

Research on Online Teaching of College Mathematics Courses Under the Novel Coronavirus Pneumonia Epidemic

Xuan Li^{1,a,*}

¹ Department of Mathematics, Tianjin University of Finance and Economics Pearl River College, Tianjin, China

^a lqlixuan@126.com

*corresponding author

Keywords: online teaching, implementation process, optimization plans

Abstract: With the sudden outbreak of the 2019-nCoV, universities across the country actively conduct online classroom teaching responding to the Ministry of Education's proposing of "classes suspended but learning continues". As a new type of teaching method, online teaching puts forward comprehensive requirements for both teachers and students. In this paper, firstly we discuss the characteristics of online teaching concluding its advantages and disadvantages. And then we introduce the main implementation process of online teaching by taking the teaching of "Probability Theory and Mathematical Statistics" course as an example. Finally, several optimization plans for online teaching are given, hoping to provide new ideas and suggestions for the reform of college mathematics online teaching.

1. Introduction

With the sudden emergence of the 2019-nCoV, schools have integrated their own high-quality teaching resources and selected different online teaching models in the context of the new measures of "classes suspended but learning continues" proposed by the Ministry of Education. Therefore, online courses, online recorded teaching, online live teaching, and other online teaching models have been widely used. It mainly focuses on recorded or live broadcast.

Since teachers are not as familiar with online teaching as they are in carrying out offline teaching, they will inevitably encounter difficulties. Teachers and students, students and students cannot communicate face-to-face, and online teaching cannot provide real-time interactive feedback. [1] Therefore, for college mathematics online teaching how to make students consciously observe the online class time, learn consciously, and improve the quality of online education and teaching is crucial important. In the present paper, we first discuss the advantages and disadvantages of online teaching mode, and then we explore the effective implementation process of online teaching considering the characteristics of online teaching, taking the "Probability Theory and Mathematical Statistics" course as an example, Finally We give further online teaching optimizations to prepare for the development of online teaching in emergency situations.

2. Characteristics of online teaching

Online teaching is different from the traditional teaching mode. Its main environment is the combination of online resources and network tools. Teachers can no longer teach students face-to-face like classroom teaching, but use other network tools to establish the relationship between students. As a new type of teaching method, online teaching has its own advantages and disadvantages. [2]

2.1 advantages of online teaching

There are abundant teaching resources and a wide range of teaching sources. Relying on advanced network technology, there are abundant online teaching resources and a large number of courseware and videos matching the course for teachers and students to learn on the Internet. Teachers and students can enjoy teaching resources at home and abroad. Students also can use network video and courseware to review the content of what they have learned, which greatly improves the efficiency of students' learning.

The teaching method is highly flexible. Traditional classroom teaching is where teachers teach students face-to-face knowledge and answer students' questions, but online teaching classrooms can be flexible and changeable. Teachers can freely distribute recorded videos or online boutique courses for students to learn, and teachers can teach through online live broadcast. In the process, teachers can also communicate with students on advanced networks such as WeChat and QQ, which increases the feelings of teachers and students in teaching and learning.

Online teaching classroom can generate "study notes". In traditional offline classrooms, it is difficult for students to record the entire section of the teacher's content. However, the teacher's presentation process of the ppt live broadcast at the Tencent meeting will be saved and be sent to the students, so the students have "study notes" for review after class, therefore, this improves the learning effect of students.

2.2 disadvantages of online teaching

Online teaching is restricted by conditions such as information network technology. The development of online classroom teaching depends on mobile phones, computers and other communication equipment. If the network signal is interrupted or equipment failure during lectures, online learning will be interrupted. Sometimes students can only hear the teacher's voice during the lecture but they cannot see the screen information and sometimes students can only see the screen content but cannot hear the teacher clearly, which greatly hinders the smooth development of online classroom teaching.

Teachers cannot keep track of students' learning dynamics. Online teaching is different from offline teaching. Teachers and students are thousands of miles apart, they cannot teach face-to-face, and cannot directly observe students' learning. Since students can independently determine their learning status and learning environment, their learning effect greatly depends on their self-consciousness. For example, some students just completed the sign-in and entered the live broadcast room but did not study hard at the computer.

Students who have been teaching online for a long time are prone to fatigue and lose interest in learning. During the epidemic, all courses are taught online. Students who study in front of the computer for a long time are prone to learning fatigue and they are lack of concentration. Especially for the mathematics courses which contain a large number of calculation formulas, it will be difficult for students to understand the content of the teacher's lectures. If students are not learning hardly like offline teaching.

Assessment for online teaching is difficult. First of all, online exams have very high requirements for network conditions. Online exams are likely to be suspended due to network interruptions or equipment problems, or test results cannot be submitted and saved normally. Secondly, cross-space proctoring is difficult to ensure the fairness of online exams. It is difficult to prevent students from cheating frequently in offline exams with multiple teachers' monitoring, not to mention this kind of scattered cross-space proctoring, it will have more students cheating in exams which will lose fairness to those students who study hard.

3. The implementation process of online teaching (taking the "Probability Theory and Mathematical Statistics" course as an example)

In the spring of 2020, with the Ministry of Education proposing "classes suspended but learning continues", the school's educational affairs departments actively contact major online teaching platforms and train teachers in the use of learning platform tools, they also help solve various problems that teachers have in the initial stage of implementing online teaching to ensure the

overall operation effect of online teaching. The Mathematics Teaching and Research Section actively sets up a teaching team, carefully discusses each part of the teaching content, and implements precise policies, one lesson for one policy. The Mathematics Teaching and Research Section also explore flexible teaching methods, reasonable selection of teaching platforms, and careful design of teaching activities. Now we take "Probability Theory and Mathematical Statistics" as an example to discuss how to effectively implement the online teaching process.

Step1. Choose a suitable teaching platform and prepare for class. Online teaching platform is the basis for online teaching, before choosing a teaching platform, teachers firstly establish a student QQ group for the class they teach. Students need to join the class QQ group through real-name authentication so that teachers can upload the PPT of the chapters taught and the exercises corresponding to the chapters to the group, and discuss questions with students. Secondly, students are required to download the China MOOC app to ensure that students can watch the videos required by teachers. At the same time, the instructor records the video related to this section as a backup video and uploads it to the "Wisdom Tree" platform to prevent network interruption from affecting students' learning.

Step2. Implement online teaching according to teaching design. Firstly, students sign in on the "Wisdom Tree" platform about 5 minutes before the start of the class. Secondly, the instructor ask students to complete the video on the Chinese MOOC platform specified by the teacher for this class within a certain period of time, and students need to complete relevant exercises and tests within the specified time. Thirdly, the teacher will explain the content of this lesson in detail on the Tencent Conference app.

In the process, the teacher maintains the interaction with the students in the classroom explanation. The teacher actively organizes the students to conduct interactive speech exchanges and discussions in the classroom. In order to stimulate the students' enthusiasm for learning and thinking about the content of the classroom, teachers interspersed with online questioning, practice and other links during the PPT lecture, students are divided into different groups, and the exercises are also classified. Through a limited time, students in different groups are allowed to submit their questions online, and then teachers make real-time comments, which can not only increase student participation, but also arouse the enthusiasm of students. And this can make instructor effectively grasp the learning situation of students, teachers would explain in time the areas that students do not understand.

To motivate students' enthusiasm in the learning process, a variety of teaching methods such as heuristic teaching, case teaching, teaching on behalf of practice, and combination of numbers and shapes are also used. For example, when teaching student how to solve the probability density function of one-dimensional continuous random variable function, the teacher use a method of combination of numbers and shapes, which can enhance students' concentration.

Example. [3] Let the probability density of a random variable be

$$f_x(x) = \begin{cases} \frac{2x}{\pi^2}, & 0 < x < \pi, \\ 0, & \text{else.} \end{cases} \quad (1)$$

Please solve the probability density function of

$$Y = \sin X \quad (2)$$

Answer. Firstly, we give the expression of distribution function of Y

$$F_Y(y) = P(Y \leq y) = P(g(X) \leq y) = P(\sin X \leq y) \quad (3)$$

Then we draw an image according to the meaning of the question as follows.

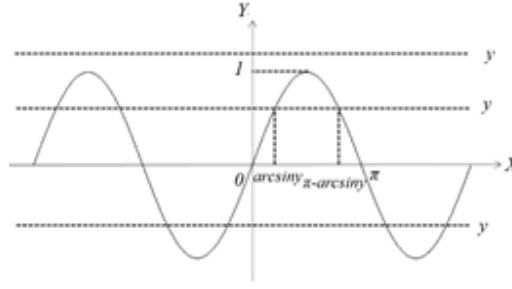


Figure 1 The relationship between distribution function and random variables

From the image, we can see

If $y \leq 0$, we have

$$F_Y(y) = 0 \quad (4)$$

If $y \geq 1$, we have

$$F_Y(y) = 1 \quad (5)$$

If $0 < y < 1$, we have

$$\begin{aligned} F_Y(y) &= P(\sin X \leq y) = P(0 \leq X \leq \arcsin y) + P(\pi - \arcsin y \leq X \leq \pi) \\ &= \int_0^{\arcsin y} \frac{2x}{\pi^2} dx + \int_{\pi - \arcsin y}^{\pi} \frac{2x}{\pi^2} dx \end{aligned} \quad (6)$$

Finally, we can solve the probability density function of

$$Y = \sin X \quad (7)$$

If $y \leq 0$ or $y \geq 1$, we have

$$f_Y(y) = F'_Y(y) = 0 \quad (8)$$

If $0 < y < 1$, we have

$$f_Y(y) = F'_Y(y) = \frac{2}{\pi\sqrt{1-y^2}} \quad (9)$$

Step3. Track online teaching feedback and improve teaching methods. [4] After the class is over, the teacher publishes the after-class test questions on the teaching platform and limits the completion time, which can urge students to review in time. Teachers also carry out lively and interesting interactions after class, such as "one-to-many" interaction between teachers and students. For problems that are prone to errors or generally found to be difficult, the teacher will focus on explaining in the exercise class or give the solution steps in a timely manner in the QQ group. Teachers provide in-depth intensive guidance and interactive communication. For offline Q&A, students ask questions through QQ groups, and teachers answer one by one online. The teacher summarizes the classroom teaching in a timely manner according to the students' questions and improves it in the explanation of subsequent courses. The "one-to-many" interaction between teachers and students has improved students' attention in class and stimulated their enthusiasm for independent learning.

Although the online teaching of "Probability Theory and Mathematical Statistics" has greatly improved the quality of the course through active and effective teaching exploration in various forms, there are also problems with students' learning effects. For example, although there is a corresponding online test after each chapter of the learning platform, and measures such as topic discussion, answering and asking questions are also set up, there is still a phenomenon of homework plagiarism. For this reason, it is necessary to further optimize the online teaching plan to prepare for the development of online teaching classes in emergency situations.

4. optimization plans for online teaching

Based on the practical experience of online teaching, the online teaching reform of college mathematics courses should start from the following aspects

Firstly, online learning resources should be enriched. Before giving lectures, teachers should make full use of the existing equipment and information to establish and publish online ppt courseware that matches the course; publish online quality lesson videos that match the course; establish a complete online Q&A system. Which make them answer students' difficult questions at any time. More complete network resources will promote students' enthusiasm for independent learning and increase their interest in learning mathematics.

Secondly, we will strengthen classroom teaching interaction and increase teacher-student exchanges. [5] For example, when explaining exercises, students should be fully motivated to participate. Teachers design exercises PK link and arrange different students to answer the same question. And then teachers upload the answers on the teaching platform within a limited time, comparing the pros and cons of the problem-solving methods through evaluation, and arrange for students with unique and novel problem-solving methods on the platform Live explanation, this approach will greatly arouse the enthusiasm of students to participate in the classroom.

Finally, a reasonable assessment mechanism will be established. Teachers should strengthen the evaluation of the process of online teaching. Some open questions can be added to the discussion area to test students' innovation and problem-solving abilities, instructors also can add questions with certain challenges and practical application backgrounds. Through the design of a variety of evaluation indicators teachers can comprehensively evaluate the quality of student learning, so that the overall evaluation results can fully reflect the comprehensive ability of students.

5. Conclusion

In the process of exploring and practicing online teaching, teachers have moved from “crossing the river by feeling the stones” to gradually adapting to the teaching method to continuously optimizing the online teaching plan. These efforts can better deal with the suspension of classes in emergency situations. At the same time, it also combines the concept of "Internet + education" with traditional teaching models to lay a practical foundation for online and offline teaching reforms, which will further improve the quality of application-oriented talent training.

References

[1] Xinghua Li, Laizhen Luo, Meiyu Cheng. Exploration of the online teaching mode of linear algebra courses during the epidemic period[J]. Heilongjiang Education (Theory and Practice), 2020(09): 8-9.

[2] Ruli Huang. Exploration and experience of online teaching in the context of the new crown pneumonia epidemic[J]. Neijiang Science and Technology, 2020, 41(11): 156-157.

[3] Lingling Yang, Chao Wang. Solving the Function Distribution Problem of Continuous Random Variables with the Combination of Number and Shape[J]. Journal of Mathematics in Practice and Theory, 2014, 44(11): 294-299.

[4] Xiuquan Zhang, Wenju Zhao. The design and realization of online teaching interactive sharing mode under the background of "Internet+"——Taking "Advanced Mathematics" as an example[J]. Technology and Innovation, 2020(23): 76-77.

[5] Yingyi Wang. Practice and thinking of college English online teaching during the new crown epidemic: Taking Harbin University of Science and Technology as an example[J]. Heilongjiang Education (Theory and Practice), 2020(12): 81-82.