

THE SATISFACTION OF FLIPPED CLASSROOM: A PERSPECTIVE OF STUDENT'S EXPERIENCE

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ABSTRACT

Based on the existing literature, this paper studies the satisfaction of flipped classroom from the perspective of student's experience. Based on the core framework of customer satisfaction model, this paper constructs a satisfaction model of flipped classroom from the perspective of students' experience. Through Factor Analysis of evaluation indicators, it shows that the satisfaction of flipped classroom is affected by four common factors: professional quality (F_1), learning process (F_2), teaching effect (F_3) and teaching level (F_4). The results show that flipped classroom satisfaction has a high and low positive correlation with teaching effect (F_3) and teaching level (F_4) respectively. Suggestions are put forward that the teacher is the key, the communication platform is the driving force, and the reasonable evaluation is the lever, so as to provide ideas for improving the overall satisfaction of flipped classroom.

Keywords: *Student experience; flipped classroom satisfaction; Factor Analysis; Logistic Regression Analysis.*

INTRODUCTION

Flipped classroom is a new teaching model in which teaching videos impart knowledge, students watch the videos before class and internalize knowledge in class. By reversing the process of after-class learning and internalization in class, it changes the traditional teaching (Li, 2015). Flipped classroom originated from middle school teachers in Colorado, USA. In 2007, Aaron Sam and Jonathan Berman John Bergmann made videos of their lectures, arranged for students to watch self-study before class, and tested self-study effect and individual guidance in class (Xia & Luo, 2017). By 2011, flipped classroom mode became popular all over the world. Under the guidance of the strategy of "rejuvenating

the country through science and education and strengthening the country through talents", heuristic and exploratory teaching has been favored by the educational circles, thus giving birth to the domestic flipped classroom teaching model (Si et al., 2020).

At the practical level, in 2011, Chongqing Jukui Middle School adopted the information technology integration strategy, introduced the "flipped classroom" teaching mode, and implemented the new classroom reform (Bi, 2015). In 2013, Nanjing Jiulong Middle School selected six subjects of Arts and Science to explore and practice the "flipped classroom" teaching mode (Chi, 2015). Academic research on flipped classroom has been growing rapidly since 2013. From the perspective of research objects, the research of flipped classroom in secondary education is relatively high, the attention of primary education is relatively low, and the attention of vocational education and higher education is in the middle (Long, 2016). For example, Yan (2018) analyzed the combination of micro class and high school mathematics flipped classroom, and formed an effective high school mathematics flipped classroom teaching mode through curriculum design and teaching practice. From the research dimension, we tend to study the flipped classroom of single course. For example, Wan (2016) found that the flipped classroom teaching mode has been approved by most students, and the learning effect, learning process and learning attitude have been improved. In terms of research content, most of them focus on the theoretical research on the value, connotation, characteristics and significance of flipped classroom. In addition, practical teaching and case analysis of flipped classroom are also quite concerned, while the evaluation, thinking and technical research of flipped classroom are relatively less concerned. For example, Chen (2017) used factor analysis to study the flipped classroom satisfaction of sampling technology course in Shangluo University through questionnaire survey.

The research on flipped classroom is increasingly rich, but it is still in the exploratory stage, and some scholars even have doubts. For example, Yin (2014) thinks that the degree of education informatization in China is not high, and the comprehensive promotion of flipped classroom will be hindered. Tian (2015) pointed out that the flipped classroom teaching mode has the following problems: heavy workload of teachers, lack of autonomy of students' extracurricular self-study, difficult to control the classroom, imperfect teaching evaluation system and so on. The digital platform needs to be further improved. Some studies also point out that flipped classroom model is not significant in classroom adaptation, new teaching model can improve teaching methods, but students' satisfaction will not necessarily improve (Wei, 2019; Wang, 2014).

Flipped classroom is a new teaching mode based on information technology. Influenced by many factors such as the nature of the course, the object of implementation, the technology platform and the evaluation system, it is difficult to measure the implementation effect of flipped classroom teaching mode from the micro perspective of single course and small sample object. Based on the whole school flipped classroom, from the macro level, this study uses factor analysis method to explore the satisfaction and influencing factors of flipped classroom. Based on the logistic regression model, it further clarifies the factors influencing the satisfaction of flipped classroom, and then puts forward targeted improvement measures to promote the further development of the whole school flipped classroom.

RESEARCH METHODS

Data Sourcing

In this study, Huanggang Normal University to carry out flipped classroom reform in the class as the research object, covering 21 courses such as economics and management, art, information and so on. Through discussion and questionnaire survey, the questionnaire design widely solicits the opinions of experts, teachers, students and so on, carries on the inspection and the revision, including three parts: the overall satisfaction, the influence factor evaluation and the basic information, uses the Likert five level scale method to evaluate, namely "very satisfied", "relatively satisfied", "general", "dissatisfied", and "Very dissatisfied" is represented by 5, 4, 3, 2 and 1 respectively. By using the Purposive Sampling Method, 500 participants were selected in this study. According to Krejcie and Morgan (1970), a minimum of 384 samples is sufficient enough for a population that more one million. Therefore, a total of 500 questionnaires were distributed, 473 of which were returned, and 439 of which were valid, with a return rate of 93%.

Data Processing

All data collected in this study were processed using SPSS version 22.0. For the missing values in the original questionnaire, the table deletion method is used, that is, if there is a missing item, the record will be deleted, and finally 419 valid data will be obtained.

Data Analysis

In this study, Factor Analysis Method is used to make statistics and analyze on the evaluation elements. The complex variables are extracted by dimension reduction, and the preliminary design variables are modified to form a three-dimensional evaluation index system of flipped classroom satisfaction. Based on this, through the Logistic Analysis Method, to analyze the influence of each common factor.

Determination of Common Factor Weight

When calculating the weight of each common factor (W_i), the variance contribution rate of each common factor is normalized to get the weight of each common factor.

$$W_i = X_i / \sum X_i \quad (1)$$

Where X_i is the variance contribution rate of the common factor and $\sum X_i$ is the cumulative variance contribution rate.

The Factor Model of Influencing the Satisfaction of Flipped Classroom

Logistic regression model was used to analyze the correlation between flipped classroom satisfaction and the influencing factors. The formula of logistic regression model is as follows:

$$\text{Logit } P = \alpha + \beta_1 * F_1 + \beta_2 * F_2 + \dots + \beta_m * F_m \quad (2)$$

P is the dependent variable of flipped classroom satisfaction, α is a constant, β is the corresponding coefficient of each influencing factor, *F_m* is the different influencing factor.

Variable Selection

Learning satisfaction is an important index to measure teaching experience in Colleges and universities (Li & Pei, 2018). Based on the core framework of American Consumer Satisfaction Index (ACSI) model (Wei, 2019), this study constructs a flipped classroom learning satisfaction model from the perspective of student experience, which covers four potential variables: satisfaction, value perception, quality perception and loyalty. Among them, satisfaction is the objective variable, value perception and quality perception are reason variables, loyalty is the result variable. Under each potential variable, the evaluation indicators are designed to reflect the connotation of the potential variables, so the evaluation index interpretation table as shown in Table 1 is formed to measure the flipped classroom satisfaction.

Table 1: Definition of Evaluation Index

Latent variable	Connotation	Evaluation	Indicator assignment specification
satisfaction level	Students' psychological feeling and comprehensive evaluation of flipped classroom teaching mode	How much do students like flipped classroomX ₁	Like (5), like (4), average (3), dislike (2), dislike (1)
		The degree of problem solving in classX ₂	Completely solved (5), mostly solved (4), generally (3), a small part solved (2) not solved at all (1)
		Classroom atmosphereX ₃	Very active (5), more active (4), average (3), less active (2) very dull (1)
Perception of quality	Under the flipped classroom mode, the actual feelings of students in the learning process can be reflected from the aspects of "teaching" and	The cost of extracurricular timeX ₄	Very much (5), more (4), average (3), less (2) basically no time (1)
		Degree of group cooperationX ₅	Very close (5), relatively close (4), average (3), less close (2) basically uncooperative (1)
		The difficulty of homeworkX ₆	Very difficult (5), more difficult (4), average (3), easier (2) very easy (1)

	"learning", such as teaching design, extracurricular learning behavior, classroom performance and so on	WorkloadX ₇ The degree of perfection of curriculum platformX ₈ Adequacy of teaching contentX ₉	Very large (5), large (4), average (3), small (2) very small (1) Very perfect (5), more perfect (4), average (3), less perfect (2) extremely imperfect (1) Very sufficient (5), more sufficient (4), general (3), less sufficient (2) extremely insufficient (1)
		The attraction of teaching methodsX ₁₀	Very attractive (5), more attractive (4), average (3), less attractive (2) very unattractive (1)
Perception of value	Whether the time and energy invested by the students and the learning effect are worth it can be measured from the aspects of self-learning ability, professional knowledge mastery degree, learning interest and professional emotion.	Degree of professional knowledgeX ₁₁ Learning interestX ₁₂ Feelings for majorsX ₁₃ Self-learning abilityX ₁₄	Very good (5), good (4), general (3), poor (2), extremely poor (1) The improvement is very obvious (5), the improvement is more obvious (4), average (3), not obvious (2), no improvement at all (1) Obviously (5), strengthened (4), generally (3), only a little (2), no reinforcement (1) Very fast progress (5), relatively fast progress (4), average (3), slow progress (2) no progress at all (1)
Degree of loyalty	Psychological commitment formed on the basis of flipped classroom satisfaction, that is, continuing to choose flipped classroom mode learning or recommendation willingness.	Opinions on flipped classroom for other coursesX ₁₅	Very willing (5), more willing (4), average (3), less willing (2), very unwilling (1)

MODEL ANALYSIS

Reliability and Validity Test

In this study, the effective data after processing were analyzed by Factor Analysis and SPSS 22.0. The results of Reliability Analysis show that the Cronbach's Alpha Coefficient based on the standardized term is 0.816, which shows that the questionnaire has high reliability and high use value. Meanwhile, the Validity Test shows that KMO is 0.824, which shows that there is no significant difference in the correlation degree of each variable. The data after processing is suitable for Factor Analysis. Bartlett Spherical Test Approximate Chi Square is 4049.151 and the probability of significance is 0.000 (< 0.05), indicating that there are common factors among the correlation matrices of the original variables, which is suitable for Factor Analysis.

Extracting Common Factors

Principal Component Analysis is used to extract common factors (as shown in Table 2). Four common factors are extracted by Variance Maximization Rotation. The cumulative variance contribution rate is 76.899%, indicating that the original variable information is less lost. The lowest factor variance extraction of 15 evaluation indexes is 0.670 (classroom question solving degree), indicating that the Factor Analysis results are reliable. According to the factor load after rotation, the variance contribution rates of the four common factors are 21.663%, 20.707%, 19.999% and 14.531% respectively. Among them, the common factor F_1 reflects the students' awareness of the improvement of knowledge, skills, emotion, learning interest and self-learning ability, so it is named "professional quality"; Common factor F_2 reflects students' perception of extra-curricular time investment, group cooperation and homework completion in flipped classroom mode, which is named "learning process"; The common factor F_3 is embodied in the overall cognition and psychological identity of students to carry out the flipped classroom course, which is named "teaching effect"; The common factor F_4 reflects students' perception of teaching video, network platform, teaching content and teaching methods, so it is named "teaching level".

Table 2: Factor Analysis

First level target	Secondary indicators					Third level indicators			
	Common factor	Characteristic value	Cumulative variance contribution rate	Mean value	Variance	Index	Factor load	Mean value	Variance
Satisfaction of flipped classroom (3.49775)	F ₁ Professionalism	3.249	21.663%	3.2082	.577	Master degree of professional knowledgeX ₁₁	0.876	3.1623	.634
						Interest in learningX ₁₂	0.877	3.3341	.548
						Feelings for majorsX ₁₃	0.882	3.0979	.495
						Opinions on flipped classroom for other coursesX ₁₄	0.943	3.2387	.603
	F ₂ Learning process	3.106	42.370%	3.0728	.568	The cost of extracurricular timeX ₄	0.928	3.0525	.562
						Degree of group cooperationX ₅	0.853	3.1313	.578
						The difficulty of homeworkX ₆	0.845	3.2076	.519
						WorkloadX ₇	0.822	2.8998	.564
	F ₃ Teaching effect	3.000	62.368%	3.6223	.555	How much students like flipped classroomX ₁	0.903	3.6563	.599
						The degree of question solving in classX ₂	0.812	3.5704	.480
						Classroom atmosphereX ₃	0.809	3.6277	.531
						Opinions on flipped classroom for other coursesX ₁₅	0.895	3.6348	.610

F ₄ Teaching level	2.180	76.899%	4.0867	.555	The degree of perfection of curriculum platformX ₈	0.813	4.0549	.511
					Adequacy of teaching contentX ₉	0.831	4.1480	.504
					Attraction of teaching methodsX ₁₀	0.805	4.0573	.647

Analysis of the Satisfaction Degree of the First Level Target

According to the results of the Factor Analysis, 15 evaluation indexes are recombined according to the extracted common factors to construct a 1-4-15 three-dimensional flipped classroom evaluation index system (Table 2). Further descriptive statistical analysis of the average value of each index in SPSS 22.0 shows that the overall satisfaction of flipped classroom is about 3.5. Tosun (2002) pointed out that the average value of 1-2.4 is low, 2.5-3.4 is neutral and 3.5-5 is high. In this case, the statistics show that the overall evaluation of students' satisfaction with flipped classroom is positively high. Therefore, the teaching mode can be further promoted in schools.

Second Grade Index Satisfaction Analysis

In the second level indicators, the mean values of F₃ and F₄ factors are in the approval range, while the mean values of F₁ and F₂ factors are in the neutral range, which means that students have higher satisfaction with teaching effect and teaching level, and have a neutral attitude towards professional quality and learning process. It shows that students have a good evaluation on the results of flipped classroom, but they have a reservation on the process evaluation.

Third Grade Index Satisfaction Analysis

Through the analysis of the single factor mean value of the three-level indicators, the students' satisfaction with the factors such as the perfection of curriculum platform, the sufficiency of teaching content, the attraction of teaching methods, the degree of liking, the degree of solving classroom questions, the classroom atmosphere, and the willingness of other courses to carry out flipped classroom is higher, and the mean value is above 3.5. That is to say, students think that teachers are fully prepared to carry out flipped classroom content, and pay attention to the improvement of curriculum platform and innovation of teaching methods, which is consistent with the teaching concept of "Century Huang Teacher" (Wei, 2019). Furthermore, most students can accept two courses and adopt flipped classroom teaching mode at the same time.

Among the single factors of the third level indicators, the average value of extra-curricular time cost, group cooperation degree, homework difficulty, homework volume, professional knowledge mastery degree, learning interest, professional emotion, self-learning ability and other factors is in the

neutral range of 2.8-3.3. Among them, the satisfaction evaluation of the amount of homework is the lowest. Through the discussion survey, the students' feedback that the amount of homework in flipped classroom is large, and the extra-curricular time is spent more. Some students' group homework is completed by "sitting on the villa system". The reason is that teachers in flipped classroom receive relevant training, and know that the difficulty of assignment should not be too large, but the amount of homework and the way of completion are not well controlled, so that a small number of students have resistance to the flipped classroom. In order to improve the effect of students' extracurricular learning, teachers need to strengthen the analysis of learning situation, understand students' learning situation, and reasonably arrange homework.

Regression Analysis of the Second Grade Index

In order to further analyze the influence of common factors on flipped classroom satisfaction, the Regression Analysis was made by taking the variable "total satisfaction of flipped classroom" F as the dependent variable, and the factor scores of four common factors: F₁, F₂, F₃ and F₄ as independent variables.

After Logistic Regression Analysis (see Table 3), the judgment coefficient adjusted R² = 0.834, and the fitting degree was higher, and the variables not explained were less. The probability of the regression equation significance test is 0.000 (< 0.05). The linear relationship between the explanatory variable and the explanatory variable is significant, and the linear equation can be established. The tolerance is greater than 0.1 and the Variance Expansion Factor (VEF) is less than 5, which indicates that there is no collinearity problem among the variables of the equation. The significance of F₁ and F₂ is greater than 0.05, and the re-modeling should be eliminated and a better regression equation can be established by formula (3):

$$F = 3.656 + 0.699F_3 + 0.103F_4 \quad (3)$$

Table 3: Regression Analysis on the Satisfaction of Flipped Classroom and the Second Grade Index

Model	Nonstandard coefficient		Standardization coefficient	t-value	Conspicuousness	Collinearity statistics	
	B	Std. Error	Beta	t	Sig.	Tolerance	VEF
Constant term	3.656	.015		236.820	.000	1.000	1.000
F ₃	.699	.015	.903	45.249	.000	1.000	1.000
F ₄	.103	.015	.134	6.689	.000	1.000	1.000

The two common factors of teaching effect factor (F_3) and teaching level factor (F_4) are positively correlated with the explained variable "overall satisfaction of flipped classroom", which indicates that students' satisfaction evaluation of flipped classroom is more based on learning effect experience. In order to improve the overall satisfaction of flipped classroom, higher requirements are put forward for teachers. Among them, the teaching effect is highly correlated with the overall satisfaction. On one hand, with each improvement, the overall satisfaction of flipped classroom will increase by 0.699 units, that is, the teaching effect will greatly affect the overall evaluation of students on flipped classroom. On the other hand, a low correlation between teaching resources and overall satisfaction, and the overall satisfaction of flipped classroom increases by 0.103 units with each unit increased. Therefore, the teaching effect is an important problem to be solved. The results of this study shows that when students evaluate the satisfaction of flipped classroom, they think that as long as the flipped classroom can bring them better learning experience and learning effect, they will agree with the flipped classroom teaching mode, and even are willing to try the flipped classroom mode in other courses.

There is no obvious linear relationship between the overall satisfaction of flipped classroom and the factors of professional quality (F_1) and learning process (F_2). Professional quality belongs to the level of value perception, and the value perception of process level is difficult to have obvious effect in a short time. Although the teaching process takes up a lot of extra-curricular time for students to complete their homework, but the students' evaluation is still rational. They think that as long as the effect is good, it has little impact on the overall evaluation, which may be affected by the traditional education "Score Theory" (Wei, 2019).

Regression Analysis of the Third Grade Index

In order to further clarify the influence of the third level indicators on the second level indicators, the factor scores fac_3 and fac_4 of F_3 and F_4 were taken as dependent variables, and the corresponding third level indicators were taken as independent variables for Regression Analysis. The results are shown in Table 4.

Table 4: Regression Analysis of the Second Grade Index and the Third Grade Index

Impact factors	R ²	Conspicuousness	Structural equation
Teaching effect F_3	0.987	0.000	$F_3 = -5.591 + 0.365X_1 + 0.4X_2 + 0.349X_3 + 0.430X_{15}$
Teaching level F_4	0.912	0.000	$F_4 = -6.161 + 0.523X_8 + 0.512X_9 + 0.472X_{10}$

Influence on Teaching Effect

There is a moderate positive correlation between flipped learning's liking degree, classroom question solving degree, classroom atmosphere and other courses' willingness to carry out flipped classroom and teaching effect. The results show that students not only pay attention to the flipped process feeling,

such as the active degree of classroom atmosphere, but also pay attention to the result feeling. Through the flipped teaching mode, only when students' questions before class are solved, they will like this mode, and they are willing to try other courses to carry out flipped classroom. The flipped classroom teaching mode which pays equal attention to form and content, process and result will improve the teaching effect.

Influence on Teaching Level

There is a moderate positive correlation between the perfection of curriculum platform, the sufficiency of teaching content and the attraction of teaching methods and teaching resources. Influenced by the aura of "Huanggang Normal University with a hundred year history", students have a high evaluation of teachers themselves. However, flipped classroom is a new teaching mode which combines traditional teaching with information technology. While students attach importance to classroom platform, teaching content and teaching methods, teachers are faced with higher challenges from traditional to new technology.

CONCLUSION AND SUGGESTION

Leading by Teachers is the Key

The common factors F_3 and F_4 extracted by factor analysis are positively correlated with the overall satisfaction of flipped classroom, which shows that students valued the experience of learning effect, and good learning effect depends on the design and guidance of teachers. As the leader of flipped classroom, the main role of teachers should be reflected in stimulating students' thinking and guiding high-level thinking. Therefore, it is particularly important to grasp the "appropriate content" of curriculum design and the "individual breakthrough" of teaching design. In view of the students' negative evaluation of the extra-curricular time cost and the amount of homework in the learning process, teachers need to deeply analyze the characteristics of the course, knowledge objectives, reasonably choose the content with discussion space to flip, arrange the homework that can cultivate and improve students' high-level thinking based on the learning situation, and grasp the balance between stimulating students' interest and increasing the workload of homework. The content of curriculum design should be appropriate. Research and practice in western countries show that the time when students need teachers most is not knowledge explanation, but when they encounter difficulties in learning (Bergmann & Sams, 2012). The teaching design needs to do a good job in the introduction before class, guide students to self-study according to the teaching objectives, pay attention to the problems existing in the process of students' self-study, and "break through each one" pertinently in the classroom. Only when the doubts existing in students' learning process are solved, can students think it is an effective turnover.

Communication Platform is the Motive Power

According to Walker et al (2011), the essence of flipped classroom is the process of two-way interaction and communication in teaching. Based on the Factor Analysis, the situation of extra-curricular learning and homework completion in the learning process, the classroom atmosphere

and the degree of question solving in the teaching effect all reflect that communication is an important factor to measure students' quality perception and satisfaction. The communication of flipped classroom includes online communication and offline communication, but only providing students with a platform for communication and display is the inexhaustible motivation to stimulate students' active learning. Online communication relies on the convenient online learning platform of colleges and universities. We can learn from cloud online, FLN, Qingguo Classroom and other platforms (Wei, 2019). It is better to build a self-built MOOC platform based on the nature of the course, the characteristics of students, flipped content and so on, so as to achieve targeted. Offline communication can enable students to discuss in class, share learning achievements, provide exhibition opportunities through debate meeting, report meeting, assignment exhibition and other platforms. Relying on teaching design, it can guide students to ask questions, investigate questions, and solve questions, and form a classroom forced mode through interlocking communication and exhibition.

Reasonable Evaluation is a Lever

The evaluation of learning effect in flipped classroom requires the combination of process and summative assessment, qualitative and quantitative evaluation, and general and individual evaluation (Zhu & Zhu, 2013). A reasonable evaluation system is an effective lever to ensure the implementation of flipped classroom. It is necessary to change the traditional "Score Theory" evaluation concept, pay attention to the role of process evaluation in flipped classroom, determine the weight between the learning process and the test results according to the nature of the course, and formulate evaluation standards for the communication and display in the learning process and the completion of homework. According to individual differences, open projects are designed and additional points are added to cultivate students' personalized development. Through the multi-dimensional and quantifiable evaluation system, we can guide students to improve radiantly, gradually enhance their professional emotion and improve their professional quality.

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