development of online resources

Probability Theory and Mathematical Statistics course is the core basic course of university science, engineering and agricultural medicine, and there are many electronic resources on online platforms such as MOOC, Superstar, and learn Silver Online in China. However, online resources may not match the teacher's offline teaching, or the online resources are too simple or too difficult, so teachers should develop their own online resources, make micro-lessons for some key knowledge nodes, make electronic tutorials for the explanation of courses, and make online resources with a higher degree of matching with offline teaching, in order to truly do a good job in online and offline hybrid teaching. And the development of online resources cannot be static, based on the learning cycle theory, whether it is the teacher's teaching or the student's learning will have new problems. The development of course electronic resources should also be a process that is often more frequently new, and it must be combined with new technologies, new theories, and new discipline prefaces in order to make good online resources.

4.2.2. Integration of offline resources

Offline teaching links in the mixed teaching is occupying a more important position, after all, the teaching of the classroom, is the main battlefield of knowledge inheritance, only to do a good job in the design and explanation of offline courses, with the help of multimedia equipment, with the help of probability theory and mathematical statistics teaching aids, with the help of board book deduction arguments, in order to really teach a good lesson, in order to let students have more learning. Some teachers' offline teaching is almost scripted, which is undesirable, there is no derivation and argumentation of formulas and theorems, there is no presentation of teaching aids and experimental intuitive images, there is no good teaching design and smooth classroom presentation, it is difficult for students to really learn knowledge.

4.2.3. Dynamic development of resources

The teaching of courses, the transmission of knowledge, whether online or offline, are inseparable

from the expression of emotions, we must do a good job in curriculum thinking, science has no borders, but scientists have a motherland. Probability theory and mathematical statistics courses are basic courses, not only about scientific literacy, but also on the teaching of curriculum ideology and politics in online and offline hybrid teaching. Electronic resources on the Internet are not extralegal places, and they cannot pass on wrong ideas and values to students. And any good teaching reform, any good teaching theory, any good teaching materials cannot solve the problems in teaching once and for all, and the same is true in the online and offline hybrid teaching of probability theory and mathematical statistics courses. In the development of resources, we should maintain a dynamic balance, do a good job in teaching assessment feedback, pay attention to the emotional orientation of the course, update online resources, and design a more suitable offline teaching design for students, so that the course can be in a dynamic balance to continue to teach the course.

5. Conclusion

Based on the theory of learning cycle, relying on the use of online and offline resources, the online and offline hybrid teaching mode of "three goals, three stages, four cycles, and eight links" is realized, which promotes the teaching of probability theory and mathematical statistics courses, so that the teacher's teaching is excellent, and the students' learning is also multi-pronged, improving the teaching quality of the course. Curriculum teaching reform cannot be self-contained, only continue to do a good job in the teaching reform of probability theory and mathematical statistics courses, in order to really take this course.

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