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Reconstruction of Teaching Process and Implementation of Flipped Classroom Mode of Linear Algebra Course

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Abstract

To promote the teaching reform of college mathematics and encourage students to participate in autonomous learning, this paper explores the feasibility of flipped classroom teaching mode for the undergraduate course linear algebra. Combining the characteristic of flipped classroom teaching mode and linear algebra itself, the paper reconstructs the teaching process and provides a Multiple evaluation method. The specific implementation process of flipped classroom is demonstrated, and the teaching experience and teaching effect of flipped classroom are summarized, which provides an operable demonstration for deepening the reform in teaching reform.

Keywords

Linear algebra; flipping classroom; circulating teaching method; small private online course.

1. Introduction

Linear algebra is an important public basic course in Colleges and University. It is also the theoretical and algorithm basis of computer graphics, cryptography and other courses. This course embodies the connection between geometry and algebra, contains strict logical reasoning and ingenious induction, which can effectively strengthen the logical thinking ability of college students. The nonlinear model in scientific research can be approximated as linear model, so linear algebra is widely used in natural science and social science.

Information technology provides new opportunities and challenges for the integrated development of higher education. Flipping classroom is a new education mode based on mobile Internet. In this teaching mode, students watch the teaching video the network to and take part in online test provided by the teachers, complete the self-study of new knowledge points before class. In the classroom, the teachers check and accept the students' learning effect through discussion and presentation. Ultimately, teachers make in-depth and targeted explanation, so as to improve the students' abilities of understanding [1-3]. Flipped classroom teaching mode is not only the reform of teaching structure and process, but also the reform of students' learning and thinking mode.

Scientific research shows that in the whole life cycle, our brain constantly changes and form new connections (i.e. plasticity). Therefore, active learning plays an important role in people's life. In the teaching of linear algebra, Xi'an University of science and technology actively practices the teaching form of flipped classroom. Taking the flipped teaching practice of linear algebra as an example, this paper makes a practical analysis and summary of the preparatory work, implementation process and experience results of the teaching reform, so as to provide a reference for further classroom reform in the future.

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2. Feasibility Analysis of Flipped Classroom Teaching of Linear Algebra

Flipped classroom teaching mode, which integrates discussion teaching and learning outside the classroom, has a broad application prospect in the teaching of university courses, and provides practical operation scheme and basic process for autonomous learning. College students generally have the ability of self-conscious learning and self-discipline. They can discuss collaboratively with classmates and communicate effectively with teacher, which is the major premise for the implementation of flipped classroom teaching.

The popularity of Internet technology and university computer courses provides technical support for the practice of flipped classroom teaching in Colleges and Universities. The information network center of Xi'an University of Science and Technology is equipped with sufficient computer rooms for the library and departments. The campus is fully covered by wireless network. Through the application of computers and mobile App, students can flexibly arrange their own learning time, watch teaching videos and use other teaching resources in all corners of the campus. All of these helps to carry out flipped classroom teaching mode. courses The learning tasks of the corresponding links in the classroom.

3. The Implementation of Flipped Classroom Teaching

3.1. Construction of Resource Platform

The implementation of linear algebra flipped classroom in Xi'an University of Science and Technology is based on small private online course (SPOC). SPOC is suitable for courses with the scale of dozens to hundreds of student, and sets restrictive access conditions for students. It is a hybrid learning mode combining classroom teaching and online teaching. It uses targeted online teaching resources to help implement flipped classroom teaching [4].

Linear algebra of our school uses the platform of Chao Xing to implement the flipped classroom teaching in the form of SPOC. Firstly, the teaching team sets up the framework of the course on the platform. Secondly, the content of linear algebra is reorganized, and the test database suitable for network is compiled. Teachers prepare and upload the PowerPoint and micro-video to the corresponding chapters. Finally, the information of students will be imported into the platform. Students will be informed to register and login in their own account on the mobile terminal for learning. Teachers can effectively supervise students' learning progress through publishing discussion topics, assignments and tests in the system. Teachers can also issue questionnaires to investigate students' problems online studying.

3.2. Reconstruction and Refinement of Teaching Process

The flipped classroom mode extends the traditional classroom to before and after class [5]. Therefore, the teaching process should also include the relevant links before and after class. The teaching team proposed a seven-step cycle teaching process which is listed as follow.

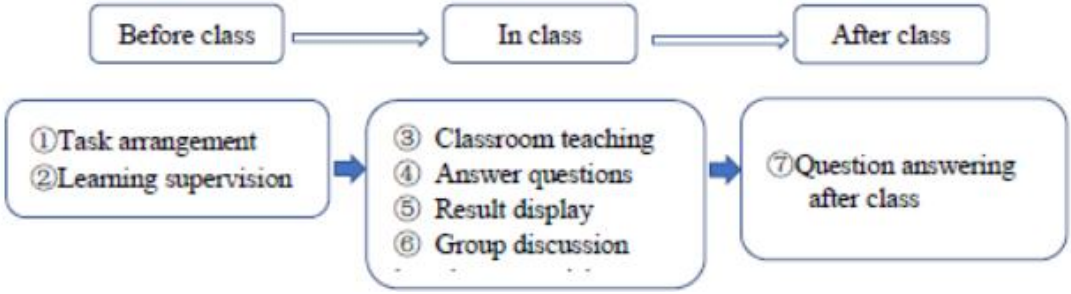

Fig 1. A seven-step cycle teaching process

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In the new teaching process, the start point of the course is task arrangement. Then we explain each step in detail.

① Task arrangement

According to characteristics of students' major, the guidance is published through the network platform before class, which includes videos and discussion topic and so on.

② Learning supervision

Teachers can effectively supervise the students' preview progress and the completion of each task. In addition, we can classify and summarize the questions that students encounter in the preparatory stage.

③ Classroom teaching

In this stage, teachers focus on the key and difficult contents of this section. Based on the syllabus of postgraduate entrance examination, we explore the content deeply.

④ Questions answering in class

In the class, encourage students ask questions about the topics arranged before class and the points taught in this section.

⑤ Result display

The main conclusions, methods and theorems are displayed in an organized way, which enables students to have a macro understanding of the contents of this section,

⑥ Group discussion

In order to develop students' ability of solving problems, students are arranged group discussion in class. This link is the biggest reform of flipped classroom teaching mode compared with traditional method, which encourages students to actively participate in teaching activities, improve their ability of learning. As the organizer of the discussion, the teacher should control the rhythm and guide the students constantly.

⑦ Question answering after class

There are two forms of question answering. One of them is face-to-face communication and answering, which is mainly used to help the students understand the basic concepts and principles at class, and is also a supplement of step ④ . Question answering can be carried out online platform, focusing on the specific solution ideas and skills.

The above seven stages are an organic cycle.

3.3. Multiple Evaluation Method

A suitable evaluation system not only helps teachers to outline all dimensions of students' development, but also inform teachers how well students master knowledge [6]. In the traditional evaluation system, students' final grade is composed of the usual score (weight 30%) and the final paper score (weight 70%). Generally, the usual scores have no clear quantitative rules.

Table 1. Weight distribution of every teaching link

Number	Teaching link	Weight
1	Online pre-course preview score	15%
2	Online check-in number	5%
3	Online discussion participation degree	10%
4	Online assignment score	10%
5	Classroom performance score	10%
6	Final examination score	50%

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After the practice of flipped classroom teaching mode, we adopted multiple evaluation standards to reform the original evaluation. The evaluation of students' performance is based on the examination results and online grade. The specific weight distribution is shown in Table 1.

Note that the proportion of final grade is weakened and the evaluation of online grade is included in the performance evaluation, which reflects the reform idea of focusing on process learning. The reform of multiple evaluation mode also provides an operable demonstration for other courses.

4. Summary

At the end of each semester which practices flipped classroom teaching, the teaching team designed questionnaires to investigate students' views and suggestions on this new teaching methods. The results show that 92% of the students satisfied to flipped classroom teaching, which reflected the students' acceptance of the flipped classroom teaching method.

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