An Analysis of Online Teaching Reform of College Teachers under the Background of COVID-19 Epidemic—Taking Advanced Mathematics Teaching as an Example

Xiao-rong ZHU, Yi-lin BEÍ and Sai QIAO
Department of Information Science and Technology, Taishan University, Taian, China
*Corresponding author

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Abstract. With the outbreak of COVID-19 epidemic, online teaching has been fully carried out in Chinese universities, which is changing the way teachers teach and the way students learn. This paper mainly discusses the characteristics of online teaching from the perspective of teachers, and takes advanced mathematics teaching as an example to study the reform of online teaching from three aspects: the redesign of the teaching content, the diversity of teaching methods and the practice of reflective teaching.

Introduction.

In early 2020, the outbreak of covid-19, the ministry of education proposed a new measure of "no suspension of classes", which brought about a drastic change in our education methods. With unprecedented popularity, online teaching has entered every university and every teacher, and every teacher has to become an online anchor. Online teaching goes deep into teachers' daily teaching instead of theoretical and experimental discussion. It is meaningful to study how to deal with such an emergency and provide abundant theoretical and practical experience for online teaching.

In April 2018, the ministry of education issued “the education informatization 2.0 action plan”, pointing out that the education informatization 2.0 action plan is an inevitable choice for the development of education in an intelligent environment, and will profoundly change the demand for talents and the form of education. In fact, online education has been proposed before, but the implementation of the situation is not universal. Taking the course of advanced mathematics as an example, advanced mathematics is a compulsory course for almost all freshmen in universities. The content and knowledge categories of the course determine its rigorous theoretical and logical nature. Due to the stereotype of educational concepts, many people think that this subject is more suitable for traditional teaching methods. Some teachers even oppose the application of PPT to advanced mathematics teaching process, but also the use of educational technology to implement online teaching. Nowadays, online teaching is imperative. Traditional teaching and application of modern educational technology are two different teaching modes, which need different teaching strategies and methods. In order to attract students' attention, arouse their interest in learning and successfully complete the teaching task, this paper discusses how to apply the online teaching mode supported by modern educational technology to the teaching activities of higher mathematics from three aspects: the redesign of the teaching contents, the diversity of teaching methods and the practice of reflective teaching.

The Redesign of the Teaching Content

The Introduction of Mathematical Models in Life, Do a Caring Educator

Based on the textbook content, it provides students with more comprehensive application examples of knowledge entry, especially those closely related to computer science. These examples become mathematical models after abstract induction, and mathematical models are a bridge between reality and mathematical knowledge. Let the students realize how the abstract knowledge they have learned is put into practice, also understand the thinking method of establishing mathematical
model, and then realize the importance of mathematical learning, which is conducive to enhancing their interest and promoting the transformation of knowledge to ability.

For example at the start of school, we should start to learn the knowledge of the ordinary differential equations, in view of the epidemic and the knowledge, I will give students the introduction of infectious disease model. Through the study of special mathematical model in the specific environment and carrying on the omni-directional communication and guidance with the students, it makes the knowledge close to reality and abstract into the nature of mathematical knowledge. In order to make students fully integrating into online class, I introduced the model by taking photos by hand, and made use of network resources to do more popular science. The students' response and participation were very high and achieved good results.

**Pay Attention to the Development Process of Mathematics and the Application of Cutting-edge Achievements, and be a Leader in Developing Thinking**

In the course, the development process of the history of mathematics, the thinking process of mathematicians and the latest research situation of modern mathematics are introduced at times. Guide students to understand the thinking method of higher mathematics, broaden their thinking, inspire their thinking, and cultivate their ability to analyze and solve problems. Students can be divided into groups, randomly select a group of students and ask them to consult materials in advance to introduce the history of this math knowledge to other students. This process can give students a strong demonstration and enlightenment, let them experience the fun in the process of math creation, and greatly improve the topic degree and participation in the online class.

**Set Open Questions and be the Designer of Situational Teaching**

Since the 1970s, when Japanese math educators put forward "open questions", this kind of teaching method has been applied to the classroom. Usually due to the time and the number of students and other restrictions, it has not been formally tried. However, the online class of nearly eight weeks give me the opportunity to try it out, and the students are given the task of open questions in advance based on the content they are going to learn. Applying this method to the teaching of multivariate differential function, the effect is surprising, which greatly develops students' ability to integrate knowledge and draw inferences from one case to another.

**The Diversity of Teaching Methods**

**Pay Attention to the Funny Design of Teaching Process**

In order to make the course more close to the students' psychological and cognitive process, in the teaching process design, we should try to avoid large dull difficult formula derivation and theorem deduction. However, the contradiction is that such formula derivation and theorem deduction is inevitable in the knowledge of advanced mathematics. If 80% of students are unable to verify and understand, it will greatly damage the positive psychology of learning. In order to protect students' learning enthusiasm, the method of piecework verification can be adopted. Just like knowledge quiz and answer, after analyzing the idea of the question to give the previous part of the proof, let the students answer the latter step, and get the final result step by step with the student number solitaire or the form of pre-answering reward.

It can also be combined with the setting of open questions. Sometimes, the correct answer may not be obtained. Students can be asked to "diagnose" the problem, and the teacher can finally summarize the evaluation. In fact, whether the result is correct or not is not the most important, this design is to let students experience the interest of the learning process of advanced mathematics, which needs mutual inspiration and cooperation to experience the charm of mathematics.

Before learning of the total differential, I put forward an open problem in the super star pan-ya platform in advance, so that the student can think about the relationship of continuity of multiple functions, the existence of partial derivatives with the differentiable. However, the setting of open problem is not suitable for all the content, and it must be the programmatic problem of this section,
which can run through the whole content of the section through this question, and are students' previous contact. In the class, a group of students are randomly selected as speakers, and they are asked to give their team's thinking conclusion and evidence. At this time, other students can add their opinions, and then a preliminary result will be formed, and with which, the following learning will begin. In the study of total differential, students will often put forward different ideas on the open questions, which can be revised until the students think the conclusion is perfect and accurate, and then the teacher will reveal the final conclusion. Sometimes students think the conclusion is not perfect and maybe has the end of the error, but the think learning process is often interesting like Sherlock Holmes settle a lawsuit. During the process, the students learn to praise and encourage each other with mutual question and cooperation, and learn a lot of theoretical knowledge unconsciously.

Pay Attention to Develop the Student’s Subject Consciousness

The teaching of advanced mathematics involves a wide range of contents, and it is impossible for teachers to cover all aspects in online teaching. In the classroom, teachers should play the leading role and students should be the main body. Flexible and diversified teaching methods should be adopted to fully mobilize students' autonomy and stimulate their interest in learning. They should not be afraid of mistakes and failures, so that they can realize that mistakes and failures made under the guidance of correct goals are actually another kind of harvest. Students are encouraged to spontaneously form a small learning discussion group after class, and teachers can join each group to guide them.

Integration of Various Teaching Methods

The three elements of online education are teacher, student and platform. The teacher records the course through the terminal equipment (such as video recorder, projector, camera, etc.), and transmits them to the online platform established by the government or educational institutions. Then the students use the terminal equipment (mobile phone, tablet or personal computer, etc.) to complete the course on the platform through the Internet. Compared with traditional education, teachers and students are still the subject and object of online education. The biggest difference between them lies in the fundamental change of teaching carrier. In traditional higher education, teaching and learning activities are usually completed in the classroom of the university, while online education needs to be completed on the network platform (or cloud platform). At present, the well-known Online education platforms at home and abroad mainly include Coursera, Khan University, Udacity, Stanford Online, Chinese University MOOC, University Online, Netease cloud classroom, etc[2].

After a period of online teaching, I transfer the teaching platform of advanced mathematics from the very beginning combining of MOOC WeChat group, the Chinese university and super star to the rational combination of Dingding live broadcast, China university of MOOC and super star platform, integrating offline teaching methods with online methods. I explore the live broadcast + SPOC + live online classroom mode, and make full use of the sign, live, questionnaire, vies to answer first, homework and unit test to bring the teaching contents and teaching designing knowledge, maths culture and even experience to the students. The arrangement of the classroom rhythm is shown in figure 1.
The Practice of Reflective Teaching

In order to better complete the teaching task, under the initiative of the school and the college, the little things that can be read and written and accumulated in the teaching are recorded, I make a complete teaching log and teaching records, which can be the material for reflective teaching. "Every teacher should write an educational journal, a teaching essay and a teaching record." Sukhomlinskii said. Although the educational log is only a record of words and phrases, it is the footmark of daily gains and monthly advances, and it is the source of cultural creation and the basis of reflective teaching. After class, I often read students' and colleagues' comments on the online class, and often watch the videos of the live class to seek for problems and shortcomings in the class and strive for improvement in the following teaching. At the same time, I will also appreciate a moment of excellent performance and try to make the best of it in more classes. Such reflective teaching will benefit teachers a lot.

The teaching mode of live broadcast +SPOC+ live broadcast, as an online teaching form close to offline classroom, has the advantages of high level of teacher-student interaction and strong sense of teaching presence, but it has the problem of low stability due to the concurrent traffic. Therefore, it is the choice for future development to integrate various online teaching modes and combine the advantages of online open courses with the teaching mode of live broadcast +SPOC+ live broad. Before class, students learn by themselves on the online learning platform and online measurement. In class, teachers conduct discussion and question-answering on the live broadcast platform to promote students' knowledge consolidation and transfer. At the same time, all kinds of online teaching modes should be based on the premise of students' effective independent learning, and different online teaching modes should be selected or combined to effectively achieve "no suspension of classes without suspension of classes", so as to promote education reform basing on technological integration and lasting student-centered.

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