A First Experience of Flipped Classroom in Operational Research
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Abstract. In information times, the “flipped classroom” “is a kind of teaching mode to changing “passive study” to “active study”. We investigate that how to apply effectively this mode to in the course of Operations Research. Through summarizing the problems existing in the implementation process, effective measures are put forwarded. It shows that micro video autonomous learning is conducive to mobilizing learning enthusiasm, training students' language expression ability and courage, and strengthening the communication between teachers and students and students. Which has greatly improved the teaching effect.

Introduction
“Devising strategies within a command to win a victory thousands miles away”, Operational research is a optimal decision subject, which mainly focuses on quantitative analysis, with the help of systematic, scientific and mathematical analysis methods, by means of modeling, testing and solving mathematical models. Its core objective is to study the theory and methods of optimization. Operations Research is a very wide range of courses, such as mathematics, management, systems science, information and computing science, etc, many majors are set up this course. For many years, operational research has been regarded as a core compulsory course for students majoring in Applied Mathematics and management in many colleges and universities. The operational research courses of Sichuan University and Shandong University have been included in the National Excellent Courses for construction.

In order to achieve the teaching objectives and tasks of this course, many teaching workers and scholars have done some research on the teaching methods and methods of operational research. Sun[1] studied artificial intelligence solutions of linear programming. On the basis of analyzing the existing problems in the teaching of operational research, Zheng[2] studied teaching aims, teaching methods and teaching methods of operational research, and put forward corresponding reform ideas and measures. According to the requirements of Applied Talents Training Mode in undergraduate education in Colleges and universities, Liu[3] examined the traditional educational concepts and teaching system of “operational research” course and discussed the reform scheme of “operational research” course teaching system from the aspects of course structure, teaching content, teaching methods, examination methods and teaching management system. On the basis of in depth analysis of the current situation at home and abroad, Zhu[4] studied the requirements of military operations research course for the training of new military personnel under the new military reform, and put forward some reform suggestions and measures. Li[5] discussed operational research teaching and put forward some measures. Zhang[6] applied the teaching mode of “flipped classroom” to the teaching of simplex method in operational research, and achieved certain results.

“Flip Class” originated from two chemistry teachers at Rocky Mountain Woodland Park High School in Colorado. “Flipping Classroom” [7,8,9,10] is a teaching mode of knowledge imparting and knowledge internalization by using modern technology. It is a powerful means for teachers and students to interact and stimulate interest in learning. It truly embodies the “student-centered” educational concept. Under the flip-flop classroom teaching method, students' main learning method is “asking questions”. Put forward their own problems when watching video in class, discuss with students, and ask the teacher to answer them. Under this teaching mode, students from the past “I want to learn” into “I want to learn”, mainly to enhance students' interest in learning and
learning efficiency. Flip classroom teaching method essentially refers to a teaching mode of “learning knowledge at home, communicating and tutoring in the classroom”. In this teaching mode, students need to learn the video released by the teacher in advance, learn related knowledge, and conduct self-test, and the classroom has become a place for interaction between teachers and students, students and students, including answering questions, the use of knowledge, and so on, so as to achieve good educational results. Marta Caligarisa, Georgina Rodrigueza, Lorena Laugero [11] applied the “flipped classroom” model to the teaching of numerical analysis courses. The results showed that students had great interest in video learning and gave more recognition to the “flipped classroom” teaching method. Zheng and Lu[12] systematically sorted out the teaching activities and their key support from the macroscopic, mesoscopic and microscopic perspectives on the teaching characteristics of flip-flop classroom, and put forward the teaching design and optimization strategies on the three stages of pre-class knowledge imparting, in-class knowledge internalization and after-class inspection and evaluation.

The Construction and Implementation of the Teaching Mode of “Flipped Classroom”
Different teaching contents should be designed for different teaching contents of operational research course. The basic principle of simplex method, duality theory, iteration principle of table operation method, solution and characteristic of integer programming, establishment of objective programming model, basic idea and principle of dynamic programming, algorithm principle of shortest path problem and maximum flow problem are taught by means of teaching and multimedia assisted teaching. And the table simplex method, dual simplex method, table work method, goal planning graphical method, Hungary method, dynamic programming method, maximum flow problem operation research model solution method and application are taught by the “flip classroom” teaching model.

Establishing Network Communication Platform
Makeing full use of modern information technology, establish QQ group network communication platform, teachers release video, homework on the platform. If you have any questions, you can exchange answers on the Internet, discuss and answer questions.

Eaching Video Recording
Firstly, the teaching content is recorded into video in advance, and the video time is usually 10-15 minutes. Video content should be streamlined, each video content either a topic or a solution.
For simplex method, dual simplex method, table work method, goal planning graphical method, Hungary method, dynamic programming method, maximum flow problem, using video teaching method, these contents are recorded into seven videos, each video content introduce a solution and arrange certain exercises and thinking problems.

Classroom Discussion
Taking 2015 applied mathematics profession as the test project, the class is divided into 8 groups, which two groups are 7 peoples, other groups are 8 peoples. Students download instructional videos one week in advance and learn the contents of the videos in their extra-curricular time, then in the discussion class, each group explain the contents of the discussion. Students can put forward the questions in the videos, their own ideas and discuss them under the guidance of the teacher. After each group’s explanation, we can ask questions about the content, explanation and teaching attitude of the group. And the group was graded. The average score is the score of each member of this group.

Combination of Multiple Assessment Methods
The course consists of five parts: attendance, computer experiment, stage test, video discussion and final examination. The five sectors accounted for 5 points, 15 points, 15 points, 15 points and 50 points respectively. Every examination should be recorded.
The video discussion section is mainly completed by the students. Each discussion assigns the students to take notes, calculate the score of the discussion, and publish it. Finally, the score of the whole semester is divided into this section averagely. Each stage of the test by the teacher, marking papers, the average score of the three tests as this link. The experiment was conducted by the teacher on the basis of the experimental report and the attendance on the computer. Final examination is conducted in closed form.

Building Student Learning Files

Set up learning files or electronic files for each student to record each student's learning situation throughout the semester. Feedback the situation of each link to the students in time so that the students have a dynamic and comprehensive understanding of their learning situation.

Investigation and Problems of the Teaching Mode of “Flipped Classroom”

Effect Survey

At the end of the semester, by the students' implementation effect and form of flip-flop classroom, a questionnaire survey is designed on the three major sections to conduct an anonymous survey on the students' learning under the “flip-flop classroom” teaching mode. A total of 61 questionnaires are sent out and 61 questionnaires are retrieved, including 31 female students and 30 male students.

The questionnaire is divided into three parts. The first part is mainly about personal information. The second part is about the content, methods, students' attitudes and opinions. The third part is about the comparison between flipped classroom and traditional classroom. Through investigation, we find that:

1. 40 out of 60 students think that the important content and theoretical knowledge agrees to use video learning, the best time is about 10 minutes, not too long.
2. 32 students think that self-study depends on the specific conditions of the day, only 23 students think that self-study; 32 students will give up self-study because of other interference factors, only 18 students think that they will not be disturbed and persist in learning, the proportion is low, from this problem is also reflected in the usual discussion class.
3. 37 students think that micro-video preview and learning were effective; 45 peoples think that it is necessary to set up a platform communication and answer questions between teachers and students;
4. The number of people who actively browse and learn all the microvideos in advance was 30, there were 36 peoples who thought that the microvideos needed to be repeated in class.
5. Most of the students suggested that teachers should check the extracurricular micro-video learning through random questions, group discussions, explanations and other ways; suggested that teachers should adopt more open interactive learning in the classroom, such as group competitions, group discussions and research; most think that there are many suitable classes in the university. Learn from microvideos, such as mathematical analysis, operations research, mathematical experiments, data structures, etc.
6. About 45 peoples believe that the “flipped classroom” teaching method is more conducive to improving the harmony between teachers and students, and improving students' autonomous learning ability, enhancing communication between students and improving students' personalized learning.

Since the implementation of the flipped classroom teaching method in this semester, some good results have been achieved. The way of classroom discussion makes people learn on their own initiative, have more interest in exploring knowledge, and the way of asking questions is conducive to cultivating thinking ability. Students learn independently through extracurricular micro videos. Classes are easier and less difficult to learn. Students feel that this way is conducive to learning. This way of teaching gives students more opportunities to speak and enhance communication between teachers and students.
Existing Problems

The following problems have been found in the implementation process:

1. Self-regulated learning is poor, and extracurricular learning is easy to be interfered with. According to the survey, 52% of the people will give up extracurricular learning because of interference.
2. The difficulties and doubts encountered in micro-videos cannot be solved in time, which will also affect autonomous learning.
3. Most people think that knowledge in video needs to be repeated in class, which may increase hours.
4. Extracurricular learning lacks supervision and supervision. Lazy people are easy to exploit.
5. Because the discussion is in the form of group and content, some students do not take an active part in the discussion, and some students suggest that the contents of each group should be randomly assigned.

Improvement Measures of “Flipped Classroom” Teaching Mode

We puts forward some measures to improve the implementation of the “flipped classroom” teaching mode in the next semester.

1. A group of 3-5 students, preferably a dormitory student, will study in a small group, and a restraint mechanism will be established to form a system of mutual supervision and supervision. The group should help each other and strengthen communication between the group and the group. And each group selected a group leader, responsible for the group's learning and discussion of video content, timely communication with the teacher if in doubt.
2. In the discussion class, the teacher randomly assign the contents of each group. the team members should coordinate and complete the content together.
3. Each group should ask questions about the tasks assigned by the seminar teacher.
4. Teachers should focus on the classroom problems according to the problems in the discussion class.

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