Constructing and Realizing a Model of College Students' Learning Engagement Strategy Based on Factor Analysis
--A Case Study of Students Majoring in Advertising in Applied Universities

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Abstract
The innovative cultivation of applied media talents aims to promote profession optimization, consolidate curriculum systems, build integrated faculty, improve cultivation quality, and realize collaborative education through the guide of value. In this paper, a 5-point Likert scale is used to explore the influence relationship by quantifying the influencing factors of engagement and basic information of learners in the subsequent data analysis. The five main factors in the paper include students, teachers, learning resources, learning platform, and learning evaluation. With a study on the current situation and influencing factors of student engagement in the blended learning environment, the SPSS software is used in the validity analysis to ensure the correctness and authenticity of this study, which directly impact the next inferential stage. Strategies are proposed to enhance learning engagement.

Keywords: *factor analysis, blended learning, learning engagement strategy model*

1.INTRODUCTION

In the process of blended learning, the main teaching form is a combination of online and offline teaching, in which students are the main body and teachers play the leading role, and the direct motivation of students' learning effect comes from the degree of students' participation in class [1]. In terms of the teaching method of blended learning, the innovation model of talents cultivation is actively explored and applied by universities and colleges. As the education reform progresses, the problems of the blended learning model are gradually discovered. Based on this, this paper conducts a survey of students majoring in advertising in a blended learning environment at Zhengzhou Sias College as per the learners' engagement. Useful attempts are made to enhance student learning engagement in the blended teaching model, and different paths are provided to improve students' learning performance and teaching quality.

2.QUESTIONNAIRE DESIGN

The design of the questionnaire in this paper is carried out in the following four aspects: survey purpose, survey subjects, survey method, and questionnaire design.

2.1. Survey purpose

In order to understand the relationship among the influencing factors of students' learning engagement in the blended learning environment, this paper not only collects the basic information of learners (such as age, gender, grade level, etc.), but also designs and analyzes in detail the influencing factors of learning engagement, the current situation, and their relationship [2].

2.2. Survey subject

The survey subjects involved in this paper are students majoring in advertising in the 1st semester of the academic year 2021-2022 in Zhengzhou Sias College. A total of 731 questionnaires were distributed,

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and 517 valid questionnaires were collected.

2.3. Survey method

The questionnaires were distributed mainly through Xuexitong online by the teachers who shoulder teaching in each grade. It lasted for four months (September 2021 to December 2021).

2.4. Questionnaire design

Based on the structure of blended learning, learning engagement is divided into online and offline parts. The questionnaire is designed to obtain online learning engagement and offline learning engagement as the main basis. The influencing factors and basic learner information will be quantified in the subsequent data analysis to explore the influencing relationships. The 5-point Likert scale is used for influencing factors.

3.DATA STATISTICS AND ANALYSIS

Firstly, the questionnaire is tested for credibility and validity to confirm the credibility of the statistical data and to ensure the integrity of the data analysis of the learning engagement. Secondly, the influence of basic student information on learner engagement is learned. Third, statistical analysis is conducted regarding online and offline learning engagement. Fourth, factor analysis is used to determine the influencing factors of learning engagement. Fifth, regression analysis is used to study the correlation among the factors influencing learning engagement. The statistical analysis software is SPSS 24.

3.1. Validity Analysis

The main purpose of the validity analysis using SPSS is to ensure that this study is correct and true, which has a direct impact on the next inferential link.

Table 1 Questionnaire of KMO and Bartlett's Test

		N	%
Observed values	Valid	517	100
	Excludeda	0	0
	Total	517	100
All variables based on the program are eliminated.			

Table 2 Summary of observed values

KMO and Bartlett's Test		
Appropriateness of Kaiser-Meyer-Olkin measurement of sampling		0.933
Bartlett's spherical test	chi-square	22113.115
	df	1679
	Significance	0

Content validity tests are usually measured using KMO (Kaiser-Meyer-Olkin) and Bartlett Test. When KMO>0.8, the structural validity is good. When KMO>0.6, the structural validity is acceptable. When KMO<0.5, the structural validity is poor. Table 1 shows the overall external validity of the questionnaire. With KMO=0.933, it indicates that the correlation between the internal variables of the questionnaire is high and common factors exist among the variables, which is suitable for factor analysis.

3.2. Reliability analysis

The common test for credibility in questionnaire survey design is L.J. Cronbach's α coefficient. α coefficient interval distribution and acceptance are: α coefficient < 0.5, questionnaire is not used; α coefficient < 0.6, questionnaire needs to be redesigned; 0.6 < α coefficient < 0.7, questionnaire needs to be modified to add items or modified; α coefficient = 0.7, minimum acceptable boundary; 0.7 < α coefficient < 0.8, good. 0.8<α coefficient <0.9, very good; α coefficient >0.9, extremely good. The reliability analysis of this survey study is as follows.

3.2.1. Overall reliability analysis of the questionnaire

The number of valid observation samples in Table 2 is 517, which shows that there are no missing data from the questionnaire, and all of them are valid.

Table 3 Reliability statistics

Cronbach's Alpha	Cronbach's Alpha based on standardized items	Number of items
0.913	0.927	37

In Table 3, the α coefficient > 0.9 in Table 3 and reached 0.913, which indicates that the reliability of the questionnaire is good.

3.2.2. Reliability analysis of factors influencing learning engagement

Table 4 Reliability analysis of the scale of factors influencing learning engagement

Cronbach's Alpha	Cronbach's Alpha based on standardized items	Number of items
0.971	0.971	24

In Table 4, the variable α coefficient of the factors influencing learning engagement = 0.971, and it indicates high consistency and good reliability of the variables.

The validity and reliability values of the questionnaire reached a good level, and the reliability of the questionnaire and the correlation of the variables

within the questionnaire are high, so the next statistical analysis of the data can be conducted for the questionnaire data.

3.3. Basic information of students

Through the statistical analysis of the basic information of students in the sample, the percentage of students in the third year of college among the students participating in the study is 74.51%, and that of the remaining grades is 25.49%. The percentage of female students among the students participating in the study is 75.12%. Considering the characteristics of journalism and communication majors, the ratio of male and female students is inherently unbalanced. As for the sample selection in this study, the major of advertising belongs to the humanities, and its subject system and curriculum are not considered in this study.

3.4. Students' participation in learning

The factors of students' learning participation mainly include teaching environment, number of online courses, learning platform, learning terminals, learning hours, online learning participation, needs for answering questions, and offline participation. The number of online courses refers to the number of online courses chosen by students. The learning platform in this study is mainly Chaoxingfanya's Xuexitong, supplemented by other platforms. The content related to students' offline course learning is mainly put on the need for answering questions.

3.4.1. Teaching environment

The teaching environment of blended learning mainly reflects the combination of online and offline teaching. Statistics show that students are more active in the combination of offline classroom teaching and online learning, with an acceptance rate of 71.95%. The acceptance of purely offline or online learning is relatively low (Table 5).

Table 5 Students' choice of teaching environment

Option	Percentage（%）
Offline classroom teaching	19.62%
Online teaching	8.43%
Blended teaching	71.95%

3.4.2. Number of online courses

The number of online courses chosen by students varies due to the different number of courses taken by students and the different teaching methods used by teachers. Among the number of online courses chosen, 23.14% of students chose 1-2 courses, 56.73% chose 3-5 courses, 12.71% chose 6-10 courses, and 7.42% chose more than ten courses. In general, 79.87% of students chose less than five online courses, which indicates that students are quite active in online courses without considering factors such as general education courses.

3.4.3. Learning platform

In different universities, sample learners choose different learning platforms. In China, most choose Tencent Classroom, XuetangX, and China University MOOC, while, in foreign countries, most choose Coursera and Edx. From the statistical data, the learning platforms chosen by learners are mainly platforms purchased by universities, which account for 65.26%. MOOC accounts for 21.91%, and other platforms account for 12.83%.

3.4.4. Learning Terminal

From the analysis of the learning situation, as the early users of the Internet, the percentage of learners in the sample using laptops and smartphones for learning is as high as 89.63%, which shows from another side that learners use the fragmented time to learn for a longer period of time than the time of traditional offline lectures.

3.4.5. Length of study

Compared with the length requirement for the traditional offline lecture, this study classifies the weekly online study length as less than 2 hours, 2-4 hours, 4-6 hours, and more than 6 hours, with statistics showing their percentages are 32.57%, 49.62%, 17.23%, and 0.58%. 2-4 hours per week is not enough for an online course to complete the necessary lecture requirements. However, statistically speaking, the main reasons why students cannot allocate more time to complete the course may include more time allocated to other courses, lack of initiative in online learning, unattractive online teaching content, and more tasks in the second classroom. The emergence of the last factor also becomes one of the main factors for the lack of learner engagement.

3.4.6. Online learning participation

Learners' online interaction is the main indicator of online learning platforms. For this reason, the scale of online learning participation is designed as always, often, sometimes, and occasionally, and the statistics show that they account for 9.23%, 35.16%, 31.95%, and 23.66%, respectively. In terms of learners' completion of learning, more than 60% of the students mainly completed the current learning task, with less learning interaction, less interactive initiative, and even less mutual collaboration among students. For this reason, how to improve learners' online interaction and active participation in

learning discussions becomes the primary problem.

3.4.7. Offline Learning Participation

Offline learning participation in the blended learning process is mainly represented by the process of learners' participation in the offline classroom. Therefore, the scale of learners' offline learning participation is designed as important, unimportant, and no comment. The statistics show that the above types account for 76.51%, 8.56%, and 15.93% in order. More than 70% of learners think that classroom interaction can improve the learning effect and provide a basis for teachers' smooth classroom design. It also provides a basis for conducting blended learning research and shows that learners' participation in classroom interaction significantly improves the learning effect.

3.4.8. Need for answering questions

Teachers' classroom teaching design is classified as the need for answering questions because of the inclusion of guidance, problem-solving, feedback, and supervision in teaching design. Therefore, the options for this part of the scale designed from the learners' perspective are mainly discussion guidance, problem-solving, feedback on academic performance, and supervision of learning. The statistics show that the above types account for 46.92%, 25.27%, 21.45%, and 6.36%, respectively. The above data shows that learners are positive about teachers' participation in interactive classroom discussions and their guidance in teaching and learning, providing data to support teachers' understanding and reflection on teaching.

3.5. Factors influencing learning engagement

The reliability and validity of the factors influencing learning engagement have been analyzed previously, and the next step is to conduct factor analysis and regression analysis on the scale data. Since SPSS software does not have an independent principal component analysis module, the principal component analysis is implemented with the help of the factor analysis module [5].

3.5.1. Commonality test of factors influencing learning engagement

Through spatial rotation and based on principal component analysis, factor analysis brings professional interpretable meaning to the virtual principal components. Generally speaking, factor loadings <0.3 are called low loadings, and loadings >0.4 are called high loadings. Therefore, high or low loadings become an important prerequisite for determining whether principal component analysis can be performed. The principal component loadings analysis shows that its commonality value is>0.7, and there are many commonality features among the factors. The validity is obvious, and the extraction of principal component analysis can be completed (Table 6).

Table 6 Commonality test

	Onset	Commonality
Q1	1.000	0.814
Q2	1.000	0.752
Q3	1.000	0.826
Q4	1.000	0.851
Q5	1.000	0.836
Q6	1.000	0.794
Q7	1.000	0.761
Q8	1.000	0.835
Q9	1.000	0.826
Q10	1.000	0.865
Q11	1.000	0.811
Q12	1.000	0.758
Q13	1.000	0.846
Q14	1.000	0.827
Q15	1.000	0.818
Q16	1.000	0.831
Q17	1.000	0.829
Q18	1.000	0.837
Q19	1.000	0.842
Q20	1.000	0.796
Q21	1.000	0.832
Q22	1.000	0.841
Q23	1.000	0.847
Q24	1.000	0.819

3.5.2. Principal component analysis of factors influencing learning engagement

There are five influencing factors in the principal component analysis of the factors influencing learning engagement (Table 7). The cumulative contribution of the variance of the top five factors is 88.813%, and their eigenvalues are>1 (in SPSS, the primary condition for being a principal component is eigenvalue >1).

Table 7 Eigenvalues and contribution rate of principal components

Component	Initial eigenvalues			Extraction of square and load capacity			Spiral square and load capacity		
	Total	Variance%	Cumulation%	Total	Variance%	Cumulation%	Total	Variance%	Cumulation%
1	8.93	37.208%	37.208%	8.93	37.208%	37.208%	8.810	36.708%	36.708%
2	5.216	21.733%	58.942%	5.216	21.733%	58.942%	4.130	17.208%	53.917%
3	2.581	10.754%	69.696%	2.581	10.754%	69.696%	2.530	10.542%	64.458%
4	2.963	12.346%	82.042%	2.963	12.346%	82.042%	1.570	6.542%	71.000%

5	1.625	6.771%	88.813%	1.625	6.771%	88.813%	1.360	5.667%	76.667%
6	0.327	1.363%	90.175%						
7	0.303	1.263%	91.438%						
8	0.211	0.879%	92.317%						
9	0.205	0.854%	93.171%						
10	0.194	0.808%	93.979%						
11	0.183	0.762%	94.742%						
12	0.174	0.725%	95.467%						
13	0.155	0.646%	96.113%						
14	0.147	0.612%	96.725%						
15	0.131	0.546%	97.271%						
16	0.120	0.500%	97.771%						
17	0.105	0.438%	98.208%						
18	0.101	0.421%	98.629%						
19	0.095	0.396%	99.025%						
20	0.084	0.350%	99.375%						
21	0.078	0.325%	99.700%						
22	0.065	0.271%	99.971%						
23	0.057	0.237%	100.208%						
24	0.051	0.212%	100.421%						

A rotation is done in Table 7 to obtain a rotated component matrix table (Table 8) to determine the influencing factors. The common factor loading of Table 8 is>0.7, showing high factor importance.

Table 8 Rotated component matrix

	1	2	3	4	5
Q6	0.892	0.370	0.092	0.081	0.133
Q24	0.841	0.306	0.648	0.214	0.024
Q11	0.825	0.076	0.199	0.276	0.259
Q19	0.817	0.673	0.350	0.189	0.171
Q12	0.810	0.674	0.029	0.487	0.232
Q10	0.793	0.699	0.523	0.150	0.302
Q15	0.774	0.311	0.322	0.310	0.684
Q17	0.736	0.001	0.553	0.525	0.109
Q5	0.306	0.858	0.541	0.078	0.270
Q18	0.045	0.819	0.127	0.237	0.294
Q8	0.226	0.784	0.227	0.045	0.164
Q7	0.449	0.772	0.191	0.111	0.109
Q23	0.205	0.757	0.616	0.002	0.391
Q9	0.567	0.192	0.827	0.244	0.168
Q4	0.337	0.088	0.791	0.319	0.562
Q1	0.422	0.338	0.763	0.669	0.238
Q13	0.310	0.367	0.741	0.444	0.284
Q22	0.052	0.592	0.733	0.097	0.125
Q3	0.255	0.029	0.037	0.885	0.137
Q16	0.178	0.074	0.246	0.811	0.128
Q20	0.659	0.097	0.328	0.801	0.297
Q2	0.573	0.276	0.072	0.486	0.761
Q14	0.295	0.265	0.395	0.666	0.753
Q21	0.437	0.133	0.071	0.065	0.719

3.5.3. Naming of common factors of factors influencing learning engagement

The results of naming the common factors obtained from Table 8 are shown in Table 9.

Table 9 Factor naming

Factor item	Question item	Factor loading	factor naming
Factor 1	6. Do you are interested in learning the course?	0.794	Student
	10. Do you like the online and offline learning mode?	0.865	
	11.Do you have good independent learning ability?	0.811	
	12. Do you have good self-discipline?	0.758	
	15. Do you have good reflective ability?	0.818	
	17. Do you participate in discussion forums on certain issues?	0.829	
	19. Do you understand the teaching objectives of the course?	0.842	
	24. Are the learning objectives consistent with the teacher's teaching objectives?	0.819	
Factor 2	5. Does the teacher provides adequate instruction?	0.836	Teacher
	7. Does the teacher provides timely feedback?	0.761	
	8. Is the teacher able to help with answering questions and reflection?	0.835	
	18. Does the teacher monitor the learning process well?	0.837	
	23. Does the teacher evaluate himself/herself?	0.847	
Factor 3	1. Are online videos interesting?	0.814	Learning Resources
	4. Are online videos useful?	0.851	
	9. Are online videos easy to understand?	0.826	
	13. Are online learning resources rich?	0.846	
	22. Are online learning resources clearly categorized?	0.841	
Factor 4	3. Does the learning platform have navigation and guidance?	0.826	Learning Platform
	16. Does the learning platform have assignments and tests?	0.831	
	20. Does the learning platform record students' tracks?	0.796	
Factor 5	2. Does the course have evaluation criteria?	0.752	Learning Evaluation
	14. Are the course evaluation criteria detailed?	0.827	
	21. Are teachers' evaluation methods diversified?	0.832	

3.5.4. Regression analysis of factors affecting learning engagement

In the regression analysis of the factors influencing learning engagement, the independent variables are teachers, learning resources, learning platform, and learning evaluation, and the dependent variable is students [3]. The four independent variables are significantly correlated in the product-moment correlation matrix, and there is a significant correlation with the dependent variable.

Table 10 Summary of coefficient a

Model	Unstandardized coefficient		Standardized coefficient T		Significance	correlation			Collinearity statistics	
	B	Standard error	Beta			Zero order	Part	Part	Tolerance	VIF
1(Constant)	2.170	0.180		4.983	0.000					
Teacher	0.479	0.161	0.617	15.930	0.000	0.144	0.697	0.237	0.603	0.298
Learning resource	0.265	0.387	0.283	6.154	0.000	0.283	0.234	0.384	0.138	0.482
Learning platform	0.626	0.532	0.051	0.275	0.670	0.077	0.563	0.204	0.459	0.012
Learning evaluation	-0.442	0.185	-0.031	-0.583	0.601	0.114	0.161	0.187	0.016	0.117

a. Dependent variable \: student

From Table 10, the regression equation from Table 10 is as follows:

Students= 0.617 x teacher + 0.283 x learning resources + 0.051 x learning platform - 0.031 x learning evaluation.

4.ANALYSIS SUMMARY AND INSIGHTS

4.1. Analysis summary

This paper is based on a survey of the learning

participation of blended teaching methods, and the main object of the study is the students majoring in advertising at Zhengzhou Sias College. The survey finds that students are more active in the mode of combining offline classroom teaching and online learning, and the acceptance rate is 71.95%. However, fewer accept pure offline or online learning methods. 79.87% of students chose less than five online courses, which indicates that students are quite active in online courses, except for general education courses and other factors. More than half of the students studied online for less than four hours per week. 89.63% of them use laptops and smartphones to study. More than 60% of the students focus on completing the current learning task, with few interactions and low enthusiasm for interactions. More than 70% of the learners think that participating in classroom teaching interactions can improve the learning effect. Learners are interested in teachers' participation in interactive classroom discussions, and their ability to lead them to actively think about teaching and learning is positive.

The regression equation of learning engagement shows that the main influencing factors include students, teachers, learning resources, learning platform, and learning evaluation. The independent variables that include teachers, learning resources, learning platform, and learning evaluation have a significant correlation with the dependent variable--student. However, it is also important to mention that excessive learning evaluation can also diminish students' learning engagement because learning evaluation is negatively correlated with students.

4.2. Insights

Starting from the regression equation of learning engagement, the main ways to improve the effect of blended teaching include the following aspects.

First, students are the main body. The blended learning environment emphasizes motivation and requires students to actively participate in the learning process. In the process of blended teaching, teachers can combine knowledge and social lives. By associating education with students' real-life problems, teachers can make students actively participate in teaching activities, improve students' ability to solve practical problems with appropriate guidance to think and encourage mutual assistance among students [4].

Second, the teacher takes a leading role. Blended teaching does not mean giving up the teacher's control of the classroom. On the contrary, the teacher should guide teaching and integrate into students. Meanwhile, they need to ensure the authority of knowledge, so that students' questions can be answered and solved, and students' ideas can be spurred and encouraged. The academic level set by the teacher should vary from person to person.

Third, learning resources are improved. The speed of updating and the interest in learning resources become a great motivation to attract learners to participate in learning. With their simple production, interesting content, and visualized presentation, short videos have led to the trend of the new media era and can make the content of learning resources more down-to-earth and scenario-based.

Fourth, the learning platform is ubiquitous. The fragmented reading and learning time determines that learners in modern society will no longer be the same as before: sticking to a single learning platform and completing the established learning topics. The ubiquitous learning platform is required to meet the learning requirements of learners in time and space dimensions and from lower to higher levels. The advent of 5G, intelligent media, the Internet of Things, and other new technological means can meet the above requirements of ubiquitous learning.

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