An Empirical Study on the Optimization of MOOCs in Universities Based on Distributed Cognition

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Abstract

MOOC is an important supplement to the teaching of universities, but there are still some defects in teaching resources and student participation. From the theoretical perspective of distributed cognition and Marxism's educational concept, this paper, on the basis of a large-scale questionnaire survey, proposes that the positioning of MOOCs in college teaching should be clarified, multiple interactive methods should be designed from a cognitive perspective, and suggestions on the construction of MOOCs which are based on specialties.

Keywords: *Distribute Cognition, MOOC, Marxism Educational Philosophy*

1 INTRODUCTION

MOOC started in China in 2013. Due to its advantages of breadth, autonomy and convenience, it has become a common learning system, and has formed a variety of related forms such as flipped classroom and micro-class, which has played a role in the socialization of knowledge. It plays an irreplaceable role and is an important means to promote education fairness and balance of educational resources in the whole society. However, over the past ten years, MOOCs in universities still have problems such as different levels of teaching resources and weak learning atmosphere, and universities rarely incorporate MOOC learning into the credit system. In this regard, this paper intends to carry out empirical research and countermeasure analysis from the perspective of cognitive objects.

2 RESEARCH PROGRESS

Overall, MOOCs have triggered a lot of exploration in the academic world. As of June 2022, the number of documents with titles as search paths and MOOCs as search terms has reached 10,560 in CNKI. The research approaches are mainly from three aspects.

The first is the research on the nature and characteristics of the MOOC itself. The fundamental characteristics of MOOCs are openness, participation and dispersion. In a brand-new educational ecological environment, MOOCs bring new ideas to educational

methods [1]. The essence of MOOC is online education, and its core is the four elements of large-scale, open, online, and curriculum [6].

However, the criticism of MOOCs is also sharp. Some studies believe that the essence of MOOCs is receptive learning rather than inquiry learning, and that MOOCs can only be a supplement to classroom teaching rather than the mainstream [14]. The action logic behind the MOOC trend includes the promotion of commercial capital, the establishment of cultural soft hegemony, the urgent needs of domestic higher education reform, and the needs of the online teaching market, etc. But in the final analysis, technical tools cannot bring about the true nature of higher education. The lack of growth point of local education mechanism makes it difficult to respond to the challenges of globalization [9]. A recent study suggests that the development of MOOCs has encountered three major bottlenecks: the unbalanced development of MOOCs has widened the inter-regional digital divide, which is contrary to the concept of educational equity in the new era; the gap between learning motivation and ability makes MOOCs complete. The shortcomings of low and high dropout rate; the lack of knowledge fragmentation and over-standardization in MOOCs cannot provide differentiated services for different types of learners [15].

Facing the dilemma of MOOCs, some scholars believe that MOOCs should develop in the direction of improving and promoting credit courses in the future [7]. Some scholars also predict that the future development of

MOOC will show the following trends: building a new online course culture; curriculum is designed with core knowledge as the main line; building a new teaching and learning model; building a systematic deep-level learning analysis; Participate; inject mature business models into public welfare undertakings [3].

The second is the MOOC practice research on each stage and different courses. Research in recent years has focused on the diversity of MOOC audiences and specific courses. For example, Liu Zhen took "the basic principles of Marxism" course as an example to analyze the influence of MOOC-based blended teaching on modern teaching in four aspects: learning environment, learning behavior, teaching mode, and teaching concept, and theoretically demonstrated that based on the blended teaching effect of MOOC is better than traditional teaching [8].

Qian Xiaolong proposed that in order to make MOOCs better serve the lifelong learning of the whole people, the learning management mechanism and the public service attributes of MOOCs should be improved; the internationalization and localization of MOOCs should be promoted and the construction of educational informatization infrastructure should be strengthened [11]. Let high-quality educational resources be shared by the whole people, and let education move from knowledge-based to comprehensive quality-based [2].

Finally, there is international progress research on MOOCs. In reviewing the development process of global MOOCs, researchers pointed out that the deep integration and adaptive changes between MOOCs and universities are still going on. On-campus teaching reform based on MOOCs continues to advance [13].

From a regional perspective, studies in the United States and Canada have pointed out that while MOOCs have achieved results, they also faced problems such as how to deal with the relationship between MOOC learning and flipped classrooms, how to improve the benefits of video learning, how to effectively use classroom teaching time, and the role of teachers [12]. Research in Europe shows that the number of MOOCs participating in universities has increased steadily; curriculum development goals and motivations are diverse; MOOC functions and values have been recognized; the trend of cooperation with international platforms is rising; regional cooperation and exchanges have become a consensus [10].

Despite the rich theoretical results, two obvious problems remain. First, there is a lack of research to analyze the effect of MOOCs from the perspective of the object receiver. There are only two of the top 200 highly cited articles have conducted empirical research on MOOC learning for college students. Second, the comparative research on the applicability and differences of MOOCs for different disciplines is almost blank, and the differences in teaching methodology caused by the disciplinary differences between natural sciences and humanities and social sciences cannot be ignored in MOOC research.

3   THEORETICAL PERSPECTIVE

3.1   *The Educational Philosophy of Marxism*

The development of MOOCs adheres to Marxism's educational concept, which includes propositions such as the social significance of education, the method of education, and the purpose of education. First of all, from the perspective of the social significance of education, Marx made a clear analysis of the social significance of education. He believed that whether an individual can successfully develop his talent depends entirely on needs, which in turn depends on the division of labor and the results generated by the division of labor and conditions of education. That is, social divisions lead to differences in people's educational levels and will determine the further development of individuals. Engels also believed that the education of the growing generation was very important, and he proposed that education would enable people to live in an environment more with human dignity.

Secondly, from the perspective of educational methods, Marx believed that the early combination of productive labor and education was one of the most powerful means of transforming modern society. He regards the power of education as an important means of transforming society, and highlights the methods and methods of education from the perspective of intervening in reality through practice.

Thirdly, in terms of the purpose of education, Engels made improvements from the perspective of a communist society. He pointed out that education enables young people to quickly become familiar with the entire production system. Education, therefore, frees them from the one-sidedness that this modern division of labor creates for everyone. This further deepens the relationship between the all-round development of people and the combination of education and productive labor.

Although Marx could not mention the multiple education methods in the current digital age, they fundamentally expounded the methods and social significance of education, and fully affirmed the value of education to people and society. On this basis, in the current modern vision, MOOC teaching can span time and space through digitalization, and further develop in a distributed way.

3.2   *Distributed Cognitive Theory*

Distributed cognition is a cognitive theory proposed by Hutchins of the Department of Cognitive Science at the University of California, USA. Through his

anthropological research on sailing activities, especially navigation activities, he proposed that cognition does not only occur in the minds of individuals, but a distributed interactive behavior that integrates with the surrounding environment, artificial objects, others, etc. Cognition is rooted in the environment, and changes in the environment are constantly influenced by the recognizer. As Wittgenstein talked about the relationship between the river and the riverbed, the riverbed is a basic world picture that regulates the flow and direction of the river, but the riverbed itself can be washed and changed by the current. Distributed cognition and cognitive science's important theories such as situational cognition, embodied cognition, and extended mind have jointly become the basic program of the second generation of cognitive science, and have opened up new paradigms in philosophy, education and other disciplines.

MOOC is a distributed teaching activity. The way students acquire knowledge is not limited to the classroom, but through networking and digitization, they can access richer knowledge in a more flexible way in a larger space and time. The significance of this theory to MOOC teaching is that educational activities are not only one-way teaching, but should fully consider the students' receiving methods and learning effects, and implement interactive methods such as questioning, answering, practice, and practice in the learning process and finally achieve a full cognitive effect.

4 RESEARCH DESIGH

This survey takes Marxism's educational philosophy and distributed cognition as the research framework, through large-scale questionnaire surveys and in-depth interviews and other empirical research methods, to investigate the preferences, behaviors and evaluations of college students using MOOCs. The subjects of the survey were undergraduates from universities J in the Pearl River Delta region and university Z in the Yangtze River Delta region. A total of 1,550 questionnaires were distributed, and 1,375 valid questionnaires were recovered, with an effective rate of 88.71%, of which 43.0% were male and 57.0% were female. There are 17 questions in the questionnaire, involving the advantages and disadvantages of MOOCs, students' usage habits, satisfaction and learning effects of MOOCs. Frequency analysis, multivariate response analysis and other operations were carried out on the data by SPSS26.0.

The effective sample size of this survey is 1375. Since the program design adopts simple random non-repetitive sampling, the design effect deff is taken as 2. The theoretical maximum sampling mean error in estimating the population proportion from this is:

$$\mu = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.5 \times (1-0.5)}{687.5}} = 0.0191 \quad (1)$$

For example, according to this survey, the proportion of respondents who are more optimistic about MOOC is 70.2%. Therefore, under the 95% confidence level, the estimation error of this estimator is:

$$d = 1.96 \times \mu' = 1.96 \times \sqrt{\frac{p(1-p)}{n}}$$
$$= 1.96 \times \sqrt{\frac{0.702 \times (1-0.702)}{687.5}} = 3.42\% \quad (2)$$

That is to say, we are 95% sure that in this survey, the proportion of respondents who are more optimistic about MOOCs falls within the range (66.78%, 73.62%).

5 EMPIRICAL RESEARCH AND ANALYSIS

5.1 Course Resources Do Not Match the Needs of Students

From the perspective of learning resources, as of the end of February 2022, the number of online MOOCs in China has exceeded 50,000, and the number of course selections is nearly 800 million. However, there are some differences in the feedback of students. Only 25.0% of the respondents said they could find the content they wanted to learn in the MOOC, 64.3% said they could find it sometimes, and 10.7% said they could find the content they wanted to learn. could not be found.

From the perspective of the effect of using MOOCs, 31.9% of the respondents suggested that they had not used it completely, and 17.6% of the respondents suggested that English listening would be improved, learning efficiency would be improved (14.2%), and time control would be improved (12.0%)., to achieve the desired effect (11.4%), enhance self-control (9.4%) and so on. As shown in Figure 1.
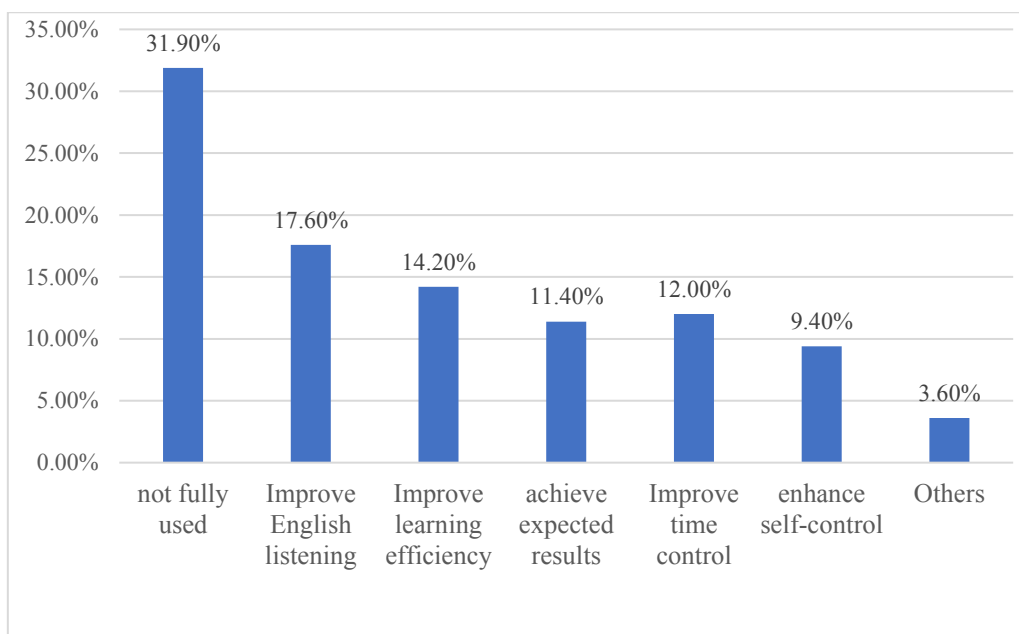
Figure 1: The effect of using MOOCs

5.2 Different Subjects Show Significant Differences in Learning Preferences

The difference between traditional teaching and MOOCs is very obvious. This survey analyzes students' attitudes from the two dimensions of interest and efficiency. 44.5% of the respondents are interested in MOOCs but are not efficient. 26.4 % of the respondents are more interested in traditional teaching methods, but they are not very efficient. Only 14.0% and 15.2% of the respondents indicated that they were interested in both MOOCs and traditional teaching and had high efficiency.

Although China has formed a complete set of digital higher education solutions, the matching between professional differences and MOOC teaching models cannot be ignored. This survey takes language courses and computer courses as examples to analyze students' learning style preferences. The survey results show that language courses are more inclined to traditional teaching methods (accounting for 37.0%), followed by online learning + offline discussions with teachers (accounting for 27.3%); while computer courses are more inclined to full online self-learning (accounting for 33.4%), followed by online learning + offline discussion with teachers (accounting for 30.1%). As shown in Figure 2.
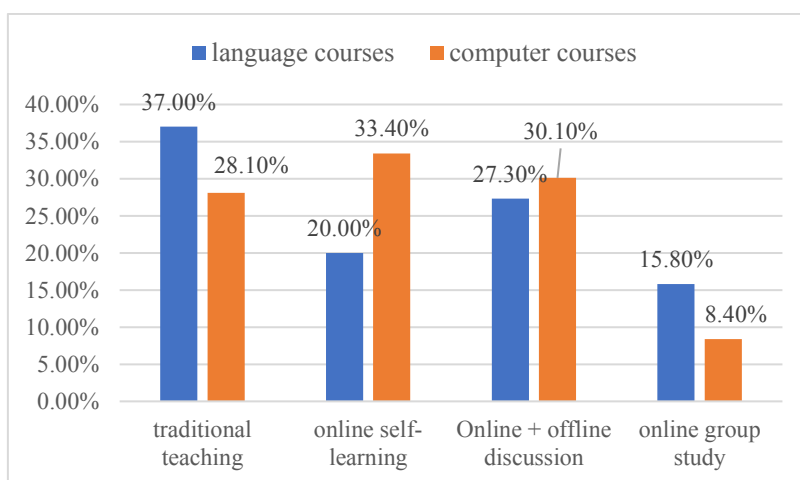

Figure 2: Learning preferences of different subjects

There are also significant differences in satisfaction with MOOCs across different disciplines. In humanities and social sciences, 21.0% of the respondents said they were very satisfied, 33.9% of the respondents were satisfied, and 39.0% of the respondents were neutral. But

in contrast, the respondents in the science and engineering category, only 11.9% were very satisfied, 29.9% were satisfied, and 50% were neutral. Overall, respondents in science and engineering are less satisfied with MOOCs than those in humanities and social
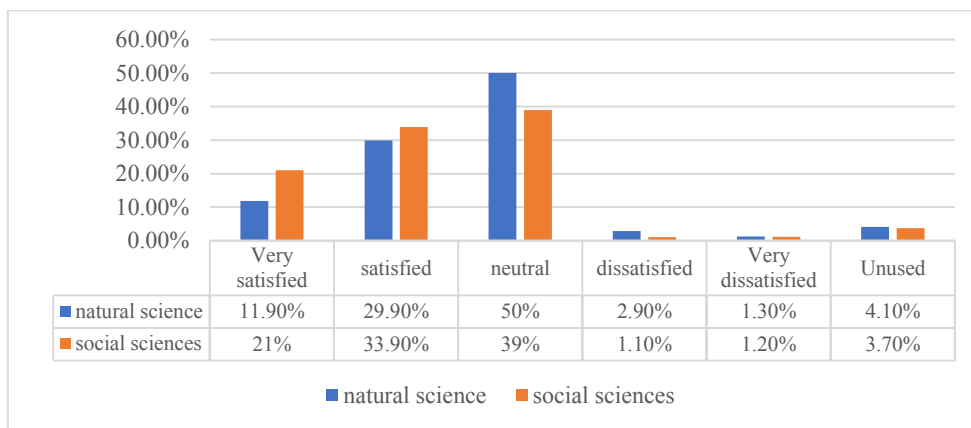
sciences. As shown in Figure 3.

Figure 3: Differences in Satisfaction of Natural Science and Social Sciences

5.3 The Advantages and Prospects of MOOCs

For the analysis of the advantages of MOOCs, 71.4% of the respondents believed that MOOCs could make full use of modern technology to improve learning efficiency, 66.8% of the respondents believed that MOOCs provided a way to contact the courses of famous teachers in famous schools, and 50.1% of the respondents suggested that Course learning is more convenient, 44.9% of the respondents suggested that the cost is lower, and 38.3% of the respondents suggested that the range of courses is relatively wide. As shown in Table 1.

Table 1: Analysis of the advantages of MOOCs

Advantages of MOOCs	attitude
Make full use of modern technology to improve learning efficiency	71.4%
Provide access to the courses of famous teachers of famous schools	66.8%
Easier to learn courses	50.1%
Low cost	44.9%
Broad range of courses	38.3%
others	2.0%

In terms of the prospect of MOOCs, 12.7% of the respondents are very optimistic, this is a subversive innovation that will replace traditional education; 70.2% of the respondents are relatively optimistic, this is a constructive innovation, complement each other with traditional education; 14.2% of the respondents are not optimistic, MOOCs are just a niche product; and 2.9% of the respondents are not optimistic. As shown in table 2.

Table 2 Prospects for MOOCs

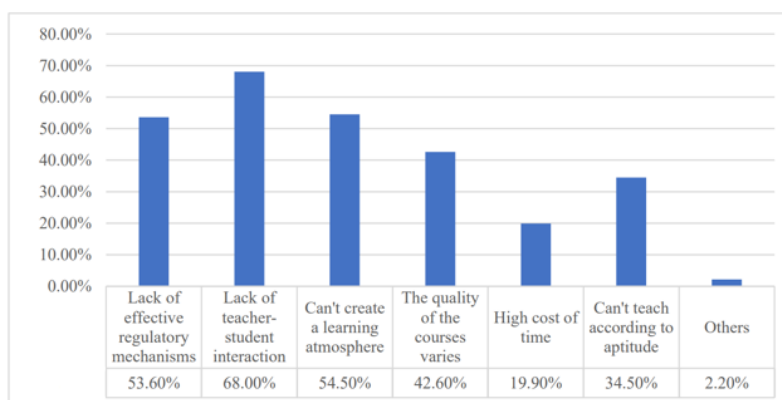| Attitude	Proportion
Very optimistic, these are some disruptive innovations that will replace traditional education.	12.7%
More optimistic, this is a constructive innovation that complements traditional education.	70.2%
Not very optimistic, after all, it is just a niche product.	14.2%
It will disappear soon.	2.9%

Figure 4: Problems with MOOCs

5.4 Problems with MOOCs

There are still many problems that cannot be avoided in the development of MOOCs. In this survey, 68.0% of respondents believed that MOOCs lacked teacher-student interaction, 54.5% of respondents believed that MOOCs could not create a learning atmosphere, and 53.6% of respondents believed that MOOCs lacked an effective supervision mechanism. The three options with the highest proportions are all related to the cognitive effects of knowledge recipients. There are also 42.6% of the respondents that the quality of the courses is uneven, 34.5% of the respondents said that they cannot teach students according to their aptitude, and 19.9% of the respondents said that the time cost is high. As shown in Figure 4.

6   CREATE INTERACTIVE LEARNING OF MOOCS AND BUILD STUDENTS'DEEP COGNITION

6.1 Avoid Business Model Influence as Much as Possible

MIT has announced that its MOOC platform EdX is not set up for commercial purposes, but an extension of its university classroom. But today, the development of the MOOC platform has included the forces of universities, teachers, commercial capital and non-profit organizations. Foreign countries have also formed a relatively clear business profit model, taking adult education as one of the main target markets, and providing courses with high market popularity. However, from the perspective of universities, it should be guided by the development of disciplines rather than market demand, respect the laws of higher education in terms of fees and curriculum design, and avoid the influence and guidance of business models on MOOC courses in universities as much as possible.

6.2 Clarify the Positioning of MOOCs in Higher Education

The function of MOOCs in higher education should be clearly defined. In 2012, only 50-60% of the students on Coursera, an internationally renowned MOOC platform, watched the first lecture repeatedly. And only about 5% of students received an official certificate of completion of the course [5]. Ten years later, the data of this survey shows that 31.9% of students still have not completed a course on a MOOC platform. This shows that due to the lack of interaction and lack of instant feedback and other system defects, MOOCs can only be used as reference courses for preview or review, and cannot replace traditional teaching or even live broadcast courses.

Although this survey shows that 10.7% of the respondents think that they cannot find suitable courses, it is not necessary for the construction of MOOCs to be fully rolled out. When educating college students, quality courses that can meet professional needs should be provided to avoid duplication of construction. The supply of MOOCs should be based on a high degree of matching with the needs of students, rather than chasing the trend of universities, or setting assessment indicators to form a rigid assessment system, increasing the burden on teachers.

6.3 Design Multiple Interactive Modes of MOOCs from a Cognitive Perspective

The University of Edinburgh's course "Introduction to Philosophy", a MOOC on the Coursera platform, closed the course forums because the course group was unable to manage the forums, citing "increasing hostility and increasing hostility" among students [4]. However, the discussion of problems that began with Socrates is a basic way of philosophy learning. New understandings and breakthroughs are formed through the direct collision of thinking. Other majors also need to be jointly constructed the understanding of the course content on the basis of interaction such as discussion and analysis. In the

absence of interaction in the MOOC itself, the unsustainable nature of the course forum highlights the systemic problems of the MOOC.

This survey confirms the reasons for similar phenomena. The lack of teacher-student interaction, the inability to create a learning atmosphere, and the lack of an effective supervision mechanism make it difficult for students to fully establish a cognitive system for MOOCs, which may further lead to a lack of experience and authenticity. The MOOC learning is difficult to run through. Therefore, the quality MOOCs should be further designed including group discussions, teacher Q&A, on-site questioning and other interactive means to mobilize the enthusiasm of learning, with corresponding technical support, and try to respond instantly through AI or online teaching assistants.

6.4 Design According to The Nature of The Course

The nature of talent training in science and humanities and social sciences is completely different. Science and engineering teaching focuses on methods such as logic, mathematical deduction, operations, and experiments, and imparts complex and standardized knowledge, which requires deep learning at the cognitive level. However, when students study MOOCs, they are more inclined to fragmented learning in the absence of constraints. The teaching of humanities and social sciences pays more attention to the knowledge and methods of concepts, theories, and analysis, which is relatively well matched with the teaching methods of MOOCs. This research suggests that on the basis of providing high-quality MOOCs, the science and engineering MOOCs should be further combined with offline teaching, and a composite model of MOOC preview + classroom learning should be formed through flipped classrooms and other forms.

7 CONCLUSIONS

Whether it is the rapid development of technology or the need to break through the limitations of time and space, the development and popularization of MOOCs has become a basic trend. However, for college education, the great progress of instrumental rationality does not mean that it also has the ability to maintain a balance with value rationality. The cognitive process of students needs to be constructed in a systematic context including interaction, discussion, response, situation and other elements, which is why the MOOC should be designed as refined and objectified as possible.

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