The Construction and Application of Hybrid Teaching Model of Flipping Classroom and Divided Classroom Base on Project-driven in the Teaching of Java programming

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Abstract. In view of the problems existing in the teaching of Java programming, in order to further improve the teaching quality of Java programming, a hybrid teaching model of flipping classroom and divided classroom based on project-driven was proposed. The problem-oriented, student-centered teaching concept forms an effective teaching activity for teachers and students. With a complete project throughout the course, online learning is adopted to deeply explore students' independent learning ability, assist the teaching of course content and group communication learning, combine the flipped classroom with the divided classroom to construct a hybrid teaching model. The experiment proves that under the project-driven teaching mode, the full use of the hybrid teaching of the flipped classroom and the divided classroom can greatly improve learning effect of students at different levels of knowledge, and students' independent learning ability, innovation and creativity ability can also be improved accordingly.

1. Introduction

With the development of computer science and information technology, the proposal of the "new engineering" construction of colleges and universities, "Java programming" occupies an important position in the training of computer science and technology professionals, and it is a professional compulsory course [1]. The traditional teaching model can no longer meet the needs of cultivating new engineering talents with innovative entrepreneurship. The teaching effect of traditional teaching mode has been unable to meet the needs of professional posts in today’s society. At the same time, students' interest in learning has also undergone tremendous changes. The traditional teaching mode has directly affected students' interest in learning, and even students have a strong rebellious mentality in the learning process. Therefore, the construction of a scientific and reasonable curriculum teaching system not only helps students’ interest in learning and technical ability, but also promotes the cultivation of application-oriented technical talents in colleges and universities.

2. The Nature of Java Programming Course and existing teaching problems

2.1. The Nature of Java Programming Course
First, Java programming is a compulsory course for computer science and technology majors [3], and it is also a basic skill for students to master.

Second, Java programming is a practical course, which mainly trains students to learn the methods and ideas of object-oriented programming.

2.2. Teaching problems at the current stage

Students' learning effect has not reached the expected teaching goal. Some students have a good grasp of basic theoretical knowledge, but they have not really grasped the programming idea of Java language, and their practical operation ability is very weak. Even some students are not familiar with the Java development platform. Most students cannot develop projects independently. The learning of programming language is still at the theoretical level, and they cannot use the Java language they have learned to solve practical problems.

After further summarizing and analyzing the learning situation of several sessions of students, the reasons for the above problems mainly include the following aspects:

First, C language is the first computer language for students to contact, is deeply influenced by the learning mode of C language, and it is difficult to change the programming thinking mode from procedural language to object-oriented language.

Second, students are relatively unfamiliar with the configuration of Java development environment, and do not take the initiative to familiarize and experience the Java development platform. In addition, the content of the Java language is rich and is more complex, the actual class hours are insufficient, classroom practice is limited, and students' ability of independent learning is weak.

Third, the existing traditional teaching methods are relatively single, paying too much attention to the explanation of Java grammar, and neglected the cultivation of students' object-oriented programming ideas and skills, which restricts students' interest to a certain extent. Students lose autonomy in deep learning of Java language, even in the process of learning, there are many students who are relatively unfamiliar with the Java development environment, just staying in the basic knowledge of the Java language.

Based on the limited teaching hours, how to improve students' programming skills, and mobilize students' interest will become a research hotspot in the teaching of Java Programming. Aiming at many problems, this paper proposes a hybrid teaching mode of flipping classroom and divided classroom base on project-driven. Through the interaction of teaching and learning between teachers and students online and offline, strengthen students' autonomous learning ability, further using the combination of theory and practice, and improve students' ability to analyze problems, solve problems [4], and strengthen students' programming skills.

3. Relevant Teaching Model

3.1. Project-driven Teaching Model

Project-driven is a series of teaching activities carried out by teachers and students to complete a complete project [5]. The teacher will develop a complete project and then instruct the student to complete a relatively independent project. During the progress of the whole project, students are required to make clear the basic requirements and expected goals of the project, and to complete the information material collection, design and implementation of the project, and finally form the evaluation. During the development of the project, the key points of each link of the project and the whole process of project are entirely controlled by the students, who can observe the relatively complete results of the project at the end of the project. Project-driven teaching mode emphasizes the combination of theory with practice and the application and innovation of practical operation skills and knowledge. Therefore, it is more suitable for project-based teaching mode in practical teaching. Through a complete project, students are organized to plan, design, implement and manage, and finally complete the course teaching activities.
3.2. Flipped Classroom Teaching Mode

Flipped classroom is also known as "reversed classroom" [6]. Under the flipped classroom teaching mode, new arrangements are made for the time inside and outside the classroom, and students have the right to decide their learning [7], which is a teaching mode of learning before teaching.

Flipped classroom can be divided into three stages: pre-class, classroom and after-class [8]. Before the class, under the guidance of the teacher, students need to learn independently the information of the traditional teaching teachers in the classroom, mainly by watching the pre-class materials such as video materials, online video classes or online e-books, etc., which are prepared in advance by the teachers. They can also discuss with classmates or communicate with teachers, anytime, anywhere. Refer to relevant knowledge materials. In class, that is, in the classroom, students can be more specialized in project learning, and in groups, they can discuss and solve related problems, so as to further study deeper contents. After class, students can summarize and evaluate what they have learned in class according to the content of the classroom, and then further plan the learning content of the following knowledge. In the whole flipped classroom, teachers not only satisfy students' needs for relevant knowledge, but also stimulate students' personalized learning mode. The teaching mode of flipped classroom is shown in figure 1.

![Figure 1. flipped classroom teaching mode](image)

3.3. Divided Classroom Teaching Model

In the divided class, teachers' classroom teaching and students' classroom discussion are combined, and the whole class is divided into two parts. One part of the class time by teachers to teach content, and the other half for the student to carry on the discussion, there is not only traditional classroom teaching, but also discussion classroom interaction between teachers and students, and interaction between students and students. Through the organic integration of teaching and discussion, the unity of opposites can be realized between "teaching" and "learning".

By redefining the classroom, reconstructing the relationship between teachers and students, and integrating flipped classroom, collaborative learning, project teaching, intensive teaching and more practice, etc., from how to teach to how to learn, give full play to students' autonomous learning ability, improve the teaching quality and improve the teaching effect. Therefore, the teaching time is divided into three parts: Presentation, Assimilation and Discussion. As shown in Figure 2.

![Figure 2. Divided Classroom Teaching Model](image)

First, the teacher's classroom teaching: intensively speaking, teachers give the framework of teaching content, give the hints of the key points and difficulties of the content, give lectures with choices about teaching content, and leave more space for students;

Second, students' internalization and absorption after class: students learn independently and carry out learning according to the teacher's classroom tips. In this session, try to learn and think as much as possible, and exercise the ability to learn and think.
Third, the classroom discussion of students: students cooperate with each other in learning. Students will discuss the results of self-study and thinking after class and the existing problems with their classmates, and complete the problems between them in group communication and discussion;

Fourth, summary and induction: teachers will carry on summarize and summarize to the group discussion question, and give answers to common problems.

"Divided Classroom" requires teachers not to cover all aspects of teaching content, but to talk about something and not to talk about it, and leave enough space for students to improve the content and build their own cognitive structure. In the process of knowledge construction, students try to solve problems, internalize knowledge, and subtly establish their thinking ability and exploration spirit, so as to improve their independent learning ability. In the stage of students’ classroom discussion, “divisional classroom” carries out discussions on the basis of in-depth independent learning, and cultivates the ability of students to learn and communicate collaboratively.

4. Construction of Hybrid Teaching Model of Flipping Classroom and Divided Classroom Base on Project-driven

Compared with the two teaching modes of flipping classroom and divided classroom, there are discussion links in common. Group communication and discussion links cultivate students’ ability to find problems, solve problems and cooperate with each other, and pay attention to students' consolidation of knowledge. However, in the process of knowledge transmission, the flipping classroom pays attention to pre-class preview, while the divided classroom pays more attention to internalization and absorption. Students will be able to better absorb the knowledge in the classroom and then carry out further knowledge expansion.

The flipping classroom and the divided classroom are ultimately accepted by students; however, due to the difference of individual students, the results obtained are also different. From the analysis of the individual knowledge and learning ability of the students, if the students have a large amount of knowledge and strong self-learning ability, then the students' autonomy and enthusiasm will be stronger. In the process of participating in group discussion and analysis of problems, students with solid basic knowledge have greater advantages and will actively participate in discussions to further enhance students’ self-confidence; however, students with weak basic knowledge have relatively weak opportunities to participate in discussions [9], and their autonomy and confidence to participate in discussions will be weakened. But in the group discussion of divided classroom, the more students exchange and discuss, the greater the potential of students to improve. Under the influence of group students, the students' knowledge and ability will be greatly helpful [9]. In order to improve classroom efficiency and improve students' autonomy and learning ability, this paper constructs a hybrid teaching model of flipping classroom and divided classroom based on project-driven.

The teaching content of Java Programming is mainly divided into two parts: theoretical teaching and practical operation. In view of the fact that Java programming is a course with relatively strong practical operation ability. Through research and analysis, students are generally weak in practical programming skills, students are vague about the concept of the project, and the reason is that the theory knowledge understanding is not enough; most students copy textbook code directly and habitually, but neglect functional analysis of the code. Therefore, in the process of the practice teaching, on the basis of the project-driven teaching mode, combined with the hybrid teaching mode of flipping classroom and divided classroom, forming pre-class preparation, classroom teaching and classroom discussion, with a mission to continue learning after class to consolidate knowledge to preview the new content, and complete the assessment and evaluation. The specific implementation of the teaching mode is shown in Figure 3.
Figure 3. Hybrid Teaching Model of Flipping Classroom and Divided Classroom Based on Project-driven

The mixed teaching mode of flipped classroom and divided classroom based on project-driven mainly refers to the activities of teachers and students in the teaching process. Among them, the teacher's main work is responsible for the planning of the pre-course content, setting a complete project for the course content throughout the teaching process; the first classroom teaching, teaching the theoretical knowledge and basic concepts of the course, and giving the important and difficult points of the course content. The learning objectives are defined for the students' post-learning; after the class, the teachers plan the theoretical teaching and practical operation of the course, and make video and other materials of students' after-class course learning and uploaded them to the network. The second classroom teaching assists students' learning by group discussion and testing. Through the first class teaching, students can understand the content framework of the course, master the important and difficult points of the course content, and make a learning plan for the later study. After class, students should learn independently according to the materials provided by teachers, complete the project tasks at each part, understand the course content through learning, extract key issues for class group discussion, and make self-evaluation and mutual evaluation on the learning of this part. In the whole teaching process, project-driven teaching runs through the whole course. Each internal link integrates the teaching, internalization, absorption and discussion of divided classroom. At the same time, it combines flipped teaching with the network platform to supplement the different levels of content to make up for different needs of students. For the flipping and internalization absorption in the self-learning process of students after class, because this process is not a necessary process for all students, Students with good foundation can directly enter into the internalized absorption process, without the need to choose the flipped process; At the end of the second class discussion, students need to conduct self-evaluation and mutual evaluation. Finally, the teacher will make a general evaluation, evaluate the group, and comment on the excellent results, affirm the students’ achievements, and build confidence for students' learning.

5. Experimental Results
Fifty students were selected to conduct experimental teaching from majoring in computer science and technology in class 2018 in School of Data Science and Computer Science, Shandong Women's university.
5.1 Project-driven Teaching Implementation
Determine the group of personnel, will set up a group of 3-5 people, and the project manager will be determined within the group, the project manager leads the team members to carry out software case analysis and development, formulate the project charter, define the project objectives and determine the division of labor [10]. During the whole project development process, the project manager will be responsible for the project management activities.

Classroom teaching is synchronized with the implementation and management of after-class group projects. When classroom learning and project knowledge converge, students will discuss and exchange learning in the classroom discussion according to the actual project situation. Practical cases have deepened students' understanding of project management and achieved the purpose of applying what they have learned [10].

5.2 The Implementation of Flipping Classroom Teaching
In view of the basic concepts and basic knowledge of Java Programming are implemented in flipping classrooms, teachers provide students with online autonomous learning materials before class; In the classroom, test students' learning situation, evaluating learning quality, expanding knowledge points, additional group discussions; after class, make full use of network video and other approaches to provide learning resources for students, so as to reduce the difficulty of students' after-class learning. Online video teaching resources of black horse programmer are selected and matched with the course as the reference and supplement of the students' learning materials.

5.3 Implementing Divided Classroom Teaching
In the teaching process of "Java Programming" course, Project task management is layered based on course content, and the content is gradually planned from easy to difficult. On this basis, the Divided Classroom teaching mode is implemented, and then the learning resources are distributed through the network teaching platform. The students complete the project tasks after self-learning, and pay attention to guiding students to summarize and summarize the content they have learned, and further expand the knowledge points. This session mainly cultivates students' logical thinking ability and improves students' learning efficiency. This session provides students with a network-assisted platform, which is mainly MOOC-National Excellent Course Online Learning Platform, as a reference and supplement of teaching materials after class for students.

6. Conclusions
Through the analysis of the learning situation of each grade of students and the students in the traditional teaching class, compared with the traditional teaching model, hybrid teaching mode of the flipping classroom and the divided classroom based on project-driven has better effect. Students have greatly improved in learning quality, self-learning ability, classroom students have greatly improved their learning quality, self-learning ability, classroom reaction and team awareness. At the same time, the teaching effect of mixed teaching has a great promoting effect on the cultivation of students’ interest and autonomy, which has been recognized by many students. As shown in Table 1.

Table 1. Comparison of Teaching Modes

| Research Direction | Traditional Teaching Model | Project-driven Teaching Model | Flipped Classroom Teaching Mode | Divided Classroom Teaching Model | Hybrid Teaching Mode |
|--------------------|---------------------------|------------------------------|--------------------------------|----------------------------------|---------------------|
| Learning Quality   | 50%                       | 70%                          | 80%                            | 85%                             | 96%                 |
| Self-learning Ability | 20%                       | 50%                          | 70%                            | 85%                             | 90%                 |
| Classroom Reaction | 60%                       | 70%                          | 80%                            | 90%                             | 97%                 |
| Team Awareness | 10% | 50% | 70% | 75% | 95% |
|----------------|-----|-----|-----|-----|-----|
| Innovation and Application Ability | 10% | 40% | 50% | 60% | 80% |

By introducing the hybrid teaching model of flipping classroom and divided classroom based on project-driven into Java Programming, the teaching effect of this course has been greatly improved and more than 96% of the students are positive about the teaching model. This teaching mode is pre-class autonomous learning and classroom collaborative learning based on Project-based. It pays attention to the cultivation of students’ autonomous learning ability, innovation and creativity ability and comprehensive literacy ability, and it also emphasizes the importance of teachers’ intensive classroom teaching. The trial of the hybrid teaching mode shows that in the traditional teaching mode, the advantages of project-driven, flipping classroom and divided classroom are effectively hybrid teaching, which not only improves students’ classroom effect and learning quality, but also enhances ability of independent inquiry, teamwork and application innovation of student.

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