Research on the Blended Learning Mode of Software Engineering Based on Study Master Platform

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Abstract. Software Engineering, which is an information technology course, is to cultivate students' comprehensive application ability in the process of software development. This article aims to study the blended learning mode of software engineering based on multimedia information technology – Study Master platform. The teaching team also uses the big data techniques to reshape teaching objectives, reconstruct teaching content, strengthen key and difficult points. The Study Master platform provides videos, online tests, development materials, etc. It can not only make students more flexible to master their own learning time, but also make them more actively participate in the course learning. The strategies of Study Master platform, online courses, flipped learning are all throughout the whole teaching process. Moreover, various evaluation methods are adopted, including online process assessment, practice assessment, and traditional examination. The survey is also sent to learners which is used to verify the effect of the Study Master platform.

Keywords: Information technology · Blended learning · Online learning · Study master platform · Big data

1 Introduction

In the new era, the rapid development and progress of internet technology, information technology, and multimedia provide a good opportunity for China to continue to promote the reform of education and teaching. With the support of the network and big data, information technology can provide students with sufficient learning resources on one hand, and on other hand, online education tools are providing various advantages for distance learning, which has taken an important position in our lives [8–11]. Software engineering is a compulsory specialized basic course in Computer Science Department. This course guides software developers to design, develop, maintain and manage software with engineering thinking. Education plays an important role in the talent training system of software engineering disciplines [4, 6]. However, a large number of students have failed exams in the traditional instructor-centered classroom.

Recently, lots of computer-assisted teaching software have appeared. In this background, the instructor has reformed and improved the course quality through study master platform with a blended learning mode. Big data techniques can accurately record students learning behaviors, and analyze learning behaviors. Personalized learning intervention guidance can be given, and a more flexible and convenient precise teaching model has become a new research area [7].

2   Existing Problems of Software Engineering

(1) Lack of motivation.
The course content has many concepts and content which is difficult for students to comprehend. At present, most of the theoretical knowledge in the courses is taught by instructors in front of the classroom. Students just sit and follow the instructions. As a result, students lose interest in software engineering learning. Therefore, how stimulating students' interest and motivation and improving their ability to learn is very important.
(2) The project case lacks practicality
The UML section is the most important chapter of software engineering. Because students lack the development experience of actual projects, it is difficult to understand the whole process of software life cycle development. For example, in the requirement analysis stage, the project case is normally selected from the textbook, which is quite different from the actual project requirement. Students cannot accurately describe the object model and dynamic model when learning the object-oriented analysis model.
(3) Too many students in one class
In recent years, due to the rapid expansion of university enrolment, the capacity of a class is much larger than before. That is the conflict between a great number of students and insufficient college teachers. Teachers have no enough time to contact and communicate with students one by one and fail to pay attention to the individual. As a result, students lose interest in learning.

3   Blended Learning Based on Study Master Platform

It is great urgency to get rid of the current problems that existed in software engineering teaching. The study master platform provides videos, online tests, development materials, etc. It can not only make students more flexible to master their own learning time, but also make them more actively participate in the course learning. It is evident that the blended teaching mode via study master platform coincides with the solution to these problems in college teaching: First of all, the study master platform guides students to do pre-class in their spare time to learn knowledge independently. Students can learn anytime and anywhere according to their own time and planning, which expands the time of the classroom [1]. Through the students' pre-class preview, they gradually develop good preview habits, learn to formulate effective learning plans for themselves and construct a new teaching mode that combines in-class interaction with

pre-class independent preparation. Second, it transforms the traditional teaching mode from teacher-centered to teacher-student, student-student, and vital interaction [5]. It not only emphasizes the role of teachers in organizing, guiding, evaluating, and supervising but also improves students' learning enthusiasm and autonomy, thereby stimulating students' learning motivation and creativity.

4   Research on Teaching Reform of Software Engineering

4.1   Reshape Teaching Objectives Based on Big Data

Educational data mining and learning analysis are currently the most extensive application of big data in education in China [3]. The teaching team has integrated, analyzed, mined, and visualized massive amounts of educational data of software engineering provided by big data technology. Hence, the teaching team reshaped teaching objectives as follows:

Knowledge Goal 1: Be able to use the methods and models of software scale and cost estimation in software engineering to correctly estimate the workload and total cost of software projects. Understand the advantages, disadvantages, and applicability of software process models, and be able to correctly analyze and select software process models according to development requirements.

Knowledge Goal 2: Be able to formulate a reasonable software development plan according to software development requirements, be able to correctly calculate the earliest/latest start time of each task, and find out the critical path and key tasks.

Ability Goal 1: Master the unified modeling language UML, and be able to use activity diagrams, object diagrams, state diagrams, etc. reasonably according to the development scenarios. Cultivate teamwork ability. By requiring students to complete project training in groups, develop their teamwork spirit and management ability.

Ability Goal 2: Be able to develop and model requirements using object-oriented analysis models according to development requirements. According to the requirement description, the use case model, object model, and dynamic model are used for modeling, and it has the ability to analyze the actual complex problems.

4.2   Three-Stage of Blended Teaching Mode with Study Master Platform

In the three-stage teaching mode, teachers use the information technology tool - Study Master Platform to share teaching resources, publish teaching tasks, and comment on the assignments submitted by students. It can effectively grasp the knowledge of students and make an objective evaluation. Students can also use the platform to learn independently, take tests, ask questions, and share learning experiences, which improves their ability to learn independently [2]. It enables students to learn various technical resources by themselves in their spare time meanwhile teachers provide necessary assistance and online guidance so that students can improve their practical operation ability in the process of continuous practice. In the second stage, instead of being forced to input knowledge by the teacher, teachers and students communicate with each other in the classroom, a presentation from each team will state their issues and findings. Teachers
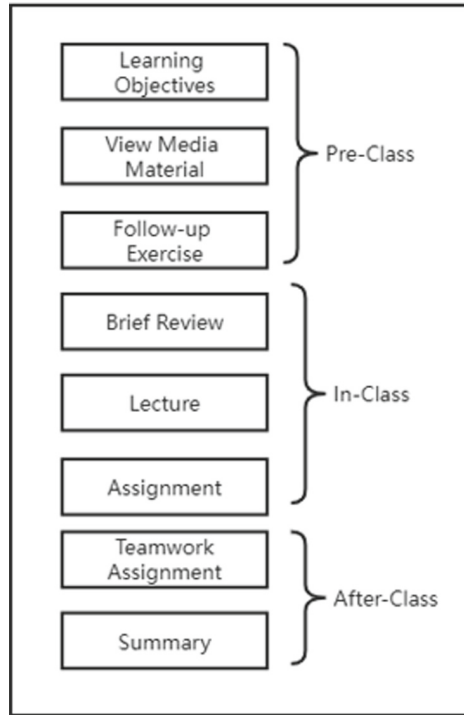
Fig. 1. Instructional design (Photo credit: Original)

summarize their results and ask students to reflect on what they have learned so that they can fully grasp the knowledge. Moreover, teachers can utilize the study master platform to publish tasks in which they can provide feedback and acknowledge the learning status immediately. Finally, the teachers assign the task using the study master platform to deepen their understanding of knowledge.

The setup of the teaching session is shown in Fig. 1.

(1) Pre-Class Learning: Teachers send teaching objectives and learning tasks to students in advance through the "study master" platform, and students can conduct pre-class previews independently. The content is various, such as pre-class guidance videos recorded by teachers, PPT courseware for online courses, sample-based pre-tests, demand analysis cases, and so on. Adding some interesting scenes to the course content of software engineering before class can arouse students' interest in learning. After the preview, students complete the preview quiz, fill in the preview experience, and record the online learning time, so that teachers can grasp the students' online learning situation in time.

Software Engineering is a comprehensive course that includes theory and practice. In the traditional teaching process, students' theoretical knowledge learning time is too long, which limits the time for practicing. The study master platform enables students to learn various technical resources by themselves in their spare

time, and teachers provide necessary assistance and online guidance so that students can improve their practical operation ability in the process of continuous practice.

(2) In-class Learning: At the beginning of the class, teachers will give comments and feedback based on the results of students' class preview via the study master platform and guide students to solve the problems. At this stage, the teacher's task is no longer to implant knowledge to students, but to inspire students to think and enhance their ability. Based on the evaluation of pre-class, the teachers already familiar with the learner's situation and propose some proper advice. Meanwhile, they can reconstruct the focus of the teaching and arrange follow-up the real enterprise tasks to guide students to do further study in order to extend the teaching content. The theoretical knowledge content of the course is placed before the class; the class is mainly to analyze subject matter and solve problems encountered in practice. The focus of teacher-student interaction is shifted to the cultivation of students' practical ability. During the enterprise tasks, students conduct group discussions and complete presentation independently. At the same time, teachers can check the completion status on the study master platform in time, and give the comments if needed.

(3) After-class Learning: After-class tasks are conducted in small groups to complete the object-oriented demand analysis. In the early stage of the course study, the teacher understands the students' professional learning through online questionnaires and selects several students with software development experience to serve as team leaders. The team leader recruits team members to form a small team. According to the characteristics of each person, different roles are assigned to carry out project demand research, analysis, design, coding, testing, database design, etc. The project is in "student-centered" mode, the teacher will provide real business cases. Each group chooses its own topics. All the materials are posted in the study master platform. The post-class stage helps students consolidate course knowledge. The quality of the presentation as an important part of their final assessment. At the end of the term, students are required to share their learning experiences in class.

(4) Assessment and evaluation

The teaching team utilizes a diversification of evaluation mechanisms and makes full use of intelligent technologies tools to evaluate the whole learning process. All of the learning activities and scores are recorded in the study master platform. The pre-class activities include online assessments, the process of watching the video, and other tasks that account for 15%. In class, course discussions and in-class exercises, as well as class performance, account for 15%. In after-school teamwork, it accounts for 30% of which comes from self-assessment, students' mutual assessment, and teacher's evaluation. Procedural evaluation of the final exam score takes the percentage of 40, which is shown in Table 1. All examination items are carefully designed for teaching objectives. For example, evaluate students' ability to master basic knowledge according to the questions answered by students; inspect students' document editing ability according to project documents submitted after class. Compared to the traditional one-time examination to determine the course results, this teaching reform adopts a process-based assessment method based on study master information technology tool.

Table 1. Evaluation mechanisms on study master platform

	Item	Proportion
Process evaluation (60%)	Pre-class (15%)	Self-learning of resources (5%)
		Pre-class assessment (10%)
	In-class (15%)	Attendance (5%)
		Class discussion (10%)
	After-class (30%)	Assignment (10%)
		Participation in the project (5%)
		Project display related (15%)
Result evaluation (40%)	Learning Result (40%)	Final Exam (40%)

5   Result of "Three-Stages" Blended Teaching Method with Study Master Platform

After two semesters of teaching experiments, the blended teaching mode of software engineering based on the learning master platform has achieved great success. It reveals that the blended learning of the three-stage teaching method of "pre-class, in-class, and after-class learning" is credible and effective in teaching. Moreover, the teacher team can observe that students' subjective initiative and autonomous learning ability have been improved a lot. The effect of reform can be revealed from two aspects:

5.1   Effects of Blended Learning Mode with Master Study Platform

In the study, 172 undergraduate students in the computer science department were selected to verify the effects of curriculum reform. 87 students in the first class belong to the experimental class, and 85 students in the second class belong to the control class. They had similar developmental skills before the experimental treatment. They use the same textbook and are taught by the same teacher. During the experiment, the experimental class adopts the innovative blended learning mode based on studying master information technology, and the control class adopts the traditional teaching method. The study lasted for one semester. The exam paper is the same for the experimental class and control class. At the beginning of the semester, the test was sent out to the students. Table 2 clearly demonstrates that the students' academic foundation in the experimental class and control class are similar.

After one semester of a teaching experiment, a post-test was conducted to investigate and compare the changes in students' scores between the experimental class and the control classes. The results are shown in Table 3. The score of the experimental class is higher than the control class.

At the end of the whole year including the semesters 2020–2021, the teacher team compared the average score of experimental classes that were downloaded from study master platform. The students between 2020 and 2021 semesters have made greater progress in their knowledge when applying the blended learning reform. Compared

Table 2. Comparison Analysis of test result1 between the Experimental Class and the Control Classes

	Estimate total cost25	E/L start date25	OOA model25	UML25	Mean 100	Stand deviation
Experiment class	17.5	16.8	14.5	15	63.8	15.58
Control class	16.8	17.1	13.5	17.1	65	10.86
Difference	0.7	0.3	1	2.1	1.2	5.72

Table 3. Comparison Analysis of test result2 between the Experimental Class and the Control Classes

	Estimate total cost25	E/L start date25	OOA model25	UML25	Mean 100	Stand deviation
Experiment class	18.9	18.4	20	16.3	73.6	10.92
Control class	17.1	19.2	15.6	16.5	68.4	11.94
Difference	1.8	0.8	4.4	0.2	5.2	1.02
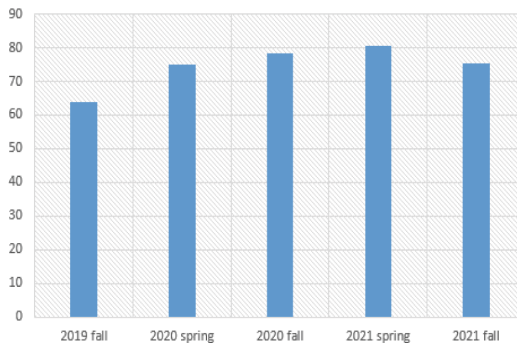
Fig. 2. Average score of experimental classes

with 2019, it proves that the blended learning teaching mode based on study master platform could have a positive influence on students' academic achievements, which is illustrated in Fig. 2.

5.2 Results of the Questionnaire

After the implementation blended teaching model via study master platform for the experimental class, an anonymous questionnaire survey was conducted in the experimental class regarding the perspective of learning interests, student attitudes, teaching mode and teaching content.

The questionnaire is based on 4-point scale: 1 point means dislike; 2 point means moderate; 3 point means like moderately; 4 point means like very much. The following are the analyses of the students.

A total of 65 questionnaires were distributed and 61 valid questionnaires were received for statistical analysis.

- Teaching mode: 68.5% of the students maintain that study master platform in software engineering makes learning more convenient and easier, effectively stimulates the interest and motivation of learning, students can learn anywhere without the limitation of the classroom. The most important is that this platform improves the communication and cooperation between teachers and students.
- Teaching content: 71.3% of the students hold the idea that the teaching content via study master platform breaks through the limitations of teacher-centered classroom. Students can make use of the rich network information resources to study independently, cultivate their designing, developing, maintaining and managing software with engineering thinking. According to their individual interest and competence, they can learn with their own pace. Meanwhile, their communicative skill has improved through the discussion and cooperation with other students.
- Learning interest: 77.2% of the students believe that learners can effectively improve their interest in software engineering learning by completing pre-class tasks via study master platform and group discussions through autonomous learning. It allows for collaboration, gaining interpersonal skills, thinking and communicating creatively. Learners are also able to view the information in their way, such as stop, pause, rewind, and even replay materials for advanced concepts.
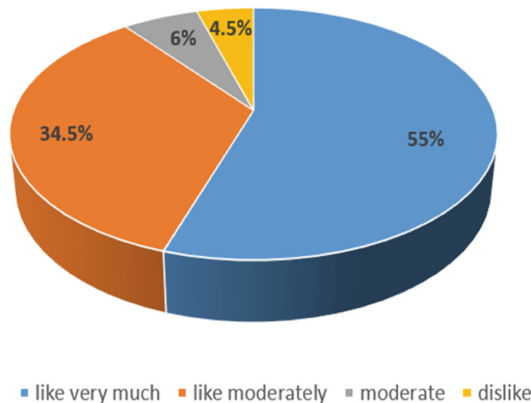

Fig. 3. Results of the questionnaire

- Student's attitude: 89.5% of the students hold a supportive attitude toward the blended learning mode. They thought that they can learn independently without the limitation of time and space via technology tool, and they are willing to cooperate with each other, which is illustrated in Fig. 3.

6   Conclusions

Blended learning teaching via study master platform method is not an online course, not a video course but a novel teaching method that increases the interaction between teachers and students, allowing students to receive a personalized education. The Blended learning mode of software engineering based on study master information technology can cultivate students' ability to learn independently, stimulate students' enthusiasm for learning, and increase the hours of practice and practice. This teaching reform can also be applied to other Computer Science courses in the future.

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