

# *Research on the Influencing Factors of Intelligent Education “Internet + MOOCs” on Flipped Classroom in Universities*

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**Abstract:** The frequent occurrence of the COVID-19 has brought new challenges to college teaching, while the teaching form of "Internet + MOOCs" of intelligent education has brought about a turnaround for higher education. This paper takes the flipped classroom in universities as the research object, and studies the influencing factors of the "Internet + MOOCs" of intelligent education on the flipped classroom in universities, which has certain practical significance in promoting the "Internet + MOOCs" teaching form of intelligent education to help the development of universities. By systematically defining the factors that affect the flipped classroom teaching effect of intelligent education "Internet + MOOCs", based on the sample data collected from the questionnaire survey, and using structural equation model, this paper constructs an indicator hypothesis model of four potential variables of intelligent education "Internet + MOOCs", namely, teaching content, teaching resources, teaching technology and teaching attitude, and their corresponding observation variables. The study found that the four influencing factors have a positive impact on the teaching effect of flipped classroom in universities, and from the perspective of the total effect of the path, the influence on the teaching effect of flipped classroom in universities from the largest to the smallest is teaching technology, teaching attitude, teaching content and teaching resources. The research provides micro evidence for the development of flipped classroom in universities, and also brings some enlightenment for the progress of the combination of the teaching form of "Internet + MOOCs" and the flipped classroom education mode of intelligent education.

## **1. Introduction**

At present, flipped classroom teaching mode is frequently adopted by universities to solve the problems that students' learning time and space is not fixed. However, in recent years, the epidemic has occurred frequently, and the development of universities has been in a passive state of stagnation, which makes the education industry turn its attention to the teaching form of "Internet + MOOCs" of intelligent education. Therefore, this paper studies the influencing factors of "Internet + MOOCs" of intelligent education on flipped classroom in universities, with a view to promoting the effective combination of "Internet + MOOCs" of intelligent education and flipped classroom, which is of great significance to the development of universities. <sup>[1]</sup>This paper constructs the structural equation

model of flipped classroom in universities from the four aspects of teaching content, teaching resources, teaching technology and teaching attitude, and it creatively uses the teaching effect variable as the result orientation, and uses AMOS software system to analyze the impact intensity of various factors and determine its key impact path, so as to provide direction for improving the teaching effect of flipped classroom in universities, which is helpful to the government and universities make effective decisions in improving the teaching effect of colleges and universities.

## **2. Theoretical Assumptions of the Research Model**

### **2.1 Teaching Content of "Internet + MOOCs" in Intelligent Education**

The teaching content is the most fundamental part to achieve the classroom teaching effect, is an important embodiment of the intuitive reflection of the quality of the curriculum, provides the most basic guarantee for students, and also brings great convenience and guarantee to the curriculum arrangement of the teachers. [2] From whether the design of the teaching content by the teacher team plays the purpose of improving students' interest and whether the organization and arrangement of the teaching content sequence is conducive to students' absorption and transformation, to whether the teaching of the teaching content by the teachers in the flipped class meets the needs of different students, and to whether the students' independent review after class is sufficient, all links play a connecting role in the systematic learning and knowledge absorption of students. Therefore, teaching content is the key factor affecting flipped classroom in universities.

Hypothesis H<sub>1</sub>: The teaching content of "Internet +MOOCs" in intelligent education has a positive impact on flipped classroom in universities.

### **2.2. Teaching Resources of "Internet + MOOCs" in Intelligent Education**

Teaching resources, including teacher resources, curriculum resources and curriculum extension resources, will have a significant positive impact on the teaching effect of flipped classroom. The traditional teaching resources have many limitations, and the combination of intelligent education "Internet + MOOCs" and flipped classroom can solve many problems existing in the traditional continuing education model. For example, curriculum resources can be saved anytime and anywhere without being limited by space and time, and the derivative resources provided in the curriculum greatly improve the richness of teaching resources. [3] The advantages of "Internet + MOOCs" teaching resources in intelligent education, such as rationality, richness and accessibility, have promoted the transformation of learning effects to a certain extent. Therefore, measuring the factors of teaching resources is of great significance in promoting the combination of "Internet + MOOCs" in intelligent education and flipped classroom in universities.

Hypothesis H<sub>2</sub>: The teaching resources of "Internet + MOOCs" in intelligent education have a positive impact on flipped classroom in universities.

### **2.3. Teaching Technology of "Internet + MOOCs" in Intelligent Education**

With the progress of science and technology, the teaching technology of universities also needs to be improved and listed in the list of urgent development. The conciseness of teaching video production, the ease of observation of user interface layout and the continuity of curriculum all have an impact on the development of flipped classroom in universities. For example, observing students' course feedback, distributing teaching resources and making teaching videos according to students' progress, which not only needs to improve the professional ability of teachers, but also needs to improve the intelligent office ability and basic computer operation ability of teachers. It can be seen

that teaching technology is also an important factor affecting the development of flipped classroom in universities.

Hypothesis H<sub>3</sub>: the teaching technology of smart education "Internet + MOOCs" has a positive impact on flipped classroom in colleges and universities.

## 2.4. Teaching Attitude of "Internet + MOOCs" in Intelligent Education

There are many uncontrollable factors in the traditional classroom, and the teaching attitude cannot be ignored. The advantage of flipped classroom is to fully mobilize students' enthusiasm in the classroom, guide students' divergent thinking, and promote students' transformational thinking. However, the "Internet + MOOCs" of intelligent education can avoid the occurrence of uncontrollable events to some extent. <sup>[4]</sup> For example, the resources provided before the class are repeatedly polished by the teacher team, effectively control the extra-curricular emotions of teachers are not reflected in the curriculum, and students who fully prepare can also reverse mobilize the enthusiasm of teachers to teach, thus strengthening the interaction between teachers and students. Therefore, teaching attitude is extremely important for the development of flipped classroom in colleges and universities.

Hypothesis H<sub>4</sub>: The teaching attitude of smart education "Internet + MOOCs" has a positive impact on flipped classroom in universities.

## 3. Sample Collection and Processing

### 3.1. Scale Preparation

Table 1: Measurement index system of influencing factors of flipped classroom in universities

Latent variable	Order number	Observed variable	Indicator meaning
Teaching content	A1	Design of teaching content	Whether teaching video design caters to students' interests and needs
	A2	Organization of teaching content	Whether the teaching content arrangement is conducive to students' knowledge understanding and transformation
	A3	Explanation of teaching content	Whether the teaching content of video teaching content is well explained
	A4	Review of teaching content	Whether students review and consolidate the teaching content of the series of courses
Teaching resource	B1	Availability of teaching resource	Whether the teaching video resources provided by MOOC are easy to obtain and learn
	B2	Rationality of teaching resource	Whether the teaching video resources provided by MOOC meet the needs of students for the course
	B3	Richness of teaching resource	Whether the teaching resources provided by MOOC meet the needs of students
	B4	Utilization of teaching resource	Whether the teaching resources provided by MOOC are fully used by students
Teaching technology	C1	User interface quality	Whether the user interface is clear and easy for learners to use
	C2	teaching video quality	Whether the teaching video is short and concise and highlights the key points
	C3	Q&A interactive quality	Q&A classroom teacher-student communication plays a role in guiding thinking
	C4	the quality of course arrangement	Whether course arrangement is linked and targeted to facilitate learners' knowledge transformation
Teaching attitude	D1	Enthusiasm of the lecturer	The enthusiasm of the lecturer is not reflected in the video and does not affect the learners
	D2	The seriousness of the lecturer	The content quality of teaching videos recorded and uploaded by lecturers
	D3	Inspiration of lecturers	Whether the lecturer pays attention to the learners' enlightening thinking in the teaching video
	D4	Interactivity of lecturers	Whether the interaction between teachers and students in the interactive Q&A effectively
Teaching effective	F1	Achievement of learning objectives	The degree of achievement of learning objectives of learners after class

ness	F2	Learner Achievement	Course evaluation learner performance
	F3	Teaching evaluation	Learners' evaluation of MOOC + flipped classroom
	F4	Knowledge transformation	The degree of knowledge utilization and internalization of learners after class

In order to accurately measure the influence factors of “Internet + MOOCs” on flipped classroom in universities, and ensure the accuracy and effectiveness of the measurement.<sup>[5]</sup> This paper compiled four potential variables and 16 observation variables of the influence factors of flipped classroom in universities, as shown in Table 1.

### 3.2. Sample Collection

Based on the measurement index system and SEM conceptual model constructed in Table 1, the final questionnaire is determined and distributed to college students in combination with expert opinions. According to Likert's five-level scale, the questionnaire is arranged according to "small impact", "small impact", "average impact", "large impact" and "great impact", and is assigned a value of 1 to 5, and is scored according to the importance of the problem. In order to obtain high-quality survey results, 258 questionnaires were distributed. After eliminating invalid questionnaires, 212 questionnaires were valid, with an effective recovery rate of 82%. The basic survey of the sample is shown in Table 2: (1) Among the respondents, the proportion of people who have participated in systematic online learning for less than 1 year is 24.53%, the proportion of people who have participated in systematic online learning for 1-3 years is 50.94%, the proportion of people who have participated in systematic online learning for 3-5 years is 15.09%, and the proportion of people who have participated in systematic online learning for 5-10 years is 3.77%, which shows that the survey data is basically reliable; (2) 75.47% of the respondents have more than one year of systematic online learning experience, can have a deeper understanding of the university and make reasonable answers to the questions of the questionnaire; (3) More than 60.38% of the respondents' study time is not fixed. Considering that most of the participants in colleges and universities are social workers, most of the respondents are already working, and the study time is not fixed, the questionnaire data is reasonable.

Table 2: Basic information of respondents (n=212)

Project	Category	Proportion %
Systematic online learning period	<1 year	24.53%
	1~3 year	50.94%
	3~5 year	15.09%
	5~10 year	5.66%
	>10 year	3.77%
Study schedule	weekends and holidays	14.62%
	Rest time every night	17.45%
	Time is not fixed	60.38%
	Other fixed time	7.55%

### 3.3. Reliability and Validity Analysis

#### 3.3.1. Reliability Analysis

Reliability refers to the reliability of the measurement problem, usually Cronbach's  $\alpha$ . The coefficient method is generally considered as Cronbach's  $\alpha$ . The coefficient is greater than 0.60, which means that the reliability of the sample data is good. Cronbach's of the whole sample  $\alpha$ . The coefficient is 0.960>0.60, indicating that the internal consistency estimation of latent variables is more scientific. At the same time, it can be seen from Table 3 that the reliability test coefficient of each latent variable in the model is greater than 0.60. The sample data has high reliability, meets the

reliability requirements, and is suitable for further research.

Table 3: Reliability test of influencing factors

	Teaching content	Teaching resource	Teaching technology	Teaching attitude	Teaching effectiveness
Cronbach' $\alpha$	0.924	0.937	0.915	0.929	0.921

### 3.3.2. Validity Analysis

Validity refers to the degree to which the sample's measurement problem can accurately and effectively measure the potential variables to be measured. Firstly, KMO and Bartlett test should be carried out on the sample data to analyze whether the sample data is suitable for factor analysis according to the test results. [6] After testing, the KMO value of the sample data is  $0.920 > 0.7$ , and the P value of Bartlett's sphericity test is  $0.00 < 0.05$ , indicating that the sample data is suitable for factor analysis. Therefore, the principal component analysis can be carried out on the sample data to further clarify whether the observed variables can reflect the potential variables. Five factors are extracted through the principal component analysis, and the cumulative variance contribution rate is 82.524%. At the same time, the dependent sub-load value of the observed variables contained in each factor after rotation is greater than 0.6, indicating that the structural validity of the questionnaire meets the basic requirements and the design of the questionnaire is reasonable.

## 4. Model Analysis of the Impact of Intelligent Education "Internet + Moocs" on Flipped Classroom

### 4.1. Model Construction

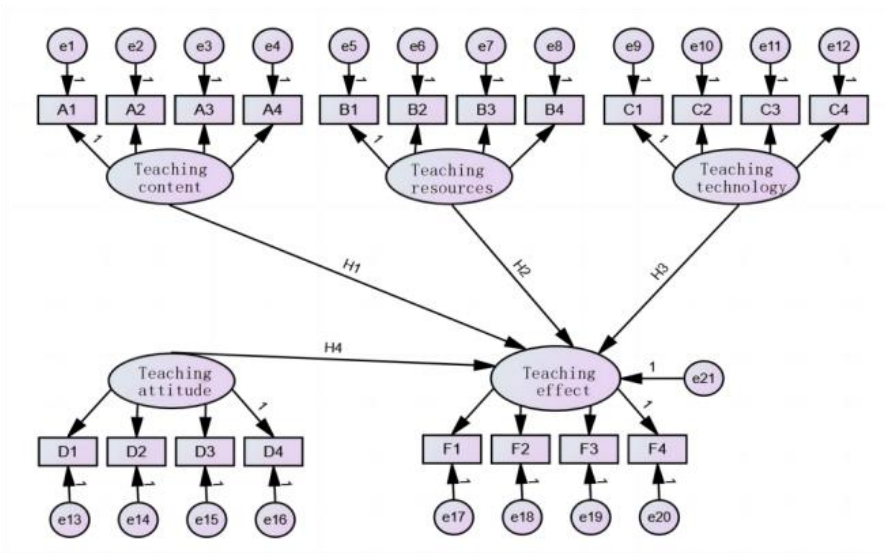


Figure 1: Initial model of flipped classroom in universities

The flipped classroom in universities is affected by many unstable factors such as teaching content, teaching resources, teaching technology and teaching attitude, and the influence mechanism of flipped classroom in universities mainly examines the complex relationship between the influencing factors in the teaching process of flipped classroom, which means that the influencing variables are numerous and highly subjective, and there are certain errors. [7] Therefore, the structural equation model is very suitable for the study of the influencing factors of flipped classroom in colleges and universities, which can quantitatively analyze the influence degree and

influence path of each latent variable on the explanatory variable. Combined with the basic assumptions of the influencing factors of flipped classroom in universities and the collected sample data, the model is constructed using Amos software. It is preliminarily assumed that there is no influence relationship between the four influencing factors, and the initial model that affects the flipped classroom in colleges and universities is established, as shown in Figure 1.

## 4.2. Model Fitting

### 4.2.1. Model Fitness Test

In order to determine the quality of the model, Amos software was used to carry out the first model fitting on the structural model of flipped classroom in universities, and the fitness test results as shown in Table 4 were obtained. It can be seen that in the initial model, only PGFI and PNFI indicators met the standard, and most indicators failed to meet the requirements, such as the absolute fitting indicators  $X^2/df$  is 4.612, which fails to meet the criterion of  $<3$ ; The NFI, TLI and CFI of the value-added fitting indicators were 0.819, 0.830 and 0.851 respectively, which failed to meet the judgment criteria of  $>0.9$ . Therefore, the initial model needs to be further modified.

Table 4: Fitness test results

Index	Absolute fitting index			Value-added fitting index			Simple fitting index	
	$X^2/df$	GFI	RMSEA	NFI	TLI	CFI	PGFI	PNFI
Judgment standard	$<3$	$>0.8$	$<0.1$	$>0.9$	$>0.9$	$>0.9$	$>0.5$	$>0.5$
Initial model	4.612	0.730	0.131	0.819	0.830	0.851	0.577	0.715
Revised model	2.466	0.855	0.083	0.907	0.931	0.942	0.651	0.763

### 4.2.2. Model Correction

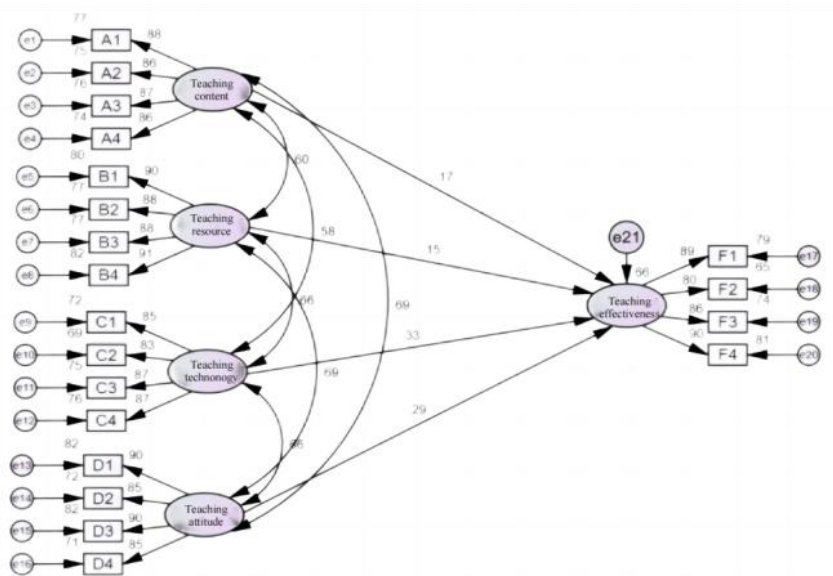


Figure 2: Path relationship of flipped classroom in universities

Because the sample data has passed a number of scientific tests, the reliability and validity of the questionnaire are good, and the observation variables of the latent variables do not need to be modified, so the covariance correction index MI obtained from the operation of Amos model is modified to make the teaching content and teaching resources, teaching content and teaching

technology, teaching content and teaching attitude, teaching resources and teaching attitude, teaching resources and teaching technology and teaching attitude related, Get the optimal model, as shown in Figure 2, and re-fit the model. The fitting value of the optimal model is shown in Table 4. It can be seen that after model correction  $X^2/df$ , NFI and TLI all meet the judgment criteria of the model, and other indicators have been improved to a certain extent, so the modified SEM model has strong rationality.

### 4.2.3. Hypothesis Test

The structural equation model usually uses the maximum likelihood method to estimate the coefficient value of each path of the model, uses the standardized regression coefficient output by Amos software, and combines the standard error of the estimated value (S.E.), the critical ratio (C.R.) obtained by dividing the value of the regression coefficient by the standard error of the estimated value, and the hypothesis test value (P) to judge whether the hypothesis test of the structural equation model is significant, so as to judge whether the hypothesis relationship of the model is tenable.

Table 5: Path coefficient of influencing factor model of flipped classroom teaching effect in universities

Path			Estimate( $\beta$ )	S.E.	C.R.	P	Inspection results
Teaching effectiveness	<--	Teaching content	0.177	0.074	2.391	0.017	significant
Teaching effectiveness	<--	Teaching resource	0.143	0.071	2.015	0.044	significant
Teaching effectiveness	<--	Teaching technology	0.349	0.08	4.386	***	significant
Teaching effectiveness	<--	Teaching attitude	0.294	0.087	3.376	***	significant

Source: arranged by the author

Table 5 shows that the P values of H3 and H4 are significant at the level of 0.01, and the P values of H1 and H2 are 0.017 and 0.044, respectively, which are less than 0.05, that is, significant at the level of 0.05. Therefore, the standardized path coefficient values of the four hypotheses are at the significant level, and the four path coefficients are  $\beta$ . The values are all positive, indicating that the direct effect of the latent variable on the explained variable is positive, which is consistent with the hypothesis put forward at the beginning of the construction of the structural equation model of the factors influencing the flipped classroom in colleges and universities. The model conforms to the fitness criteria, and the research hypothesis is supported.

## 5. Result Analysis

### 5.1. The Relationship Between the "Internet + Moocs" Teaching Content of Intelligent Education and the Teaching Effect of Flipped Classroom in Universities

The indirect influence effect is the indirect influence of multiple potential variable paths between a potential variable and the explained variable. It is expressed by the highest product of the path coefficients. [8] The total influence effect is the sum of the direct influence effect and the indirect influence effect. Therefore, the total effect of the "Internet + MOOCs" teaching content on the teaching effect of the flipped classroom in universities is 0.37, which means that the impact of the "Internet + MOOCs" teaching content on the teaching effect of the flipped classroom in universities will increase by 0.37 units each time the "Internet + MOOCs" teaching content is increased by 1 unit, indicating that the "Internet+ MOOCs " teaching content has a large positive impact on the teaching effect of the flipped classroom in colleges and universities. Assumption H1 is verified.

Teaching content design (0.88) and teaching content teaching (0.87) among the indicators of "Internet + MOOCs" teaching content have a greater impact. In terms of teaching content, in the process of using "Internet + MOOCs" to improve the teaching effect of flipped classroom in universities, attention should be paid to strengthening the two links of teaching content design and teaching content.

## **5.2. The Relationship Between the "Internet + Moocs" Teaching Resources of Intelligent Education and the Teaching Effect of Flipped Classroom in Universities**

There are one direct path and seven indirect paths for the influence of "Internet+ MOOCs" teaching resources of intelligent education on the teaching effect of flipped classroom in universities. The direct effect of "Internet+ MOOCs" teaching resources on the teaching effect of flipped classroom in universities is 0.15, and the indirect effect of the seven indirect paths is 0.22. Therefore, The total effect of the " Internet+ MOOCs " teaching resources on the teaching effect of the flipped classroom in universities is 0.37, which means that the impact of the " Internet+ MOOCs " teaching resources on the teaching effect of the flipped classroom in universities will increase by 0.37 units for each unit increase, This shows that the " Internet+ MOOCs " teaching resources of smart education also have a relatively large positive impact on the teaching effect of flipped classroom in colleges and universities. Hypothesis H2 is verified. The resource availability (0.90) and resource utilization (0.91) of "Internet + MOOCs" teaching resources have a greater impact, which indicates that the focus of the work is to focus on the availability and utilization of teaching resources when designing "Internet + MOOCs" teaching resource for smart education.

## **5.3. The Relationship Between the "Internet + Moocs" Teaching Technology of Intelligent Education and the Teaching Effect of Flipped Classroom in Universities**

There are 1 direct path and 7 indirect paths for the influence of "Internet + MOOCs" teaching technology on the teaching effect of flipped classroom in universities. The direct influence effect of "Internet + MOOCs" teaching technology on the teaching effect of flipped classroom in universities is 0.33. Among the seven indirect paths, the highest indirect influence effect is "teaching technology → teaching attitude → teaching effect", and its indirect influence effect is 0.19. Therefore, The total effect of the "Internet + MOOCs" teaching technology on the teaching effect of the flipped classroom in colleges and universities is 0.52, which means that the impact of the "Internet + MOOCs" teaching resources on the teaching effect of the flipped classroom in universities will increase by 0.52 units each time the teaching resources are increased by 1 unit, It shows that the teaching technology of "Internet + MOOCs" has a great positive impact on the teaching effect of flipped classroom in universities, assuming that H<sub>3</sub> is verified. Among the indicators of "Internet + MOOCs" teaching technology, the quality of Q&A interaction (0.87) and the quality of course arrangement (0.87) have the greatest impact. In the process of combining "Internet + MOOCs" teaching technology with flipped classes in universities, we should vigorously improve the quality of Q&A interaction and course arrangement.

## **5.4. The Relationship Between the "Internet + Moocs" Teaching Attitude of Intelligent Education and the Teaching Effect of Flipped Classroom in Universities**

There are one direct path and seven indirect paths for the influence of the "Internet + MOOCs" teaching attitude on the teaching effect of the flipped classroom in universities.<sup>[9]</sup> The direct effect of the "Internet + MOOCs" teaching attitude on the teaching effect of the flipped classroom in universities is 0.29. Among the seven indirect paths, the highest indirect effect is "teaching



attitude→ teaching technology→ teaching effect", and its indirect effect is 0.22. Therefore, The total effect of the "Internet + MOOCs" teaching attitude on the flipped classroom teaching effect in universities is 0.51, It means that the influence of "Internet + MOOCs" teaching attitude on the teaching effect of flipped classroom in universities will increase by 0.51 units each time the teaching attitude of "Internet + MOOCs" is improved, which indicates that the teaching attitude of "Internet + MOOCs" has a great positive impact on the teaching effect of flipped classroom in universities. Assuming that H<sub>4</sub> is verified. Among the indicators of teaching attitude of "Internet + MOOCs", the enthusiasm of lecturers (0.90) and the interaction of lecturers (0.90) have the greatest impact. The positive attitude of teachers in class is an important prerequisite for improving the teaching effect of flipped classroom in universities, while the full and effective interaction between teachers and students in class has played a leading role in improving the learning effect of students<sup>[10]</sup>, leading the teaching effect of flipped classroom in universities to a higher level.

## 6. Conclusions

This paper focuses on the advantages of "Internet + MOOCs" of intelligent education, combines the advantages of flipped classroom over traditional teaching mode to explore the compatibility of the combination of the two. The following conclusions: First, from the structural model, we can see that among the influencing factors of intelligent education "Internet + MOOCs" on the flipped classroom in universities, the four elements of teaching content, teaching resources, teaching technology and teaching attitude are interlinked and interact, which have a positive impact on the teaching effect of the flipped classroom in universities. Second, the teaching form of "Internet + MOOCs" of intelligent education can effectively promote the development and improvement of flipped classroom in universities, such as providing flexible learning space for students; Use MOOCs resources to help students fully preview before class and stimulate interaction between teachers and students in class; Use the targeted analysis of high and new technologies such as big data to tailor curriculum resources for students. Third, from the perspective of the overall impact of the path, the impact on the flipped classroom in universities is in the order of teaching technology, teaching attitude, teaching content and teaching resources from large to small. In the process of promoting the combination of "Internet + MOOCs" and continuing education flipped classroom, the priority of resource allocation can be reasonably adjusted accordingly.

First, accelerating the popularization of digital applications in universities, embedding new generation digital technologies such as big data, internet, artificial intelligence, etc. on the basis of the advantages of flipped classes in universities, and promoting the digitalization of courses and services are the fundamental guarantee to promote the promotion of flipped classes in universities. Second, while using the "Internet + MOOCs" to promote the development of flipped classrooms in colleges and universities, the advantages of traditional flipped classrooms are also indispensable. We should maintain the enthusiasm of the teaching team and the seriousness of lesson preparation in all links, strengthen the inspiration to students, and give play to the interaction between teachers and students in flipped classrooms. Third, teaching content, teaching resources, etc., as curriculum aids, should closely focus on technology promotion and attitude maintenance, take students as the basic point, and take the transformation of knowledge achievements as the purpose, so as to promote the fundamental improvement of China's continuing education.

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