The Reform of Data Structure Course of MOOC + SPOC Diversified Practice Method

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Abstract. In view of the existing phenomenon in the teaching of data structure in higher vocational colleges, this paper introduces the mixed teaching mode based on MOOC + SPOC. MOOC is an online network classroom, and SPOC method has achieved online MOOC support, which is the effective supplement of offline teachers. This paper expounds the nature and tasks of data structure course, applies this method for practical teaching, explores the effective role of diversified MOOC + SPOC methods in the course, and promotes the improvement of teaching quality effectively.

Keywords: MOOC · SPOC · Data Structure · Teaching mode

1 Introduction

Data Structure is a basic course of computer, which is an important theoretical and technical basis for subsequent courses such as Database and Operating System. Data Structure mainly aims at the implementation of non-numerical calculation, involving the representation, organization and processing of data in the computer during the non-numerical calculation. Due to the course status, the basis of data structure course affects students' learning many subsequent content during development and learning, both for further learning other courses in computer field, competition and practices, or in the future work and study to the student. Therefore, how to improve the teaching and learning quality of "Data Structure" course effectively is an important subject that needs our in-depth research, and it is also a difficult challenge that we have been facing all the time.

The rest of the paper is organized as the following: The teaching situation is discussed in the following section. The related work is discussed in Sect. 3. The proposed teaching model and method is presented in Sect. 4. The construction of Data Structure course under MOOC + SPOC mode is introduced in Sect. 5. Finally, the paper is concluded in Sect. 6.

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2 Teaching Situation

At present, there are some problems in the teaching process of Data Structure course in higher vocational colleges:

(1) Lackage of theoretical knowledge of advanced courses

C language program "is one of the main leading course of Data Structure. Due to vocational students' weak foundation of C language knowledge, most of the students feel theoretical knowledge can understand, but they don't know where to start to realize the algorithm, and find it difficult to grasp, so they lose their interest in learning and confidence, to affect the teaching process directly.'

(2) Little teaching hours

Data Structure is rich in knowledge points and contents, but the current class hour is difficult to support the development of some new teaching models. The teaching method in higher vocational colleges is mainly "theory + experiment", which is mainly taught by classroom, and students complete experimental courses. How to let the students participate in the teaching, it is particularly important to arrange the reasonable use of different teaching modes [1].

In view of the above question in the teaching process, the new teaching methods have become an essential topic. "MOOC + SPOC" teaching mode is a good way to solve the current problem, combining information with traditional mode, so that the teaching mode becomes more perfect. This paper conducts preliminary design and research on the construction of Data Structure under the current new teaching mode "MOOC + SPOC".

3 Literature Review

In the teaching of Data Structure, many domestic scholars are exploring new teaching methods constantly. In this section, we review some of the previous works on Data Structure teaching. In view of the importance of data structure, many teaching methods have been proposed in the course of teaching. Starting from the teaching practice, aiming at the problems in the teaching of "data structure" course, Qiu Jin et al. proposed the teaching reform and practice research program of "Data Structure" course, which includes "reasonable organization of teaching content, reform of traditional teaching mode, optimization of teaching means, strengthening of engineering practice and establishment of scientific evaluation mechanism" [2]. Based on the analysis of the teaching mode, Li proposed a teaching mode with the problem driven as the core [3]. Yang et al. applied the combination of micro class and flipped class to the teaching process of "Data Structure" course, which brought new ideas to the classroom teaching [4]. Wu et al. discussed the application prospect of flipped classroom in the course based on the analysis of the current teaching situation of "Data Structure" under the current teaching mode. Taking the teaching content of "minimum spanning tree" as an example, they studied the feasibility of flipped classroom teaching [5]. Zhao proposed to introduce flipped classroom teaching experiment mode on the basis of cloud

computing teaching platform, and designed the experimental teaching process. Practice shows that this method plays a role in promoting "teaching" and "learning" [6]. From the analysis situation and flip the concept of classroom teaching, Xiao Jingliu et al. explored how to turn effective classroom teaching mode in the classroom teaching in colleges and universities, and put forward the concrete implementation plan, finally proposed to solve the key problems in the implementation plan application analyzed [7]. Zhang yan used the WeChat public platform to assist the teaching and research of university data structure [8]. Zhang Shaowu et al. made a study of "data structure" teaching mode, studied the theory and teaching practice based on the desire platform flip of the classroom teaching, made every effort to make students learn by course, to be able to understand the logic of the master data structure, storage structure and algorithm design and analysis of the basic ideas, thus laid the foundation for study and research in the field of all kinds of computing [9].

4 SPOC + MOOC Teaching Mode

(1) MOOC

MOOC (Massive Of Open Course) is a significant reform of teaching through open online classroom. MOOC is free, self-directed learning that allows students to choose courses they are interested in. MOOC courses are rich in resources. But with the development of MOOC, some of their disadvantages have been highlighted. Firstly, MOOC learning emphasizes "autonomy", while it is difficult for students to stick to it until the end without supervision. Secondly, although resources in MOOC are classified, they are not systematic and can only be used to select courses based on personal interests. It cannot meet the university's talent training program. While MOOC are online teaching methods, the number of students from all over the world is so large that it is difficult to answer questions in real time.

(2) SPOC

SPOC (small private online course) is a small-scale limited flipped classroom method, which also uses network resources to take video resources in MOOC as auxiliary teaching content, and combines with actual classroom teaching method. First of all, teachers cut the existing MOOC video according to the requirements of the syllabus, and students learned online in advance. Then, they discussed the course content in class, arranged corresponding practice links according to the learning content, and finally assessed students according to the examination results and the usual experimental results. SPOC method enables students to solve problems in class through online learning. Teachers' understanding of students' understanding of MOOC through classroom teaching can effectively supplement and supervise students' learning status. Teachers in the evaluation of results, can be assessed through multiple aspects of students, the results of the authenticity, objectivity of the better effect. SPOC flipped classroom not only inherits the advantages of MOOC, but also makes up for the shortcomings of traditional education. It fully integrates the Internet and traditional classroom to help students complete the learning content faster.

5 Construction of Data Structure Course Under MOOC + SPOC Mode

"Data Structure" is a computer professional foundation course. Taking information engineering department of Wuhu Institute of Technology as an example, the course of the period is 64 class hours, four classes per weeks and 16-week course. The course of the training goal is to pass this course teaching, make students understand each data structure in the field of computer science knowledge, and the relevant application software to use various data structure knowledge, understand the commonly used data structure and the internal logic relationship, knowledge of computer software in the design of algorithm, familiar with the software design and programming skills, to create a preliminary comparison of different storage structure and corresponding algorithm, Have certain algorithm improvement ability, and lay a foundation for students to engage in software development and programmers in the future. At the same time, it is the theoretical basis of compiler, operating system, database system courses, but also for students to follow the successful study of courses to provide conditions. This course takes the "Data Structure" of Wuhu Institute of Technology under the MOOC platform of Anhui e-learning MOOC as the MOOC resource, takes the MOOC resource as the explanation of basic knowledge, and gives priority to teachers' guidance and comprehensive practice in class.

SPOC + MOOC mode is an online and offline teaching mode, which can be divided into "online independent learning", "online collaborative learning", "offline classroom learning", "offline practical experiment learning" and other parts. In addition, SPOC platform of course teaching should analyze the course learning needs and practical needs, make clear the professional requirements and skills, and summarize the whole teaching content and the required knowledge.

The specific steps are as follows:

Firstly, teachers download curriculum resources on MOOC platform, tailor video content appropriately according to syllabus requirements and training plan, and arrange MOOC resources as shown in Table 1. The teacher recorded 5 to 15 min of micro-lessons. Publish MOOC resources and knowledge outline to QQ group. Students study carefully after class. Teachers publish learning task content every week. Students are required to submit learning notes before class, record learning content outline and questions about videos, and take notes as homework, and give results according to the completion situation. Students can communicate and discuss online in QQ group, and teachers can answer questions online to achieve better learning effect.

Secondly, Online collaborative learning. Discussion area is very important in the course teaching. After watching the online teaching video, students will discuss their problems with their classmates through the discussion area function of the online course platform. Building a discussion community, students and teaching assistants and teachers help to answer questions. Meanwhile, the online collaboration section provides a space for students to exchange information and share resources, so they won't feel lonely in study. In the discussion area, a special person should be set up to answer questions. There should be not only a group among students, but also a special person to answer questions, so as to help students solve problems in the first time and move

Table 1. MOOC course content schedule

Course	Data Structure		Number	41units
	Num.	Chapter	Time	
	1	Introduce	5’	
	2	What is data structure	5’	
	3	The logical structure of the data	10’	
	4	Description of algorithm	20’ (2 sections)	
	5	The basic concept of Linear table	10’	
	6	Sequential storage structure and algorithm of Linear table	30’(3 sections)	
	7	The chain storage structure of Linear table and its operation	30’ (3 sections)	
	8	Examples of Linear table	16’ (2 sections)	
	9	Stack	50’(5 sections)	
	10	Queue	50’(5 sections)	
	11	The basic concept of String	10’	
	12	The storage structure of String	20’(2 sections)	
	13	The basic operation of String	20’(2 sections)	
	14	Examples of applications	15’(3 sections)	
	15	Array	15’(3 sections)	
	16	The basic concept of Tree	5’	
	17	Binary tree	20’(2 sections)	
	18	The storage structure of Binary tree	25’(3 sections)	
	19	The traversal of Binary tree	15’(3 sections)	
	20	Binary sort tree	40’(4 sections)	
	21	Conversion between tree, forest, and binary tree	25’(3 sections)	
	22	Huffman tree	20’(2 sections)	
	23	Basic terms of Graph	5’	
	24	The storage structure of Graph	20’(2 sections)	
	25	The traversal of Graph	20’(2 sections)	
	26	Minimum spanning tree	30’ (3 sections)	
	27	Shortest Path	10’ (2 sections)	
	28	Topological sorting	30’ (3 sections)	
	29	critical path method	10’	
	30	The basic concept of Search	15’	
	31	Sequential Search	10’	
	32	Binary search	10’	
	33	block search	10’	
	34	Hash table	10’	
	35	The basic concept of Sort	8’	
	36	Insertion sort	20’(2 sections)	
	37	Selection sort	10’	
	38	Exchange sort	20’(2 sections)	
	39	Merge sort	20’(2 sections)	
	40	Radix sort	10’	
	41	Comparison of sorting methods	10’	

forward smoothly. At the same time, questions related to the unit should also be set, so that students can participate in thinking and discussion and share information with each other.

Thirdly, guiding in class. "Data Structure" theory is strong, so how to do a good job in the classroom guidance, has become important particularly. In this study, MOOC and SPOC methods were used for classroom teaching of Data Structure. In the course teaching guidance, the teaching time and content are arranged as shown in Table 1. Due to the limited curriculum resources of MOOCS and the different levels of students, teachers should use MOOCS to supplement effectively and revise the teaching content. Through the teaching reform in this way, students pay more attention in class and improve their interest in this course. Through combining of MOOC and SPOC mode, students' analytical ability in the practice of Data Structure is cultivated.

Fourth, experimental arrangement. In order to enable students to better master the knowledge of "data structure", the corresponding experimental teaching contents are arranged, and the corresponding knowledge points are verified and enriched through experiments. According to the teaching objectives and requirements of "data structure" of the college, 16 experimental contents are arranged in this course to verify the key teaching knowledge in each stage. Meanwhile, the sequential experiment also carries on the review of previous experimental knowledge. In the experimental process, MOOC-related knowledge is interspersed to carry out effective experimental process. Through practice, our students' interest in experiment has been greatly improved, and students' independent learning ability and problem-solving ability have been cultivated.

Fifth, Comprehensive training. Experimental and practical training is the training stage of comprehensive ability of "Data Structure" course teaching and the integration stage of comprehensive practical ability of important knowledge points. Teachers should set practical training questions according to the characteristics of the courses. Practical training questions should contain important knowledge points in the "Data Structure" as far as possible. MOOC should be introduced to deepen students' grasp and understanding of knowledge points in practical training questions. At the end of the semester, the data structure will arrange the course design. Through this way of practical training, students have mastered the knowledge, completed the "Data Structure" teaching objectives and teaching objectives.

Sixth, performance evaluation. In the process of teaching and experimental training, MOOC and classroom teaching mode are adopted. The final score cannot be determined by one examination paper and students' usual scores. Based on the actual situation of our school, the independent study of MOOC students and the students' performance in SPOC teaching. The student performance evaluation of our school is effectively divided. In the process of score division, the weight of MOOC and SPOC will be added to effectively decompose the weight of the final examination paper. Through this way of reform to change the original test results, it can increase the students' learning initiative and improve the students' interest and ability of independent learning.

6 Conclusion

The MOOC mode allows students to learn the basic knowledge before class, and the teacher gives the initiative to the students in class. In this way, the MOOC content can be effectively reviewed, and the remaining time can be used for practical application and reasonable experiments, so as to achieve the goal of cultivating application-oriented talents. The diversified practical methods of MOOC + SPOC were applied in the course of data structure, which improved the practical ability of students and provided great help to the learning of subsequent courses.

The construction and implementation of Data Structure class teaching under MOOC + SPOC mode is a more effective reform in the information age. its establishment and the actual classroom mutual fusion, not only to release the classroom teaching of classroom space, but also to broaden the students' autonomous learning. So that it can greatly promote students' learning ability, improve the efficiency of the students' learning, let the students can put this to use. And the knowledge can better applied to the practice, at the same time it also lets teachers liberation the durance of pattern, realizes self teaching thoughts fly. It can use modern technology to optimize their teaching level and classroom teaching quality.

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