

# Exploration and Practice of SPOC Mixed Teaching Mode in Data Structure Course

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**Abstract.** This research constructed the SPOC teaching mode which is suitable for the teaching of colleges and universities in China, and filled up the blank about the research of SPOC model. At the same time, this research innovated the teaching mode of colleges and universities, it made students self-study high-quality MOOC resources before class, changed from "inculcating" to "self-help" in class, and encouraged students to cooperate in inquiry-based learning in extracurricular time. Compared with the current single teaching mode, SPOC teaching is helpful to cultivate autonomous learning ability and innovative ability. This study used MOOC resources of Shandong Technology and Business University, promoted inter-school cooperation, played a positive role in the promotion of MOOC in China, and made MOOC become an organic part of higher education.

## 1. Introduction

Contemporary college students grow up in the environment of digital technology. The use of digital technology has become their life style and basic accomplishment. It not only enriched and expanded the form and meaning of learning, but also shaped the learning ideas and ways of learners in this era. The traditional teaching classroom in colleges and universities is tedious and tedious, the teaching method of lecture has many disadvantages, and that more students dissatisfied with college classroom teaching has become a difficult problem faced by colleges and universities. Colleges and universities have the responsibility to adopt more effective curriculum reform measures and innovative educational methods to change this situation. School education should adjust teaching to adapt to the characteristics of learning in this era and cultivate a new generation of learners with innovative spirit and problem-solving ability.

< outline of National medium-and long-term Educational Reform and Development Plan (2010-2020) >put out that we should develop e-learning courses, innovate network-based teaching models, renew teaching concepts, improve teaching methods, and improve teaching results [1]. It can be seen that promoting the construction and application of network curriculum has become an important part of curriculum construction in colleges and universities, and it can enrich students learning experience. The innovative teaching mode of improving teaching effect will become an important direction of curriculum reform in the next few years.

Since entering the information society, the development of the Internet has exerted more and more influence on the field of education. With the development of science and technology, the field of education has changed from the opening and sharing of educational resources at the beginning to the attempt to diversify online mode, the development of online education has entered a relatively mature stage. MOOC, which appeared in 2008, experienced four years of precipitation, followed by explosive growth in 2012 [2]. In contrast to other online education, MOOC applies the advantage of a complete learning experience to network education with the effect of well-known schools and famous teachers. The rise of MOOC can give more people access to world-class university teaching resources. It has created a new model to promote educational equity, greatly reduced the cost of educational resources dissemination, and caused widespread concern in the educational technology community.

In the face of the MOOC attack, China actively launched the response action. Higher education institutions actively participate in the MOOC movement, build localized MOOC platform, and create a number of high-quality MOOC courses.

Small private online course (SPOC) is a combination of traditional teaching and MOOC, leveraging the strengths of face-to-face and online learning. MOOC resources are applied to the teaching solutions of small-scale fixed learners [3]. The reduced size of SPOCs allows teachers to intervene in the learning process, correct assignments, and communicate with teachers and students, and the program is aimed at a small number of learners. The rapid development of MOOC in China makes it possible for SPOC to become an innovative teaching mode to promote curriculum reform.

Data structure is an important basic course for computer majors, which played an important role in the whole curriculum system. At the same time, it is widely regarded by students as a difficult course to master. The author made a survey on the teaching of data structure course in Shandong Technology and Business University before the beginning of the study. Through the interview with the students, we know that there are some problems in the current data structure curriculum: all the time in the class is used to transfer knowledge, and the teaching activity is single; lack of practice and learning; lack of knowledge internalization; passive indoctrination; lack of independent exploration; failure to keep pace with teaching progress; poor use of after-class time; insufficient school hours; lack of effective feedback, etc. There are many reasons for this phenomenon. Besides the drawing and difficulty of the data structure, it is also an important reason that the traditional teaching method is not suitable for the characteristics of the subject.

It means that the traditional teaching model of data structure in classroom can not guide and monitor the students' study and practice in time, the students' problems can not be dealt with in time. If we only rely on the traditional classroom teaching, it is very difficult to achieve the multi-dimensional goal of imparting knowledge, training ability and improving the quality in the present study [4]. The traditional classroom teaching mode needs to be adjusted urgently.

Zhihuishu is one of the largest Chinese MOOC platform in China. It is free and open to learners and provides SPOC services to colleges and universities. Its curriculum structure design and content release are concise and easy to use, the teaching activities are in line with the teaching habits of Chinese teachers and the learning habits of Chinese students, and are suitable as a support platform for SPOC practice [5]. Professor Tang of Shandong Technology and Business University offered a 16-week "data structure" MOOC course on the platform. Ms. Tang's MOOC course is well-produced and rich in content types, including videos, documents, quizzes, rich texts and discussions, and is suitable for this applied research as an online learning resource for students.

## **2. The Application of SPOC Teaching Mode in "Data Structure" Classroom Teaching**

Before the teaching practice was carried out, Shandong Technology and Business University cooperated with the online teaching support department of Zhihuishu to register and construct the SPOC class of data structure class in Zhihuishu platform. The Zhihuishu provided SPOC platform address for teachers and students of Shandong Technology and Business University, and provided personalized SPOC environment and service for this application research. On-line data structure MOOC course lecturer is Ms. Tang Huan-ling of Shandong Technology and Business University. On-line teaching and classroom face-to-face learning were combined to complete SPOC teaching. Each teaching week is a unit, corresponding to a lecture in the MOOC platform, the online and offline learning progress is basically consistent.

Before launching SPOC teaching, teachers organize students to register on-line by class, and adopt the format of "sdtbu+school number" as the account number. Then, under the guidance of teachers, the students constructed the learning community of SPOC class, established the common learning goal of the class, the teacher infected the state of the class members with positive emotion, and made all the students of the class have the best learning state. It can promote individual development in different degrees, and finally made students grow from common cognition to common growth by imparting correct and effective learning methods and accomplishing cooperative learning between teachers and students. After the preparatory work was completed, we carried out the SPOC teaching

in the data structure classroom. According to the SPOC teaching mode, each teaching module was divided into three stages: the first stage was self-study based on MOOC, which mainly completed the task of online preparatory learning; The second stage was active learning classroom, which enable students to realize the internalization of knowledge mainly through the classroom activities; the third stage was the spiral consolidation after class, which completed the task to improve the ability through the exercise and cooperation.

## **2.1 Application of pre-class online self-study model**

### *2.1.1. Issuance of self-study task sheets*

According to the SPOC model, the teacher designs a self-study task list for this week according to the teaching contents and teaching objectives before class, which is distributed to the students in the form of electronic QQ group and paper version, for the reference of the students in the MOOC self-study stage. Content includes: the learning content of this week, learning resources, learning tasks, MOOC learning self-monitoring, pre-class exercises and learning records.

### *2.1.2. get students feedback*

Before the class, the problems and difficulties encountered in the learning process are fed back to the teacher by online investigation, QQ and so on, after the students completed the self-study task. The teacher determines the overall and individual learning situation of the students according to the student feedback and adjusts the teaching plan in time.

### *2.1.3. monitor the learning progress in time*

In the autonomous learning stage, the teacher monitors the learning behavior of the students in the SPOC class through the background data of the platform. The students' learning behavior included: course interview record, course interview number, video viewing record, textbook browsing record, post and reply record and so on. The time of students' course visit is mainly between 20: 00 and 23: 00 in the evening, teachers can give centralized online tutoring to the students in the evening, and the teachers need to supervise the students who are lagging behind in the online learning process. For students with high online learning activity or fast task completion, the teacher can arrange them to assist other students in their study. In response to the discussions, the percentage of speakers has remained at 0. 00%, indicating that the students do not agree with the MOOC discussion and communication module, the reasons behind this phenomenon need to be further investigated.

## **2.2 Application of in-class active learning model**

As the subject of learning, the students can express themselves and ask questions independently, and teach exercises in groups; teachers, as the leading part of the class, control the teaching process and learning activities, assist and listen to the students' learning situation. However, students' enthusiasm for learning is not high, the foundation is poor, and the lack of entry affects the enthusiasm of learning. It will enhance self-confidence and enthusiasm to acquire a sense of learning achievement in time. Overall, classroom teaching is basically successful, students can cooperate with teachers to complete teaching tasks, compared with last week, the progress is obvious.

## **2.3 Application of spiral lifting mode after class**

After the stage of self-study before class and the stage of formal study in class, students already have a certain degree of understanding of knowledge, and have a deeper understanding of the application of knowledge in combination with classroom practice and group cooperation. After the exercises of initial contact and simple algorithm, it can be said that the students have already formed a cognition of the content of this class, and they need to consolidate and improve their knowledge in the after-class stage.

### *2.3.1. consolidate and improve in repeated reinforcement*

The teacher arranges the after-class ability enhancement task for the students: students' autonomous exercises and group cooperation to complete the program exercises published on the student platform side.

Students are asked to do: 1, record the first use time of each problem; 2, record how many times; 3, record the fastest use time. It will achieve mastery of the continuous proficiency in the process of

repeated reinforcement of each problem; through the duration of the record, students can also be more intuitive monitoring of themselves.

### 2.3.2. Spiral lifting in a step-by-step process

With the development of students' cognition, teachers assign students the task of deepening the difficulty gradually, and guide students to reflect on, summarize, promote, expand the knowledge structure, and realize the spiral promotion.

## 3. Summary

This study has carried on the construction of the SPOC teaching mode in the university classroom based on the combination of the emerging MOOC resources and the teaching reform of the university, and the on-line learning and the subject teaching are integrated deeply, which is an exploration of the educational technology to promote the reform of the university. The author tried to make use of the advantages of MOOC learning and traditional teaching to improve the disadvantages of teaching in colleges and universities, strived to improve the teaching effect, and provided SPOC model design and first-hand experience sharing, in order to play a reference role in introducing MOOC resources into the classroom of colleges and universities.

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