

# Discussion on Undergraduate Online Teaching of Advanced Mathematics with "Student-Centered"

Ye Zhao<sup>a</sup>, Ying Han<sup>b,\*</sup>

Beijing Institute of Petroleum Technology, Beijing, China

<sup>a</sup>zye@bit.edu.cn, <sup>b</sup>hying@bit.edu.cn

\*Correspondence author

**Abstract:** *The basic mathematics course of university plays an important role in the study of follow-up courses and undergraduate's future development. Based on the practice of on-line teaching of advanced mathematics, this paper constructs a teaching model which emphasizes learning effect and emphasizes students' self-learning under the background of student-centeredness. Therefore, it arouses the interest of students' self-learning, strengthens the students' consciousness of self-learning and the ability of high-efficiency learning. And the goal of improving teaching quality is realized.*

**Keywords:** *student-centeredness, advanced mathematics, online teaching*

## 1. Introduction

In the spring of 2022, the COVID outbreak was repeated, which led to a return to online teaching for several weeks. In 2020, when the COVID broke out in our country for the first time, the Ministry of Education issued the Notice 《On Information Support Education and Teaching in Prevention and Control of Epidemic Period》. The notice emphasized that the teaching resources of class can be optimized and online teaching can be carried out by MOOC, SPOC, live teaching, network demand etc<sup>[1]</sup>. Since then, universities have started a comprehensive new practice of online course teaching. The teachers of the advanced mathematics course group of Beijing Institute of Petrochemical Technology have been continuously studying the education theory and new teaching method, at the same time, they have been continuously discussing, reforming and practicing online teaching method, and have obtained better teaching effect.

## 2. Analysis on the Situation of Online Teaching

Online teaching has its unique advantages compared with classroom teaching. It can break through the closeness of classroom. Students can study in their own learning place. Especially after 2020, for the reason of the continuous improvement and perfection of online teaching, it has irreplaceable advantages. But it also has inevitable shortcomings. Firstly, teachers' mastery of the true situation of students is affected. Teachers can't intuitively see the students' expressions and reactions, and students are also difficult to feel the teachers' body language. Online teaching is more dependent on students to answer questions or tests.

It is more likely that students can't be concentrate on lecture in the process of live broadcast. For self-discipline students, they can gain more compared with classroom teaching. But for poor self-discipline students or weak foundation students, they more easily to become lazy, release, even appear "hang-up" phenomenon.

## 3. The Theoretical Background of Student-Centeredness

In 1952, Carl Rogers, a well-known American psychology, first introduced the concept of student-centeredness, and applied it to the undergraduate education. The teaching idea of "student-centeredness" advocates making students think and explore knowledge independently, stimulating students' learning enthusiasm, making students become the subject of classroom learning, forming the habit of self-learning, and cultivating the ability of self-innovation. He argued that the objectives of education should be to promote change and learning, cultivate capable of adaptation

change and knowing how to learn. No any reliable knowledge, only the process of seeking knowledge is reliable<sup>[2]</sup>.《Outline of the National Medium and Long-term Education Reform and Development Plan (2010-2020)》 proposes that college teaching should fully mobilize students' enthusiasm and initiative, encourage students to study hard, enhance integrity conscious, foster a good learning style, cultivates a group of innovative talents<sup>[3]</sup>. The teaching reform idea of "student-centeredness" includes three aspects: "student-development -centered, student-study-centered, learning-effect-centered"<sup>[4]</sup>.

Mathematics course is an important part of the course system of undergraduate education. It is very important to train students' ability of logical thinking and solving problems by mathematics. Advanced mathematics is the first mathematics course for college students, which runs through the whole first grade. The students are different, and the learning bases of mathematics are different. Therefore, practical implementation of the teaching idea that student-centeredness, is also the difficult point of course teaching and the key point of teaching reform.

#### 4. Practice of On-line Teaching in Advanced Mathematics

In the course of online teaching in this semester, based on the course characteristics of advanced mathematics, the authors actively implement the idea of student-centeredness, give full play to the leading role of teachers, excavate the advantages of network teaching platform such as cloud class, enterprise wechat and tencent conference, adopt the method of problem-oriented, encourage "individualized" difference, while taking into account the "majority" level. We have been constantly improving teaching mode, which improved students' learning efficiency and promoted students' independent learning. The teacher's teaching task and student's learning task are break down effectively into three stages: pre-class, in-class, post-class. Specifically, the teaching plan is designed to:

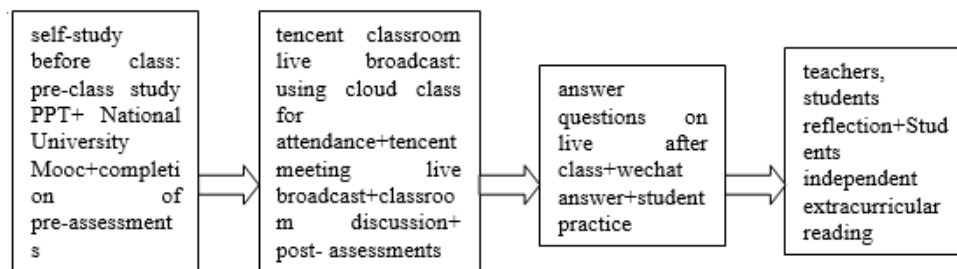


Figure 1: "Advanced Mathematics" Online Teaching Plan

##### 4.1 Autonomous learning before class

Before class, teachers upload learning resources to the cloud class. Teachers can see students who have not complete the preview to PPT and remind them. Students can also use National University Mooc to learn the course resources online. After completing the two parts of the study, the teacher issued the preparatory test before the class, and the students completed in the prescribed time. The preparatory test topic order is based on the basic knowledge point, such as basic concepts, the background of the problem, etc. Question type may be choosing, filling in the blanks, judgment. Students as long as carefully study PPT and teaching materials, the pre-assessments can be completed. Teachers can regularly check whether the students have checked PPT and completed the test, master the students' learning about basic knowledge points, so that the teaching aim in class can be targeted. Pre-class autonomous learning seems to be simple, but it plays an important role in the whole teaching activities. This is not a simple pre-study, but a transition from pre-study to research.

##### 4.2 Problem guidance, Participatory learning, Discussion and teaching

On the basis of self-study before class, the teaching contents are divided into basic knowledge points and difficulties and expanded application. Through the live online teaching, according to the knowledge points of different levels and different classes of type, we can optimize the way that students get knowledge and better accomplish teaching objectives.

Firstly, according to the situation of classroom pre-assessments, teachers strengthen the basic knowledge points, so that students can digest and absorb. Teaching focal and difficult point are core content of teaching. We can use various teaching method. For example, in addition to classroom

questions and answers, it can also be a question-oriented case study, three-minute short report, panel discussion or debate, summary (mind map), peer learning, etc., so that students participate fully in the classroom.

After the live presentation, the teacher can organize the students to complete the post-assessments once again. Test questions can be those with high error rates in pre-assessments. After the test is over, the teacher can organize the student classroom discussion. The form can be the student self-correcting, and the student explains the error cause of the pre-assessments. For the problems which are wrong both in the pre-assessments and in the post-assessments, we can adopt the method of "peer learning". Let the students who are correct both in the pre-assessments and in the post-assessments explain, which help the wrong student correct. The teacher gives comment. If the overall error rate of students is high both in pre-assessments and in post-assessments, teachers should examine the effect of classroom teaching, reflect on where the problem arises and explain it again. This can effectively test the effect of classroom teaching and improve it. Students' participation in high, improved the traditional teaching mode that in classroom teachers "endless" and students "silent", which fully reflects the student-centeredness.

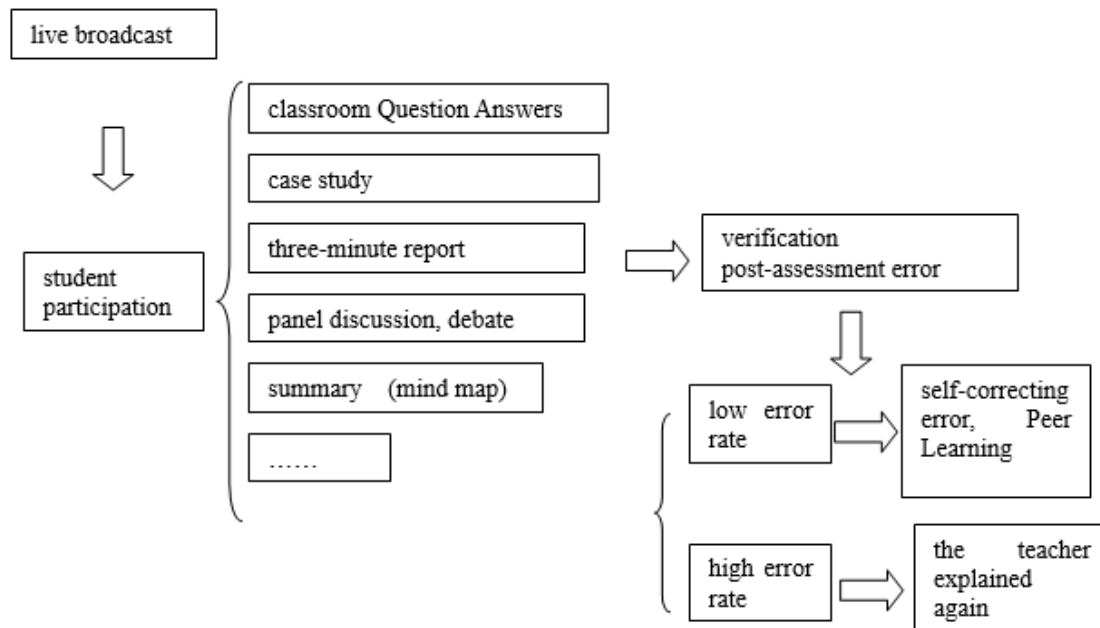


Figure 2: Teaching process of teacher explanation and student inquiry

In addition, teachers should carefully design the process of live teaching. For example, in explaining the "surface and its equations", the teacher can ask questions: the just-finished 2022 Beijing Winter Olympics, our athletes have made gratifying achievements. At the same time it is shows our country's national style of pursuing excellence with the overall situation in mind. The National Speed Skating Oval, also known as the Ice Girdle, is a light, elegant, well-designed building. What mathematical knowledge does it contain? What kind of surface is it?



Figure 3: Beijing Winter Olympics National Speed Skating Oval

Through such a practical problem, catch students' attention, inspire students to think. After explaining the knowledge of this section, it is revealed that the National Speed Skating Oval of the Beijing Winter Olympics adopts the design of the hyperboloid saddle-shaped single-layer cable net structure roof, which is also the largest single-layer two-way orthogonal saddle-shaped cable net roof in

the world.

#### **4.3 After-class Question Answering, Students Consolidation, Teachers and Students Reflection**

After class the teachers can answer questions in a variety of ways. It can be Tencent conference live broadcast or enterprise WeChat group answer questions, or one-on-one guidance. The students complete the consolidation exercise after class, and the teachers evaluate in time. Further, students can be encouraged to explore the practical aspects of the knowledge learned in the classroom, especially in the application of the student's major. After each class, teachers should summarize and reflect on the teaching situation, especially the problems which need to be explained again, analyze the cause, and improve the teaching method.

#### **4.4 Innovation Practice**

After class, the teacher can organize students who have the ability to learn more to participate in various mathematical modeling competitions. Let the student master knowledge, develop intelligence, cultivate skills, and then cultivate students' ability to practice innovation, and adapt to their individual learning will and needs. In fact, such a teaching design is also consistent with Bloom's knowing development level, from memory understanding application to analysis evaluation creation, ultimately enabling students to build the corresponding knowledge system. But it is noteworthy that in the whole process of online teaching, teachers should particularly strengthen the process of supervision, at the beginning of school clear reward and punishment measures. For students who are not active, you can communicate alone to understand the situation.

### **5. Conclusion**

Due to the students' professional differences, difference between individuals and the differences in subject, the teachers need continues to explore the methods of online teaching, establishing an online teaching model suitable for students. Through rational and effective organizing teaching and implementation, meet the individuality needs of different students, stimulate students' internal motivation for learning, and cultivates students' high level thinking. Finally this trains many outstanding talented people for the society.

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