Discussion on the Reform of the Course "Data Structure" of Higher Vocational Education Based on MOOC Background

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Abstract. Higher vocational education in China has nurtured a number of talents with certain qualifications and skills and made its own contribution to the society. MOOC is a product of the era of new technologies such as wireless networks, smart phones, adaptive technologies, cloud computing, and WeChat that are widely used in education. MOOC is a short video produced by teachers, its content is concise and its knowledge integration is strong, it can help students to find the key points of learning quickly. Students can learn online through the internet, and the process is completely free and learning freedom, without the limitations of time and space. In the background of Internet + vocational education, MOOC will bring huge influence and challenges to higher vocational education. The student and educational purpose of higher vocational colleges are different from those of undergraduate courses. A large part of the existing prestigious MOOC courses is not suitable for the learning needs of higher vocational students. Therefore, it is of great importance both in theory and practice to combine MOOC with traditional teaching and develop suitable subjects.

Keywords: Internet + vocational education · MOOC · Influence · Challenges

1 Introduction

MOOC is the short term of Massive Online Open Courses. 'Massive' describes the number of students; 'Open' means everyone can get free access to the online learning platform after a quick registration with an email account; 'online' means the whole learning process is conducted online, not like the traditional school education which study should be limited with certain time and place; 'course' is been defined as 10–15 min micro-course. The learning process of each step consists of a number of micro clips. Most online courses have their own period ranging from 1–3 months.

In January 1986, the pioneer of online teaching, professor of School of Communication of Simon Fraser University Dr. Linda Harasim unveiled the first online course the application of women and computer in education. Ten years later, University of British Columbia in Canada has provided the first group of online courses based on World Wide Web. 22 years later, massive online courses began to emerge. From 2012, Stanford University set up Udacity and Coursera, MIT co-founded edX with Harvard

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University. MOOC, a brand new internet teaching mode has gained popularity around the world and triggered the new reform of online education.

In April 2013, Hong Kong University of Science and Technology offered The Science, Technology and Society of China, the first MOOC course in Asia on Coursera. Subsequently, Chinese universities such as Peking University, Tshinghua University and Shanghai Jiao Tong University established their own MOOC platforms. A bunch of Internet companies also developed similar platforms such as xuetangx, chinesemooc, icourse163, zhihuishu and topu.

2 Advantages of MOOC

2.1 Students

Student is the main accepter and plays a major part in course evaluation. There are two advantages of online courses for students.

1. The flexibility of time and place.
In traditional classroom teaching, students with poor comprehension ability can't fully grasp the knowledge within the limited class time, teacher fails to meet all demand of students. In contrary, online teaching allows a student to download the video and watch repeatedly when he encounters a difficult point. This helps students to better understand the knowledge and improve the study.

2. Breaking the area boundary and realizing the goal of sharing resources.
Currently, the regional disparities of teaching resources and faculties and the traditional teaching concept still exist, however, with plenty of resources and large quantity of courses, online learning allows students to choose courses at their own will, besides, all resources and information are fully open and can be broadcasted through the internet and without limitation of place, time and the number of students, so students can acquire more and better materials.

2.2 Teachers

TO students, teachers are intellectual development and personality shaping. Online courses serve as a medium to highlight the role of teachers in the following ways:

1. Setting up multi-dimensional educational concept and enhancing informational quality and teaching techniques
MOOC are often displayed on professional online websites. With the growing expansion of the websites, there are new requirements to the teaching concepts in accordance to the high quality of courses. When designing and developing MOOC on mature platforms, teachers should uphold a panoramic and systematic view and combine with multi-dimensional educational concepts such as synergetic development and cognitive recognition. Simultaneously, teachers should combine relevant teaching strategies and concepts such as sharing, cooperation and interaction with the courses and build study groups in order to let students learning from each other.

MOOC era requires teachers to be skillful developers, with the mastery of IT, a thorough analysis and exploitation of online resources, more multi-dimensional view

and a more comprehensive knowledge system to better educate students. Teaching skills, a reflection of professional ability of teachers, include the integration of teaching materials, the innovation of teaching methodology and the combination of MOOC with traditional courses.

2. The transformation of teacher's role
MOOC not only becomes an important way for students to acquire educational recourses, but also set a higher standard for teachers in terms of education concept and methodology. It requires teachers reset themselves with a digital and internet oriented perspective and transform their roles. First, MOOC shifts teacher role from the only source of knowledge to serve students with cooperation of internet. Its authority in the teaching process is diminishing. Second, MOOC transform teacher role from knowledge provider to organizer of knowledge source; from lecturers and broadcaster to usher and question-solver. One advantage of MOOC is that teachers not only set suitable goal for students but also make tailored plans for individuals to help students acquire knowledge systematically. In short, there has been a dramatic change in teachers' qualifications and role recognition.

3 The Application of MOOC in Data Structure

3.1 Data Structure

Data Structure is a fundamental core course in computer-related majors and also an elementary one in some other majors. The goal of the course is enable students to grasp the knowledge of logic structure, storage structure, calculation, time analysis, spatial analysis, program and algorithm design. Through the study of the course, students can improve their abilities of innovation, comprehensive analysis and problem solving and also facilitate their job promise and improve their competitiveness. The traditional course is teacher-centered and fails to stimulate students' interest. As a result, the performance of students isn't satisfied. MOOC provides students with an alternative and can help them better grasp the course.

3.2 Content Fragmentation

In the traditional 45-min class, teachers usually spend 30 min analyzing abstract and difficult points, whereas the most effective attentive period for a human being lasts 6–10 min. Then the focus level will shrink with the result of the downfall of receiving information. The fragmented knowledge can be better absorbed and one of the most important content of designing MOOC is to transform the general knowledge to fragmented one. The traditional 45-min class period will be divided into several 10-min video clips so students could choose the clips according to their different goals. Besides, students could watch the clips at their convenience and in their most attentive time (Table 1).

Table 1. The concrete content

Course Title	Data structure and algorithm			Number of lectures	43 units
Expected total class hours	70 videos		Estimated total time	720 min	
Each lecture	Number	Title	Time	Key word	Note
	1	Course Introduction	5 min		
	2	What is a data structure?	5 min		
	3	Logical structure of data	10 min		
	4	Description of the algorithm	2 sections 20 min in total	Time and space efficiency	
	5	Basic concept of linear tables	10 min		
	6	Linear storage structure and its algorithm	3 sections 30 min in total	Insert, delete	
	7	Chain storage structure of linear table and its operation	3 sections 30 min in total	Insert, delete	
	8	Linear table application example	2 sections 20 min in total		
	9	Stack	3 sections 30 min in total	Push, pop	
	10	Queue	3 sections 30 min in total	Push, pop	
	11	Stack and queue application examples	2 sections 20 min in total		
	12	Basic concept of string	10 min	String	
	13	String storage structure	2 sections 20 min in total		
	14	Basic operation of the string	2 sections 20 min in total		
	15	String application example	2 sections 20 min in total		
	16	Array	3 sections 15 min in total		
	17	Basic concept of the tree	5 min		
	18	Binary tree	2 sections 20 min in total		
	19	Binary tree storage structure	2 sections 20 min in total		
	20	Traversal of binary tree	2 sections 20 min in total	Preorder, medium order	
	21	Clue binary tree	2 sections 20 min in total	Clue	
	22	Binary sort tree and balanced binary tree	2 sections 20 min in total		
	23	Conversion between tree, forest and binary tree	2 sections 20 min in total		
	24	Huffman Tree	2 sections 20 min in total		
	25	B tree	10 min		
	26	Basic terminology	5 min	Degree	
	27	Map storage structure	2 sections 20 min in total		

(*continued*)

Table 1. (*continued*)

Course Title	Data structure and algorithm			Number of lectures	43 units
	28	Traversal of graphs	2 sections 20 min in total	Depth, Breadth	
	29	Minimum spanning tree	2 sections 20 min in total	Prim algorithm	
	30	Shortest path	2 sections 20 min in total		
	31	Topological sorting	2 sections 20 min in total	Topology	
	32	Critical Path	10 min		
	33	Basic concept of finding	15 min		
	34	Sequential search	10 min		
	35	Dichotomy search	10 min		
	36	Block search	10 min		
	37	Hash table and its lookup	10 min		
	38	Basic concept of sorting	10 min		
	39	Insert sort	2 sections 20 min in total		
	40	Select sort	10 min		
	41	Exchange sort	2 sections 20 min in total		
	42	Merge sort	2 sections 20 min in total		
	43	Cardinality sort	10 min		
	44	Comparison of several sorting methods	10 min	Time complexity	

3.3 The Interaction of Teaching and Learning

Traditionally, teacher interacts with students through asking questions. In MOOC class, questions can be used in the video and quizzes can be arranged at the interval of video clips. Like the traditional way, asking questions can raise students' attention. In traditional class, when teacher raise a question, the lazy students tend to wait for peers to answer it without thinking about the question. However, each student must give answer to the inserted question before moving on to the next clip. When a clip finishes, student take the quiz and the system will automatically grade it. Students who don't get full scores will be required to watch the video again till they answer all questions correctly. The traditional classroom quiz will delay the study process and don't get a full feedback of students' performance. MOOC is better than the traditional one in interaction with teaching and learning. In addition to teacher-student interaction, the interactions between students are diversified. Students can share their homework and discuss with each other. They can also grade others' work. These enhance their learning motive and shape their attitude toward study.

4 Conclusion

With the introduction of MOOC, teachers should transform educational concept, upgrade relevant knowledge and improve informational skills.

MOOC is an inevitable outcome of web technology and a brand-new teaching mode. MOOC gradually makes universities more accessible and brings new opportunities to higher vocational education. The traditional functions of universities will change dramatically. MOOC will enhance the sharing of fine educational resources and equality. Education will exceed its original range to become an important carrier of national culture and soft power. Undoubtedly, the rising of MOOC will have a profound impact on the educational concept and teaching methodology to higher vocational education.

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