

Application of Flipped Classroom Based on MOOC in Bridge Engineering CAD Course

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ABSTRACT. With the development of educational informationization and Internet technology, MOOC, as an online and open sharing network course, has developed rapidly. In addition, flipped classroom, which is a new teaching method of role exchange between teachers and students, can better make up for the lack of simple MOOC, so as to promote the sustainable development of MOOC. "Bridge engineering CAD" is a comprehensive professional course integrating bridge engineering professional knowledge, engineering CAD drawing and engineering design software. It has high requirements for the width, breadth and depth of students' professional knowledge. In many years of teaching practice, the traditional teaching mode often fails to achieve the ideal teaching effect. Therefore, this paper uses modern information technology to organically combine MOOC and flipped classroom to carry out the comprehensive reform of curriculum content and curriculum system, in order to achieve the high-quality teaching results of comprehensive improvement of students' professional quality and practical ability.

KEYWORDS: MOOC, Flipped classroom, Pbl, Teaching reform, Curriculum design, Bridge engineering cad

1. Introduction

In recent years, with the rapid development of educational informationization and Internet technology, information technology has a revolutionary impact on the development of education. The "Internet + Teaching" mode of education has been widely practiced in various disciplines all over the world. Educational informationization has become the consensus of global educational reform and development. At present, the curriculum teaching mode of colleges and universities all over the world is undergoing a historical change of digitalization, networking and globalization. As a kind of online open and shared online course based on network platform, MOOC provides massive educational resources for learners, which has a profound impact on Reshaping Global Education. The teaching mode of "flipped classroom" has really subverted the traditional teaching mode, transforming the role of students from the traditional passive reception of knowledge to the process of active learning. Students fully learn the theoretical knowledge of the course before class. In the classroom, they mainly internalize and apply the knowledge in the way of communication, discussion and practice, fully mobilizing the students' autonomy and initiative. The learning mode is more flexible, vivid and diverse, realizing the combination of online and offline teaching, and the combination of theory and practice, which not only widens the width and depth of students' knowledge, but also breaks the limitation of time and space, so that students can learn more freely and independently.

2. Traditional Teaching Methods and Their Shortcomings

"Bridge engineering CAD" is a professional course set up in the direction of road and bridge for civil engineering major in Colleges and universities. It is a comprehensive professional course integrating professional knowledge of bridge engineering, engineering CAD drawing and engineering design software. It has high requirements for the width, breadth and depth of students' professional knowledge. The traditional teaching method is: teachers use PPT to explain knowledge points in class - assign homework - students complete and submit homework - teachers' correction and explanation - review after class - course assessment. In many years of teaching practice, the traditional teaching mode often fails to achieve the ideal teaching effect. It mainly has the following shortcomings:

- (1) Some students lack the habit of preview before class, do not understand the classroom knowledge in

advance, only rely on the classroom time to receive the knowledge, the efficiency is low and the effect is poor, for the difficult knowledge points can not keep up with the teacher's lecture rhythm, resulting in knowledge loopholes.

(2) Teachers will spend a lot of time in the classroom to explain the basic knowledge and basic concepts. In the limited class hours, the teaching content is thin, lack of expansion and extension of practical application, which makes the theory and practice of students disconnected, and the knowledge learned can not solve the practical engineering problems.

(3) Students' homework is plagiarized and their quality is poor. Students' study is just to deal with the examination, mostly rote memorization of knowledge points, lack of deep understanding and thinking, resulting in poor learning effect. There is a phenomenon of knowledge forgetting after the examination.

(4) The ability of combining theory with practice can not be exercised, and learning is only limited to the surface of knowledge, which can not solve the problems in practical engineering.

(5) Due to the heavy teaching tasks, limited class hours, a lot of time in the classroom for demonstration and explanation process, resulting in less time for students to operate and lack the ability to solve practical problems.

(6) The course assessment is mainly in the form of paper examination, which has certain randomness and one sidedness, and cannot accurately and comprehensively reflect the students' learning process, knowledge mastering degree, knowledge application degree and practical ability.

3. Advantages of MOOC and Flipped Classroom

3.1 The Development of MOOC and Its Advantages and Disadvantages

MOOC is a large-scale open online course, which aims at online learning for the public. MOOC is rich in resources and varied in form, including teaching videos, presentation, exercises and assessment. There are not only lecture videos, but also demonstration videos and animations of practical projects, which can effectively help students understand the knowledge points in depth. There is no limitation of time and space in MOOC class. Students can study anytime and anywhere through the network, and can review the key and difficult points repeatedly, which greatly improves the learning efficiency and learning effect of students. However, there are some limitations in the simple MOOC teaching, mainly in the following aspects:

(1) Lack of face-to-face communication. MOOC is mainly an online sharing platform, which provides a large amount of knowledge resources. However, it lacks communication and interaction between teachers and students. Only online homework can not evaluate students' knowledge mastery, and teachers can not observe and evaluate students' learning effect.

(2) Learning experience is incomplete. The massive resources are completely selected by learners, lacking systematic planning, different knowledge points may be taught by different teachers, the lecture style cannot be completely unified, it is not easy to form a knowledge system, it is also lack of practical training and application guidance, and the knowledge unit is not systematic and complete.

(3) It is difficult to evaluate the learning effect. The content of MOOC learning is completely controlled by the learners themselves, and the learning effect is difficult to evaluate due to the lack of a complete assessment system.

(4) Learning integrity is hard to guarantee. MOOC learning mainly depends on learners' consciousness. If students lack consciousness or self-discipline, it will lead to waste of resources and time, and the learning effect can not be guaranteed.

3.2 Advantages of Flipped Classroom Based on MOOC

Flipped classroom refers to readjusting the time inside and outside the classroom and transferring the decision-making power of learning from teachers to students. Before class, students learn about the teaching content in advance through video lectures, electronic materials and other MOOC resources. In class, they mainly communicate and discuss face-to-face, and work together to solve more in-depth and more challenging problems to complete the process of knowledge internalization. The classroom has become a place of interaction between teachers and students and between students, including answering questions and solving doubts, the use of knowledge, etc., so as to achieve better educational effect. Teachers can use the classroom to explain the

difficulties of the course according to the students' learning of MOOC, so as to provide more targeted guidance for students. At the same time, the project-based practical application is introduced, so as to achieve the teaching goal of putting learning into practice. The combination of flipped classroom and MOOC makes up for the shortcomings of the online course of MOOC. The organic combination of the two is conducive to the cultivation and improvement of students' innovation ability, independent thinking ability, learning ability and implementation ability.

4. The Necessity of Flipped Classroom Design Based On MOOC in Bridge Engineering CAD

At present, most colleges and universities in China still adopt the “pouring” teaching mode in which teachers are the main body and students passively receive knowledge. This kind of teaching mode ignores the students' subjective initiative and thinking creativity, pays more attention to theory than practice, which leads to the disconnection between the students' theory and practice. Many students can only take the exam but can't solve the practical engineering problems, and the practical ability and innovation ability are obviously insufficient. “Bridge engineering CAD” is a comprehensive professional course integrating bridge engineering professional knowledge, engineering CAD drawing and engineering design software. It is difficult for the students who have not experienced the actual project to understand and master the abstract professional knowledge only by the teacher's teaching, which brings some troubles to the students' learning. With the development of education informationization and Internet technology, the CAD course of bridge engineering should also comply with the requirements of the times, break the traditional education mode, make full use of the education resources of Internet big data platform, realize the integration of teaching resources and the reform of teaching mode, let students learn something, truly solve practical problems, and contribute to the construction of national infrastructure.

5. Design of Flipped Classroom Based on MOOC in The Course of Bridge Engineering CAD

5.1 Pre-Class Instructional Design

According to the training plan to determine the training objectives and develop the syllabus. According to the syllabus, the members of the research group will discuss and make a unified MOOC video as the content that students must complete before class. At the same time, introduce the pictures, videos and construction animations of practical projects related to the class content to deepen the understanding of professional knowledge. In addition, taking the excellent courses and knowledge expansion part related to the course as the elective content, so that students of different levels can choose to expand the breadth and depth of knowledge according to their own situation, which is conducive to the implementation of personalized teaching.

In order to ensure the learning effect of self-study before class, online MOOC platform needs to set up online test and evaluation feedback link, so that students can carry out online test after completing self-study, test the learning effect in the form of game breakthrough and finally form an evaluation report. This is not only beneficial for teachers to master the learning level and effect of students, but also for students to check and fill in the gaps according to the evaluation feedback results.

5.2 Design of Classroom Instruction

In the classroom, teachers mainly guide students to discuss the key and difficult points of the course, and discuss the representative problems of students in groups based on the evaluation feedback results of online MOOC test before class. Students can also show the results of inquiry tasks arranged by teachers in the form of reports, debates, competitions, etc. In this process, students can not only use the pre class MOOC learning and data collection to elaborate their personal views, but also compare and comment on the views of other students, so as to complete the knowledge internalization. In addition, teachers will introduce practical engineering cases, combine PBL project-based teaching mode, inspire students to solve practical engineering problems in the form of group discussion and brainstorming, so as to complete the process of knowledge internalization and application to practice.

5.3 Establish Diversified Comprehensive Assessment Methods

The evaluation of flipped classroom based on MOOC adopts multiple evaluation methods, which breaks the

single evaluation method of traditional paper examination, and pays attention to the combination of formative evaluation and summative evaluation, quantitative evaluation and qualitative evaluation. Formative evaluation includes two parts: Online participation and classroom participation. Among them, online participation mainly refers to the learning progress of compulsory MOOC courses and the learning of optional knowledge expansion links; classroom participation is mainly based on the evaluation given by the teachers to students' knowledge mastery, material accumulation, team cooperation, thinking dialectics, etc. during the analysis and discussion of practical engineering cases. The final evaluation includes online test and school-based course test. This kind of multi-dimensional comprehensive assessment ended the phenomenon that students memorized knowledge in order to cope with the examination, promoted students to strengthen deep thinking, completed the internalization of knowledge, and realized the application of theory and practice to solve practical engineering problems.

4. Suggestions and Reflections

The optimized combination of MOOC and flipped classroom can cultivate and improve students' innovation ability, independent thinking ability, learning ability and execution ability. In the application of bridge engineering CAD course teaching, there are several suggestions as follows:

(1) The quality of MOOC production directly affects the teaching effect. Therefore, the teacher team must constantly improve the knowledge structure, constantly update and improve various teaching materials, strengthen the learning of information technology related skills, and ensure that MOOC can meet the requirements in terms of professional knowledge, production form and characteristics.

(2) The course of bridge engineering CAD focuses on application. For students majoring in civil engineering, excellent professional quality is the ability to survive in the future. The mastery of professional quality should be guided by solving practical engineering problems. It is necessary to cultivate students' deep understanding of key and difficult points of the course, pay attention to practical engineering case analysis, and strive to improve students' ability to analyze and solve practical engineering problems.

(3) Online MOOC learning is the foundation of offline flipped classroom. If the MOOC link of self-study before class is not effectively guaranteed, it will lead to online and offline disconnection, and the flipped classroom without MOOC will be nothing. Therefore, it is necessary to strengthen the online assessment and evaluation feedback of MOOC to ensure the learning effect of basic theoretical knowledge in MOOC.

(4) In view of the importance of engineering practice, whether on-line MOOC platform or group discussion in flipped classroom, increase the proportion of actual engineering case teaching. In addition, when online and offline assessment, focus on the assessment of the analysis ability of actual engineering cases and the practical application ability of students.

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