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Research and Practice of Blending Teaching Based on "MOOC + SPOC + Flipped Classroom" for Software Engineering

Ce Zhang*, Dianhui Chu, Songlin Gu, Xiaofei Xu, Jianan Jiang , Zheng Wang, Hua Zhang

Abstract: Based on "MOOC + SPOC + Flipped Classroom", a particular blending teaching pattern adapting to MOOC teaching is proposed to strengthen software engineering students' abilities to study themselves and practice innovatively. Firstly, the process of MOOC development in China is introduced. The distinguishing feature and effect of MOOC teaching are analyzed, followed by the comparison with traditional class. The online Plus offline blending teaching pattern is the combination of online self-study on MOOC before class, seminar study of flipped classroom in class and the summary after class. With the demonstration of a typical case, a progressive strategy is given to implement blending teaching. Finally, the blending teaching pattern is assessed from multiple perspectives, of which both advantages and disadvantages are dissected. Through primary exploration, introducing online study and flipped classroom, blending teaching plays a positive role in software engineering teaching, which means traditional teaching pattern is changed. Meanwhile, students' innovative consciousness and practical ability are inspired. Nevertheless, new problems arise, so that intensive practice and improvement are necessary.

Key words: software engineering; MOOC; SPOC; Flipped Classroom; online plus offline blending teaching

1 Introduction

With the deep development and wide spread of Internet, MOOC (Massive Open Online Courses) teaching[1-5], an online teaching pattern never seen before, is brought by the shock from "Internet +" and mobile Internet to higher education. Similar to the throughout change of trading ideas and situation in online shopping, the combination of MOOC teaching and traditional class is coercing the improvement of teaching quality reversely. A massive teaching reform is brewing[6-7], which will make MOOC a new trend in the development of college teaching.

As the combination of MOOC and the condition in China, SPOC (Small Private Online Course) is booming in Chinese computer education[8-11]. High-quality teaching resources are shared, followed by relief of inadequate teachers. Meanwhile, students' abilities to self-study and practice is strengthened. Transformation of teaching pattern is greatly advanced and academic standard is raised.

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The promotion of the abilities to self-study, practice and innovate is the emphasis in the process of software engineering development of talents. Practical engineering assets are developed to be innovative, international, industrial and urgently needed by the market[4, 12]. The teaching pattern based on "MOOC + SPOC + Flipped Classroom" is quite correspond to the aim of software engineering development of talents. Under the background of modern Internet and online education, it has become an important approach to develop internationally competitive top talents who can adapt to the technology advancement and change of social requirements. It is innovative and entrepreneurial awareness that they should have.

The development process, feature, function of MOOC teaching in China and the comparison with traditional teaching are briefly classified. According to the practice in MOOC teaching of software engineering in our college, the online plus offline blending teaching pattern, which is the combination of online self-study on MOOC before class, seminar study of flipped classroom in class and the summary after class, is proposed based on "MOOC + SPOC + Flipped Classroom" pattern. With the demonstration of a typical case, a specific strategy is given to implement blending teaching. MOOC teaching in software engineering is a new attempt. It is our sincere hope that our research will explore the online plus offline blending teaching pattern suited for software engineering and offer reference to develop software engineering talents better.

2   The Status of MOOC Development

1)The process of MOOC teaching development.

In 2012, online study platforms were gradually created by top USA universities, offering free courses. The growing of three providers, including Coursera, Udacity and edX, provided the possibility to study systematically for more students[13-14]. In 2013, MOOC was unlocked in China[15], followed by the establishment of MOOC Alliance of Computer education in Colleges and Universities in China (CMOOC Alliance)[16]. In 2016, Shandong committee of CMMOC Alliance was founded. When it comes to 2017, it's a period of rapid development of MOOC teaching, including our university and college. This process can be seen in Fig. 1.
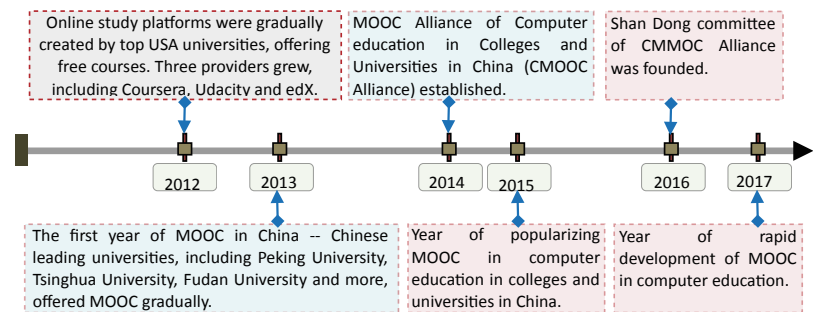
Fig. 1   The process of MOOC development.

It has to be specifically mentioned that Shandong committee of CMMOC Alliance (Committee) was founded in Shandong Province. Harbin Institute of Technology (Weihai) is not only one of the first sponsor units and member units, but also director unit and secretary unit. Office of Committee is set up in our university as well.

College became one of the twelve pilot universities in China – MOOC teaching is used for part of software engineering courses. Reviewed by CMOOC, our college became one of the twelve pilot universities in China on behalf of our university. "MOOC + SPOC" teaching pattern has been carried out in a variety of courses. (It will be introduced in 4.2.)

2)Features of "MOOC + SPOC" teaching pattern.

Unprecedented changes has been brought with the coming of Internet age. Reforms are in progress all around the society, even education. Traditional teaching pattern and knowledge achievement are being changed essentially. Networking, interaction, individuation and more characters will be added to teaching and study.

The access to watch high-quality videos, do exercises, take tests and communicate is available with the coming of MOOC teaching age. Teaching and study will be more various and fantastic. Basic features of MOOC teaching are as follow.

• The limitation of traditional class is broken. Students can study whenever and wherever they like.

• The whole process of teaching and study are completed online.

• Teaching pattern is transformed from face – to – face teaching to a combination of short videos and activities.

• Teaching contents needs to be updated.

• Learners vary from good to bad. Study is more autonomous and individual.

• Experience and achievements are attached more attention in the process of study.

• Based on online plus offline blending teaching, flipped classroom is a chief development direction in computer education of colleges and universities.

Substantially, MOOC teaching is an intensive combination of education and information technology promoted by Internet technology. Teaching will be better served by online education.

3　Differences and Similarities Between MOOC Teaching and Traditional Class

Students have to login MOOC websites and watch several series of short videos which are called micro-class. Exercises, tests, homework, exams and discussion must be done online to finish the course. The leading teaching method is primarily face – to – face class. Brief differences can be seen in Table 1.

Similarities

Although there are differences between two teaching pattern in many aspects, deep-seated similarities exist as following three points.

• Two patterns share same aim at teaching quality and result. Just teaching pattern and method are changed.

• Teachers still teach, and students still study. Just teaching method and interaction are improved. The role that teacher plays is compared between MOOC teaching and traditional class in Table 2.

• Two patterns are both combination of teaching in class and study after class. Just the teaching profundity, the situation of class and studying method after class are innovated.

Table 1　Differences between MOOC teaching and traditional class.

Patterns aspect	Traditional class(offline)	MOOC teaching(online)
Teaching Resource	textbook + PPT + teaching note（blackboard writing）	online videos + online questions + online discussion + textbook + PPT
Teaching Method	PPT + blackboard writing + programing demo + classroom questioning	videos + online answering
Practicing way	experiment + assignment	online exercises + online tests（plenty of questions）
Assessing way	experiment + exam + assignment	online test + online assignment + online exam
Communicating way	communicate in the interval between classes	online discussion

Table 2　Comparison between MOOC teaching and traditional class.

Teacher's type	Teacher's role	Effect in teaching
MOOC keynote speaker	The keynote speakers in the online videos are usually who makes this MOOC course. They are also in charge of the general situation of this course	MOOC courses are used to study knowledge ahead as a guide
Teachers in traditional class	Teachers in traditional class are who give the lecture to students. They are in charge of the classes	Teachers teach and expand knowledge, analyze emphases, give tests and exercises and answer students' questions through face – to – face class
MOOC answering teacher	Students ask questions in the process of online MOOC study, which should be answered by them. They may be the teachers from other universities	They answer students' questions online

In summary, current traditional teaching and MOOC teaching each have their pros and cons. Accordingly, it is our first choice to implement SPOC, which is an interaction of OPO (Offline Plus Online).

Correctly understanding and dealing with the relation between online teaching and offline class is the key of online plus offline blending teaching pattern. Through making best use of the advantages of OPO, teaching becomes multi-dimensional, vivid and attractive. As a consequence, students' interest is inspired and their abilities to self-study and explore are developed.

4 Online Plus Offline Blending Teaching Pattern – "MOOC + SPOC + Flipped Classroom"

The online plus offline blending teaching pattern based on "MOOC + SPOC + Flipped Classroom" is the direction of the reform of college education in the future. MOOC is an online teaching pattern that completes teaching contents within the syllabus, while SPOC emphasizes diverse teaching method for distinguishing people from different colleges[8–9].

• Online (class on the website)–Students have to study MOOC courses themselves and finish all the videos, tests and discussion.

• Offline (face–to–face class)–Students have to listen to the lectures, take tests, make presentation and discuss. Based on lectures, contents of the course should be expanded. Flipped classroom is applied in offline class to strengthen students' ability to study deeply themselves.

Figure 2 shows the online plus offline blending teaching pattern, including online study and offline study. Online study has to be finished after class by watching MOOC videos, do online exercises and tests and discussing online. Students need to finish the learning mission given by teachers ahead. In the offline study, students particulate the flipped classroom with the instruction from teachers. Then students have to present their achievements and discuss with each other. Finally, teacher will answer students' questions.

Totally, online plus offline blending teaching pattern consists of three important parts–online self-study on MOOC before class, seminar study of flipped classroom in class and the summary after class.

Flipped classroom has diversified forms, basically including achievement presentation, discussion among students and assessment from teacher. These forms share one aim to strengthen students' ability to self-study as well as to teach more emphases. Communication between teachers and students is increased. Study can be more flexible and active. Flipped classroom provides more participation to students, which makes students study more practically
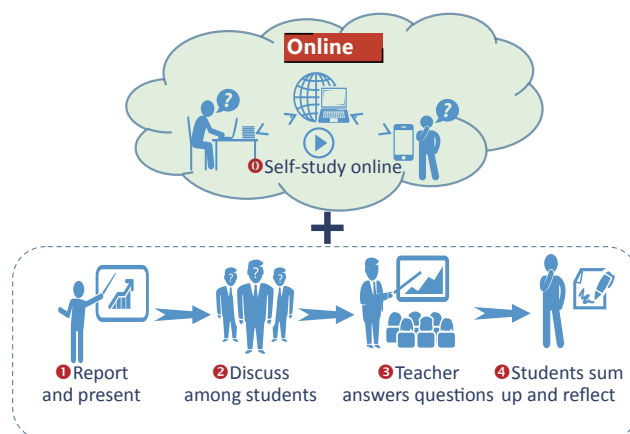

Fig. 2   Online plus offline blending teaching pattern.

through exploring themselves.

Implement strategy – progressive development in various ways. In the development of blending teaching based on SPOC, the principle of "advancing gradually and iterate repeatedly" is put into use in software engineering teaching. Experience is accumulated by partly flipped teaching in order to realize. Specifically, blending teaching can be advanced gradually by following four progressive methods: Introduce SPOC（not flipped classroom）→Partly flip small classes→→Totally flip small classes→→→Partly flip large classes→→→→Totally flip large classes. In present, the strategy is implemented in seven courses of software engineering, which is shown in Table 3.

Table 3   MOOC teaching pattern is applied in part of courses in software engineering.

Course	Type	Method
Introduction to Computer Science	Basic course	④ Partly flip large classes
College Computer	Basic course	④ Partly flip large classes
C Programming and Designing	Basic course	⑤ Totally flip large classes
Software Engineering	Core course	① Introduce SPOC（no flipped classroom）
Data Structure	Core course	④ Partly flip large classes
Principles of Computer Organization	Core course	① Introduce SPOC（no flipped classroom）
Game Engine Designing and Practicing	Optional course	③ Totally flip small classes

Based on the elicitation teaching reform, large classes are totally flipped in C Programming and

Designing (Fig. 3). Students study themselves online beyond the class. Flipped teaching is implemented by tests, assignment, discussion and presentation in class. After that, students have to sum up what they study.

Fig. 3   Activity diagram and implement thread of flipped classroom - blending teaching in C programming and designing.

There are many ways to implement the flipped classroom in Fig. 3, one of which is given. The aim is to strengthen students' ability to study, solve problems and discuss with others. The opportunity to get in touch with frontier knowledge is also offered to them. In addition, the overlap among flipped classroom, mixed study, exploring study and eliciting study will make study more flexible and motivated, which provides more participation to students.

5   Advantages and Disadvantages in Primary Assessment

In latest terms, blending teaching has been implemented variously. Students are provided more participation and offered more thorny points, important points and frontier knowledge by teachers. The reform of teaching pattern is advanced, causing considerable attention to online education. According to the communication between teachers and students, the situation of blending teaching is qualitatively assessed in Table 4.

It can be seen that individual satisfaction, individual

achievability, ability to self-study and some aspects are promoted, while study burden and difficulty are growing. Even conflicting emotions occur to some students. As a result, intensive researches should be done.
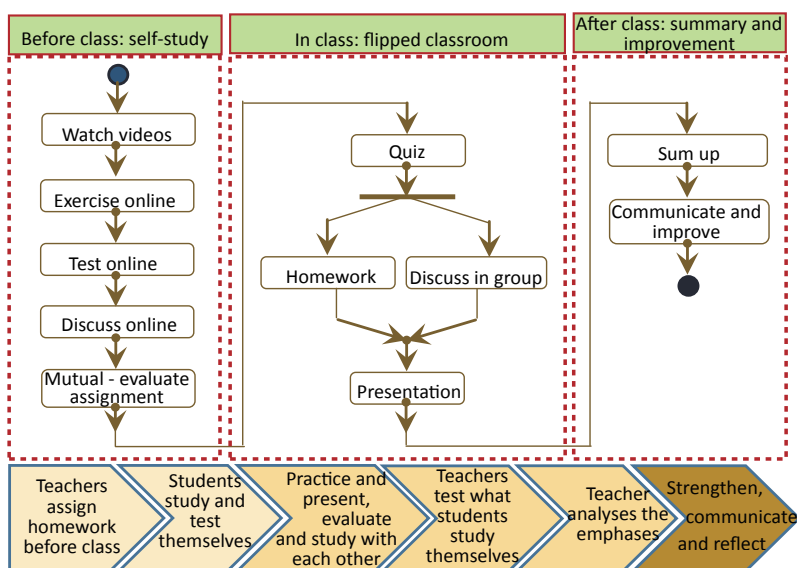
It is still in experimental stage that the teaching pattern based on "MOOC + SPOC + Flipped Classroom" is in China. A long period is needed to figure out how to implement better. We are bold in practice in software engineering to accumulate experience which is not enough. We will certainly persist in exploring an appropriate and actual teaching pattern, contributing new references for software engineering talents development.

6   Conclusion

The teaching based on "MOOC + SPOC + Flipped Classroom" is primarily discussed. A new pattern, "Internet + Teaching", is created with a stereo teaching condition rooted in modern information technology. Combining online and offline study, the blending teaching is implemented based on "MOOC + SPOC + Flipped Classroom". Students' abilities to self-study and research are strengthened, as well as innovative consciousness and creative capacity. Achievements have been made, but physical problems arise.

The time taken to implement this new teaching pattern, online plus offline blending teaching based on

Table 4   Qualitative assessment of the situation of blending teaching.

| Aspect	Result	Aspect	Result
individual satisfaction	raise	time to learn	more
individual achievability	raise	difficulty to self–study	more
confidence	raise	study burden	more
ability to self–study	raise	adaptability	difficult to easy
entertainment	raise	conflicting emotion	conflict to accept gradually
communication and interaction	raise	study effect	totally up
ability to practice	raise	Innovative awareness	raise

"MOOC + SPOC + Flipped Classroom", is too short, so that intensive practice and summary are necessary. Meanwhile, existing problems have to be solved gradually associated to the feature of the major. Various teaching perceptions, including researching, eliciting, exploring, discussing and participating teaching, should be combined into traditional class. Students' self-study and instructions from teachers can be better connected, followed by optimal overall teaching effect.

Acknowledgement

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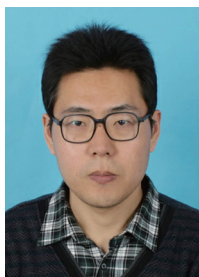
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