Research on the Framework of MOOC Interactive Teaching Model in Higher Learning Institutions under the Backdrop of the “Internet +”

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Abstract

Given the fact that MOOC lacks a teaching mode that is consistent with the national conditions, universal, easy to run and can meet the individual needs of students, as well as the existing related research results that remain on the surface, the paper, with literature analysis and Network using experience method, makes a systematic analysis of the foundation, the overall structure, the essence, etc. of MOOC teaching mode. It preliminarily constructs a general teaching mode for higher learning institutions based on MOOC that follows the teaching principle of “students as the main body and teachers as facilitators”, where teachers design the teaching objectives and dynamically adjust them based on learning data analysis and the teaching content based on the feedback. It stresses flipped teaching and blended learning methods, the learning of MOOC and fragmented and reorganized knowledge for student preview, online discussion and testing. Teachers will lead student discussion and timely send feedback, and conduct teaching activities based on MOOC multi-evaluation process.

Keywords: The Internet, University MOOC, Interactive Teaching.

1. RESEARCH BACKGROUND

1.1 Literature review

Currently, the rapid development of informatization and networking has deepened their impact on education. Educational informationization is undergoing major changes and new breakthroughs, and the construction of it is in full swing. As the open learning is gradually accepted by the public, open distance education has begun to take shape in China (Wu and Lu, 2016). In recent years, with the overall advancement of the education informationization system, the construction of the learning platform, such as Moodle, Blackboard and the web-based learning platform developed by colleges and universities, has also moved forward simultaneously, which plays a crucial role in improving the quality of distance education and promoting lifelong education. As the Internet technology has been successfully used in education, the concept of open education has been recognized by the society and social learning has become the main form of learning. Originated in the open global movement, emerged from the concept of connectivism and flourished in behavioral learning, MOOC swept the world and was adopted in most colleges and universities (Deng and Zhou, 2016). Different from the teaching-based traditional teaching and learning-based online teaching, MOOC attaches equal importance to teaching and learning, which has promoted great changes in the technology, concepts, systems and modes in global higher education and has a profound impact on social learning network construction, knowledge creation and sharing, and the development of open education. Under such circumstance, how to construct a universal and easy-to-use MOOC teaching mode has become an urgent problem for colleges and universities.

1.2 Purpose of research

At present, there are fewer than 40 articles on MOOC teaching mode, and these articles generally have such limitations as not systematic or profound in research, unclear in architecture, and unsatisfactory in operability and portability. Through the brief introduction of the MOOC and the connotation of the teaching mode, this paper concludes the MOOC-based construction mode, the overall analysis framework, initially constructs a universal, easy-to-operate, and portable MOOC-based teaching mode in colleges and universities and proposes corresponding implementation strategies (Yang, 2016), which provides a complete theoretical framework and reference model for analyzing, constructing and implementing the MOOC teaching model in higher learning institutions. Based on this model, the MOOC teaching mode can be customized to specific disciplines.
2. MOOC TEACHING MODE IN HIGHER LEARNING INSTITUTIONS UNDER THE BACKDROP OF THE INTERNET

2.1 Connotation of teaching mode

Teaching mode is a system of stable relationship, teaching procedures and specific strategies formed by various elements in teaching and learning activities (teachers, students, teaching materials, modern teaching environment) according to specific teaching objectives, contents and cognitive characteristics of students under the guidance of a certain teaching thought, teaching and learning theory, and the support of certain teaching environment and resources. In other words, it is a process of teaching activities, stable and operational (providing for the teaching process, principles and precautions), created to achieve specific teaching objectives and for specific themes in line with corresponding teaching philosophy and the basic teaching and learning theories (Xue and Wang, 2016). It is characterized by its directionality, operability, stability, flexibility, systematicness, integrity and development.

2.2 Teaching elements

According to the current related research results, the elements of teaching mode should include teaching concept, resources (including teaching environment, effective carrier), technology, objectives, content, methods, process, evaluation and design, which are linked to and restrict each other. Figure 1 shows the specific relationship between the elements.

![Figure 1. The Relationship between the Elements](image)

2.3 Teaching mode function

<table>
<thead>
<tr>
<th>Function</th>
<th>Subfunction</th>
<th>Main performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>theoretical direction</td>
<td>Nothing</td>
<td>Simplifying the teaching practice, expressing the teaching idea, and implementing the teaching better</td>
</tr>
<tr>
<td>Practical guidance (teaching activities that provide theoretical basis)</td>
<td>Foresee</td>
<td>Help teachers predict teaching activities and anticipate teaching effect</td>
</tr>
<tr>
<td></td>
<td>Guidance</td>
<td>Teaching conditions for teachers to provide goals</td>
</tr>
<tr>
<td></td>
<td>Systematization</td>
<td>Make the teaching process a complete system and give full play to all the elements</td>
</tr>
<tr>
<td></td>
<td>Perfect</td>
<td>Standardizing teaching scientifically and perfecting the teaching process, method and result in practice</td>
</tr>
</tbody>
</table>
Teaching mode can guide the theory and practice of teaching so that teachers can better grasp the relationship between the various elements of the teaching process, the diversified manifestations, control the essence and law of teaching process, promote teaching design, and improve teaching process. The specific function is shown in Table 1.

3. CONSTRUCTION OF MOOC-BASED INTERACTIVE TEACHING MODEL FRAMEWORK IN COLLEGES AND UNIVERSITIES UNDER THE BACKDROP OF THE INTERNET

3.1 Resources and environment basis

First, MOOC resources construction is to provide a technology platform to attract colleges and universities to build high-quality resources together, and to use the global university alliance to ensure the quality and advanced nature of resources and avoid duplication (Ma and Yuan, 2016). Resource are mainly in such forms as text, short videos, and embedded test questions that allow multiple answers, selection of picture quality, playback speed, subtitles, etc. They replace the blackboard with a screen, and apply board writing, quizzes, forums, Wikis and simulation experiments in the lecturing. Second, MOOC complies with the Creative Commons license to share teaching resources while preserving the author’s copyright, signature right, and right to share teaching resources under specific conditions. The MOOC platform shares advantageous teaching resources of different colleges and universities through classroom or experimental activities and realizes time-space learning based on interests through real-time remote communication among teachers and students (Li and Lu, 2014). Last but not least, with massive learning access, global collaboration and exchange of information and dynamic generation of information, the MOOC platform documents massive real-time learning data generated during the teaching process and requiring technical processing. MOOC-based big data analysis reveals trends and patterns that cannot be found in traditional models, provides insight into key issues such as student learning methods and learning validity, assists in assessing learning processes, predicting future performance, spoting potential problems, and providing the basis for student learning, teacher teaching, and decision-making of educational institutions. In addition, MOOC-based self-assessment and interactive practice will encourage students to think.

3.2 Learning mode construction principle

The construction of MOOC teaching mode in colleges and universities emphasizes individuality without losing sight of commonality, emphasizes stability without losing sight of flexibility, emphasizes creation but not reproduction, emphasizes perfection and not seeks perfection. The main principles are: (1) Openness: Open teaching based on multimedia and network space, where student mentality is unfettered, the teaching content not limited to textbooks, and teaching results not limited to teaching reference books, knowledge of authority, or the standard answer (Hu and Zhou, 2014). (2) Unification: Abandon the traditional teaching mode, adopt advanced technology combined with network self-study, change the situation where no communication is conducted between teachers and students and among students themselves, and where classroom teaching is hard to be extended. (3) Distinctiveness: Lay down teaching goals, integrate teaching content and network resources, create teaching situations, etc. to adapt to individual differences in students. Mobilize the initiative and enthusiasm of students to collect and analyze data, put forward hypotheses and validation of the problems learned, arrange teaching process for students, and encourage students to construct their own knowledge system. (4) Orderliness: Optimize the teaching process in line with educational thoughts, teaching theories and disciplinary characteristics, handle the relationship between teaching mode and teacher-student activities, and systematically design teaching process, teacher-student and student-student collaboration according to disciplinary characteristics and students’ cognition rules (Liu and Wei, 2015). (5) Effectiveness: Facilitate students’ learning of the new from the knowledge and experience in their original cognitive structure, and improve their non-intelligence factors, such as their learning interest, learning habits, socialized learning and innovation ability through new information technologies, and enhance their overall quality and that to grasp the knowledge.

3.3 Overall structure of the framework

3.3.1 Basic connotation

Teaching mode is guided by teaching thought and theory for its scientific and advanced nature. MOOC teaching philosophy in colleges and universities is mainly student-centered and teachers-led, where teachers are students’ learning partners, service providers and coordinators that will stimulate students’ interest in learning, highlight their cognitive features, student-student, teacher-student, human-computer interaction, inspire their thinking, give
them the power to solve problems, hence the formation of student-centered, and teacher and network-led new relationship (Sun and Cheng, 2015). Moreover, it emphasizes knowledge building and creation, dissemination and reproduction, social learning, short videos, assignments, testing, just to name a few. Figure 2 gives the MOOC interactive teaching mode framework.

![Figure 2. Interactive Teaching Model of MOOC in Colleges and Universities](image)

### 3.3.2 Teaching objectives

Teaching objectives are the core elements of the teaching mode, the starting and end point of the teaching design, and determine the proportion of teachers and students in teaching practice, teaching procedures, teacher-student interaction and evaluation criteria, etc. They constrain other elements, and are the teaching results, as well as the teachers’ assessment of the effectiveness of teaching activities, achieved by the teaching mode at a specific level of teaching, with specific teaching content, among specific student groups and in specific teaching scenario (Huang and Li, 2015). The MOOC teaching model in colleges and universities often analyzes the potential students first, determines highly valuable, specific and diversified teaching objectives, evaluates students’ grasp of knowledge and then dynamically tunes the teaching objectives.

### 3.3.3 Teaching content

Teaching content is the sum of knowledge, skills, thoughts and behaviors that require students to systematically grasp to achieve their teaching goals. The teaching content in MOOC is more diversified, comprehensive and open. It is carefully designed by the instructors and teams according to the characteristics of the subject and the cognitive features of the students, practical and valuable, and timely adjusted in the teaching to the feedback (Wang, 2017). It covers strong structural knowledge system, expertise, industry and latest updates which students can learn independently and construct their overall structure, as is shown in Figure 3.

![Figure 3. Teaching Content of MOOC in Colleges and Universities](image)
3.3.4 Teaching methods

This paper mainly chooses the blended teaching method, also known as O2O teaching method. Based on MOOC, the blended teaching method constructs the virtual teaching environment, gives full play to the guiding role of teachers, reflects the dominant position of students, and improves teaching effect by combining traditional learning methods with the advantages of learning platform, blended teaching mode, learning environment, learning content, and learning methods. It combines online and face to face learning in form and constructivism, behaviorism and cognitive theory in content. It realizes efficient interaction by combining teacher-led activities, student-centered participation, classroom teaching, online learning, and a variety of teaching media (Lv and Zhou, 2016). It combines strong structural knowledge system, expertise, industry, and latest updates for flexible choice of learning styles according to the characteristics of the subjects, types of knowledge, and teaching objectives. Automatic machine grading and interactive massive online exercises can encourage students to think, and peer review, urge them to learn from each other and expand their horizon.

3.3.5 Teaching evaluation

According to its role in teaching activities, teaching evaluation can be divided into positioning evaluation (judgment before the teaching activities of students’ preparation, knowledge and skills, interests, habits, etc., to choose teaching mode), formative evaluation (feedback on success or failure of learning, success strengthening, showing the need for improvement), diagnostic evaluation (assessment on errors in learning, investigation of the underlying causes of repeated mistakes) and summative evaluation (determination of the level of teaching objectives achieved, the appropriateness of teaching objectives and effectiveness of teaching strategy). The relationship of them is shown in Figure 4. According to the evaluation subjects, teaching evaluation can be divided into individual’s self-evaluation, peer evaluation, and teacher evaluation. The MOOC teaching mode evaluate students in a comprehensive manner based on the multiple-learning evaluation method that meets the characteristics of online learning evaluation (Huang, 2017). The content of evaluation includes pre-test, after-school test, subjective question-based assignments, peer review, teacher review, and final exams. The evaluation method is composed of teacher evaluation, alumni evaluation, peer evaluation and self-evaluation. The form of evaluation includes platform-based embedded testing, random questioning, machine evaluation based on learning process big data (Lang and Sun, 2014). MOOC records the entire learning process and collects, accumulates and analyzes learning data in real time. It analyzes students’ knowledge, skills and familiarity with them via data mining so that students can critically and creatively think about learning processes and topics and get familiar with learning environment and experience.

Figure 4. The Relationship between Evaluation Methods

4. Evaluation system of MOOC interactive teaching model in colleges and universities under the backdrop of the “Internet”

4.1 Evaluation method

Neural network, also known as feed forward neural network, is a three-layer - input layer, hidden layer and output layer - feed-forward hierarchical network. When given a group of network input modes, BP network will learn in
the following way: first input these modes from the input layer to the hidden layer unit, which then processes them layer by layer and generate an input pattern to the output layer, a process known as forward propagation (Xu and Zhang, 2014). The output is then compared with the expected value, and if it does not match the expected value, the error is propagated backwards along the original path and reduced by modifying the connection weight of the neurons in each layer. Such backward and forward propagation alternate and constitute memory training. The system continues to carry on these two processes, repeats the learning, until the error between the output value and the expected value is reduced to the specified range. At this point, input the fresh samples into the trained network, and you can get the corresponding output value.

4.2 Evaluation procedures

The output layer is:

\[ o_k = f(\text{net}_k), k = 1, 2, L, l \]

\[ \text{net}_k = \sum_{j=0}^{m} w_{jk} y_j, k = 1, 2, L, l \]  \hspace{1cm} (1)

The hidden layer is:

\[ y_j = f(\text{net}_j), j = 1, 2, L, m \]

\[ \text{net}_j = \sum_{i=0}^{n} v_{ij} x_i, j = 1, 2, L, m \]  \hspace{1cm} (2)

In the above two formulas, both transfer functions \( f(x) \) are:

\[ f(x) = \frac{1}{1 + e^{-x}} \]  \hspace{1cm} (3)

\( f(x) \) is continuous and actionable, and:

\[ f'(x) = f(x)[1 - f(x)] \]  \hspace{1cm} (4)

In the neural network system, the relationship between input and output is specifically represented as:

\[
\begin{align*}
Y_0 &= X_0 \\
X_1 &= \bar{W}_0^T Y_0 \\
Y_1 &= f(X_1) \\
X_2 &= \bar{W}_1^T Y_1 \\
Y_2 &= X_2
\end{align*}
\]  \hspace{1cm} (5)

The purpose of neural network training is to find the appropriate weights \( \bar{W}_0 \) and \( W_1 \), so that the following mapping holds:

\[ M : X_0 \rightarrow Z_2 \]  \hspace{1cm} (6)

Among them, \( Z_2 \) is the target matrix and \( X_0 \) is the input sample matrix. The network after training should make the following cost function take the minimum value:
\[ J = \min \| Y - Z_2 \|_F^2 \]  

In it, \( \| Y - Z_2 \|_F^2 \) is the norm of \( Y - Z_2 \), \( J \) is the square of the norm, or the mean square error of the actual output and the expected output.

Assuming that any given free weight value \( \overline{W_0} \) can be calculated according to the formula \( Y_1 \), and then \( Y_2 - Z_2 \), we can get a set of linear equations with variables according to the formula: \( Y_1^T W_1 = Z_2^T \), make \( m / n / l \) be the number of neuron of input layer, output layer respectively, and \( N \) be the number of samples to be trained. If:

\[ \text{Rank}(Y_1^T) = \text{Rank}(Y_1^T, Z_2^T) = N \]  

(8)

According to the matrix theory, it is clear that the above formula is a necessary and sufficient condition for the system of equations to be solved. That is, if the formula is true, it means \( J = 0 \). Then another formula is expressed as:

\[ \text{Rank}(Y_1) = \text{Rank}\left( \begin{array} {c} Y_1 \\ Z_2 \end{array} \right) \]  

(9)

In addition, as \( l = n_1 = \text{row}(Y_1) \), \( N = \text{col}(Y_1) \), the symbol \( \text{row}(Y_1) \) in the formula indicates the number of rows of the matrix \( Y_1 \), and \( \text{col}(Y_1) \), the number of columns in the matrix \( Y_1 \), and the full rank matrix is:

\[ \text{Rank}(Y_1) = \min\{\text{row}(Y_1), \text{col}(Y_1)\} = \min\{l, N\} \]  

(10)

5. CONCLUSION

Under the background of the Internet, this paper comprehensively analyzes the current situation of higher education, briefly outlines the shortcomings in traditional teaching and discusses the trend and advantages of MOOC in China. On such basis and through teaching content, teaching mode connotation, teaching evaluation system, it also creates a new MOOC interactive teaching mode that taps the advanced network technology and open learning platform, and in line with blended teaching methods, provides students with new teaching services which effectively makes up many deficiencies in the past teaching. It constructs an evaluation model to further improves the interactive teaching mode, so as to provide a favorable reference for teachers to adjust teaching programs and promote teaching innovation.

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