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RESEARCH ARTICLE

Research on the current situation and influencing factors of college students learning engagement in a blended teaching environment

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Abstract

Taking students from a university who participate in blended teaching of innovation and entrepreneurship as the research object, a model of the influencing factors of college students' learning engagement in a blended teaching environment was constructed. This paper constructs a model of influencing factors of college students' learning engagement in the blended teaching environment. The results showed that individual, teacher, and peer factors all have a certain degree of influence on learning engagement, but the degree of influence is significantly different. Teacher factors have the greatest impact, followed by individual factors, and peer factors have the smallest impact; Environmental factors have a moderating effect on the relationship between individual factors, teacher factors, peer factors, and learning engagement, but the direction of action is not consistent. The positive effect of individual factors, teacher factors, and peer factors on learning engagement increases with the increase of environmental factors, while the positive effect of teacher factors and peer factors on learning engagement weakens with the increase of environmental factors.

Keywords: Bended learning, Learning engagement, Teaching interaction theory.

Introduction

Since the Ministry of Education explicitly proposed "increasing students' learning investment" in the "Implementation opinions on the construction of first-class undergraduate courses", learning investment has gradually become a focus of attention and research in the academic community (Liang Yunzhen 2018). In terms of concept definition, in the 1930s, as the origin of learning engagement, Ralph Tyler, a famous management scientist, pioneered the concept of "task time", which was mainly used to explain the time learners spent in learning and its impact on their studies. The birthmark of the concept of learning engagement in the modern sense is Alexander Astin's (1984) "learning engagement" theory, which points out that learning engagement can reflect the teaching quality of higher education (Chatti M A, Dyckhoff A L, Schroeder U, *et al.,* 2012). Kuh believes that learning engagement should include two levels of content: individual engagement with students as the main body and environment creation with schools as the main body. The effectiveness of learning engagement is influenced by both individual and school factors (Kuh. G.D. 2003). In terms of theoretical and structural dimensions, in the early stage, Finn's "participation identity" model was taken as a representative, and learning engagement was divided into two dimensions: emotional engagement and behavioral engagement (Fredricks J A, Blumenfeld P C, Paris 2004). In terms of influencing factors, some scholars have explored from the perspectives of individual factors and school environment, such as (Viorel Mih and Codruța Mih and Viorel Dragoş 2015), Gentry M., Owen S. V. (2004), while others have analyzed from the perspectives of teachers and peers, such as Zhang Na (2012), Engels M C, Colpin H, *et al.* (2016), etc. Appleton pointed out an inherent connection between learning engagement and high-level thinking ability, one of

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the important indicators to measure learning satisfaction. In summary, from existing research, the academic community at home and abroad mainly analyzes the concept definition and structural dimension with fruitful results. However, from the perspective of the research, existing literature mostly starts with single variables such as individuals, peers, and teachers, studying the impact of a single variable on learning engagement. How to combine specific situational factors and explore the interaction mechanism between various variables, especially in the special background of the post-pandemic era, there is not much research on the influencing factors of learning engagement in mixed teaching environments.

Unlike traditional offline teaching modes, blended teaching mode is a reconstruction of the structure and methods of "teaching" and "learning" based on online teaching and face-to-face classrooms. According to the perspective of teaching interaction theory, the learning process of learners is influenced by the interaction between learners and learners, between learners and teachers, and between learners and learning content. Therefore, this research takes the perspective of teaching interaction theory, referring to Jennifer A Fredricks' three-dimensional theory. This paper builds a framework for analyzing the influencing factors of learning engagement in a blended teaching environment and puts forward relevant hypotheses.

Research Assumptions

Teachers' teaching behaviors such as teaching norms and attitudes are the biggest factors that affect students' active learning involvement. In a blended learning environment, whether teachers can provide clear learning guidance, supervise and provide timely feedback on students' learning status and homework, and whether teachers can frequently answer online or offline questions and communicate effectively with students can affect students' learning enthusiasm and engagement level. Based on this, hypothesis 1 is proposed: teacher factors can significantly affect students' learning engagement, namely:

Hypothesis 1a: Teacher factors can significantly affect students' behavioral engagement

Hypothesis 1b: Teacher factors can significantly affect students' cognitive engagement

Hypothesis 1c: Teacher factors can significantly affect students' emotional engagement

According to the perspective of self-system theory, students' continuous learning engagement can be further divided into autonomous, ability, and belonging needs. In a blended learning environment, whether students have a high level of learning enthusiasm and sense of belonging, whether they have good self-directed learning ability and monitoring and reflection ability, and whether they believe they can effectively learn and achieve excellent results in a blended learning environment will all affect their level of learning engagement. Based on this, hypothesis 2 is proposed: individual factors of students can significantly affect their learning engagement, namely:

Hypothesis 2a: Individual factors of students can significantly affect their behavioral engagement

Hypothesis 2b: Individual student factors can significantly affect students' cognitive engagement

Assumption 2c: Individual factors of students can significantly affect their emotional engagement

Unlike the synchronous time and shared space characteristics of traditional offline teaching, the blended teaching environment presents different spatiotemporal characteristics. Many studies have shown that interpersonal interaction can affect the effectiveness of online teaching (Githens, R.P. 2010). As far as the interaction between students and students is concerned, whether students can carry out effective cooperative learning with their peers, whether they can see the power of their peers' role models, and whether students can show and share learning achievements and learning feedback with their peers will all affect students' level of learning engagement. Based on this, hypothesis 3 is proposed: Peer factors can significantly affect students' learning engagement, namely:

Hypothesis 3a: Peer factors can significantly affect students' behavioral engagement

Hypothesis 3b: Peer factors can significantly affect students' cognitive engagement

Hypothesis 3c: Peer factors can significantly affect students' emotional engagement

The self-theory in psychology holds that an individual's possible self is unstable and susceptible to external environmental factors. Whether the content structure of the courses that students learn is clear, whether process evaluation is emphasized, whether the course platform can provide high-quality learning resources and whether the classroom learning atmosphere is relaxed and enjoyable will all affect students' level of learning engagement. Moreover, according to Lewin's "field theory", the environment, behavior, and people interact with each other. The environment is the environment of the self, and the self is the self within the environment. The interaction between teachers and students and the interaction between students and students will also be affected by the aforementioned environmental factors during the learning process. Based on this, hypothesis 4 is proposed: Environmental factors can significantly affect students' learning engagement and have a moderating effect on the relationship between individual factors, teacher factors, peer factors, and learning engagement, namely:

Hypothesis 4a: Environmental factors can significantly affect behavioral learning engagement and regulate the relationship between learning engagement and teacher factors hypothesis 4b: Environmental factors can significantly affect students' cognitive engagement and regulate the relationship between learning engagement and individual factors

Hypothesis 4c: Environmental factors can significantly affect students' emotional engagement and regulate the relationship between learning engagement and peer factors

Material and Methodss

On the basis of drawing on existing mature scales, this study takes students from a university who participate in blended teaching of innovation and entrepreneurship as the research object, and compiles a questionnaire titled "The status and influencing factors of learning investment in blended teaching at a university". The questionnaire consists of three parts: the first part is basic information, including two basic variables: gender and major. The second part is a questionnaire on the current situation of blended learning engagement, which includes 14 question options in three dimensions; The third part is a questionnaire on the influencing factors of blended learning engagement, which includes four dimensions totaling 21 question options. The questionnaire is scored using the Likert 5-level scale: 1-5 represents very non-compliant, not very compliant, average, quite compliant, and very compliant, respectively. A total of 206 valid questionnaires have been collected.

The questionnaire's reliability and validity test results are shown in the table. Table 1 shows that the reliability coefficient value of the learning engagement questionnaire is 0.871, indicating that the research data has high-reliability

Table 1: Reliability analysis

Number of items	*sample size*	*Cronbach acoefficient*
35	206	0.871

Table 2: KMO and bartlett tests

Number of items	*KMO value*	*Bartlett sphericity test*	
Current status of learning engagement	0.894	Approximate chi square df	1914.956 91
		p value	0.000
Factors influencing learning engagement	0.932	Approximate chi square df	4869.598 190
		p value	0.000

Table 3: Results of exploratory factor analysis (after correction)

Dependent variable	*Question items*	*Factor loading*	*Eigenvalue*	*Cumulative variance contribution rate*
Behavioral engagement	Pre class preview and post class review	0.564		
	Classroom tasks	0.652		
	After-class tasks	0.703		
	Online and offline questioning exchange and	0.465	3.005	60.096
	discussion real time learning on online platforms	0.620		
		0.719		
Cognitive engagement	Course learning plan course learning progress	0.727	3.808	76.154
	Course learning objectives course learning methods	0.783		
	Course learning interest	0.797		
		0.781		
		0.835		
Emotional engagement	Sense of belonging in course learning	0.825		
	Course learning value course learning exchange	0.785	3.209	80.228
		0.765		

independent variable	*Question items*	*Factor loading*	*Eigenvalue*	*Cumulative variance contribution rate*
Teacher factor	Course learning guidance course learning Q&A	0.796		
	Learning status monitoring	0.842	4.868	81.141
		0.840		
Individual factor	reminder	0.838		
	Job feedback	0.791		
	Rich teaching activities online and offline	0.761		
	encouragement	0.826		
	Believing in blended learning mode	0.855		
	Believe in yourself autonomous capability	0.844	3.312	82.811
	Monitoring and reflection ability	0.787		
	Group cooperative learning Peer discussion learning	0.923		
	Peer role model	0.912		
	Demonstration	0.937		
	Peer achievement sharing peer learning feedback	0.933		
Peer factors		0.918	4.277	85.539

Regulating variable	*Question items*	*Factor loading*	*Eigenvalue*	*Cumulative variance contribution rate*
Environmental factor	Innovative value of curriculum application course	0.818		
	process evaluation	0.827		
	Course content structure course platform resources	0.896		
	the value of curriculum for student development	0.819		
	Classroom learning	0.884		
	atmosphere	0.816	5.061	84.352

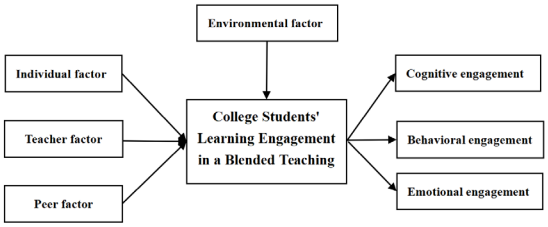

Figure 1: College students learning engagement in a blended teaching

quality. Table 2 shows that the KMO values of the current learning engagement and the influencing factors of learning engagement are 0.894 and 0.932, respectively, both greater than 0.8 and *p-values* less than 0.05. The validity of the research data is good and suitable for factor analysis.

This study further conducted exploratory factor analysis on questionnaire data, selecting principal component analysis method to extract common factors with eigenvalues greater than 1. The rotation converged after 25 iterations. The results of factor analysis on dependent variables, independent variables, and moderating variables are shown in Table 3.

Based on the analysis mentioned above and combined with existing literature, this study constructs the model as shown in Figure 1.

Result

This study used a designed quantitative model to examine the effects of individual, teacher, and peer factors on college students' learning engagement. In order to avoid multicollinearity, this study makes a stepwise regression on the three variables of learning engagement, namely, behavioral engagement, cognitive engagement and emotional engagement, by using individual factors, teacher factors and peer factors.

Table 4 shows that the teacher factor is significantly positively correlated with behavioral and cognitive engagement at a 1% confidence level. Hypothesis 1 has been partially validated; There is a significant positive correlation between individual factors and behavioral engagement at a 1% confidence level, and hypothesis 2 is partially validated; Peer factors are significantly positively correlated with cognitive engagement at a 5% confidence level, and hypothesis 3 is partially validated. This indicates that the teaching level of teachers, real-time communication and exchange between teachers and students, and between students and peers in a blended teaching environment have a positive impact on students' level of learning engagement, which is in line with the "teacher-student interaction" and "student-student interaction" perspectives of teaching interaction theory. It is worth noting that although teacher, individual, and peer factors positively impact emotional engagement, they are not significant. The possible reason is that most college students are already adults, and their outlook on life, values, and learning are basically formed. Therefore, their emotional cognition of course interests, course learning values, and other factors is less susceptible to the influence of internal and external factors. In addition, through Table 4, we can also find that although individual, teacher, and peer factors all have a certain degree of influence on learning engagement, the degree of influence is significantly different. From 1 to 6 in Table 4, it can be found that teacher factors have the greatest impact (with regression coefficients of 0.951 and 0.145 for behavioral and cognitive engagement, respectively), individual factors take second place (with regression coefficients of 0.200 and 0.143 for behavioral and cognitive engagement, respectively), and peer factors have the smallest impact (with regression coefficients of 0.052 and 0.026 for behavioral and cognitive engagement, respectively), indicating that, Although blended learning overcomes the drawbacks of traditional classroom teaching that is teacher-led and students passively receive knowledge, emphasizing students' autonomous learning ability, teachers still play an important role in inspiring, guiding, and monitoring the process for students. The advantages of teachers' "rule by man" cannot be ignored.

Furthermore, this article incorporates the interaction terms between environmental factors, individual factors, teacher factors, and peer factors into the regression equation (environmental factors × individual and environmental factors × Teacher factors, environmental factors × Peer factors) to examine the moderating effect of environmental factors. Due to the fact that college students' learning engagement includes three types: behavioral engagement, cognitive engagement, and emotional engagement, in order to examine the moderating effect of environmental factors on each type of engagement, this study regressed environmental factors with behavioral engagement, cognitive engagement, and emotional engagement, respectively.

As shown in Table 5, 1 to 3 examined the moderating effect of environmental factors on the relationship between individual factors, teacher factors, peer factors, and behavioral engagement, 4 to 6 examined the moderating effect of environmental factors on the relationship between individual factors, teacher factors, peer factors, and cognitive engagement, 7 to 9 examined the moderating effect of environmental factors on the relationship between individual factors, teacher factors, peer factors, and emotional engagement.

From Table 5, the coefficients of environmental factors are positive in all models, indicating that curriculum and environmental factors positively impact learning engagement in a blended learning environment. From model (1)-(3), we found that the interaction term between environmental factors and individual factors, as well as the interaction term between environmental factors and teacher factors,were significantly positive at a 1% confidence

Table 4: Analysis of the influencing factors of learning engagement

Behavioral engagement		*Cognitive engagement*				*Emotional engagement*			
(1) (2) (3) (4) (5) (6) (7) (8) (9)									
Individual factor	0.200***	0.143				0.051			
Teacher factor		0.751***		0.145***			0.050		
Peer factors		0.052				0.141**			0.026
Gender	-0.052	-0.070	-0.179	-0.054	-0.008	-0.021	0.058	0.310	0.106
Major	-0.015	0.011	-0.071	0.114	0.069	0.039	-0.144	0.112	-0.313
Constant	0.240	0.214	0.420	-0.098	-0.208	-0.060	0.286	-0.300	0.342
R^2	0.046	0.569	0.009	0.017	0.025	0.023	0.029	0.028	0.027
Adjusted R^2	0.032	0.562	0.005	0.002	0.010	0.009	0.014	0.014	0.012
F	3.241	8.794	0.627	1.166	1.719	1.615	1.975	1.967	1.838
sample size	206	206	206	206	206	206	206	206	206

Table 5: Analysis of the regulatory effects of environmental factors

Behavioral engagement	*Cognitive engagement*				*Emotional engagement*				
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*
Individual factor	0.224***			-0.085			0.058		
Teacher factor		0.344***			-0.054			-0.029	
Peer factors			-0.231**			0.083			0.018
environmental ×Individual	0.206***			0.154			0.004		
environmental ×Teacher		0.263***			-0.107			-0.238***	
environmental ×Peer			0.058			0.041			-0.173**
environmental factor	0.678***	0.448***	0.537***	0.188***	0.213	0.195**	0.102	0.033	0.047
Gender	-0.049	-0.067	-1.553	-0.039	-0.022	-0.023	0.057	0.036	0.056
Major	-0.023	-0.004	-0.123	0.066	0.067	0.051	-0.144	0.132	-0.160
Constant	0.112	0.173	0.279	0.024	-0.090	-0.073	0.287	0.458	0.259
R^2	0.520	0.490	0.446	0.081	0.059	0.056	0.039	0.086	0.063
Adjusted R^2	0.508	0.477	0.432	0.059	0.035	0.032	0.015	0.063	0.039
F	43.4	38.422	32.198	3.548	2.508	2.358	1.616	3.743	2.675
sample size	206	206	206	206	206	206	206	206	206

level, while the interaction term between environmental factors and peer factors was positive but not significant. This indicates that individual factors, teacher factors The positive effect of peer factors on behavioral engagement increases with the increase of environmental factors, and hypothesis 4a is verified; When examining the moderating effect of environmental factors on the relationship between individual factors, teacher factors, peer factors, and cognitive engagement model (4)-(6), we found that the interaction terms between environmental factors and individual factors, teacher factors, and peer factors were not significant, and hypothesis 4b was not validated; From model (7)-(9), we found that the interaction term between environmental factors and individual factors is positive but not significant. The interaction term between environmental factors and teacher factors is significantly negative at a confidence level of 1%, and the interaction term between environmental factors and teacher factors is significantly negative at a confidence level of 5%.This indicates that the positive effect of teacher factors and peer factors on emotional engagement weakens with the increase of environmental factors,that is, environmental resources weaken the positive correlation between teacher factors, peer factors, and emotional engagement. The possible reason is that in the post pandemic era, online and offline blended teaching has gradually become normalized. With the increasing abundance of course platform resources, the increasing emphasis on process evaluation in courses, and the improving learning atmosphere in blended teaching classrooms, the traditional teaching model led by teachers no longer has the advantage of subjectivity, and the demonstration effect of peers has also weakened. Therefore, the dependence of emotional engagement on teacher factors and peer factors is correspondingly weakened.

Discussion

The above regression analysis results show that, firstly, individual factors, teacher factors, and peer factors all have a certain impact on learning engagement to a certain extent, but the degree of impact is significantly different. Teacher factors have the greatest impact, followed by individual factors, and peer factors have the smallest impact; Secondly, environmental factors have a moderating effect on the relationship between individual factors, teacher factors, peer factors, and learning engagement, but the direction of action is not consistent. The positive effect of individual factors, teacher factors, and peer factors on learning engagement increases with the increase of environmental factors, while the positive effect of teacher factors and peer factors on learning engagement weakens with the increase of environmental factors. Counter measures and suggestions:

- Research has shown that under the blended online and offline teaching mode, teacher factors can positively affect students' level of learning engagement and are the most important factor affecting students' learning engagement. Therefore, for teachers, on the one hand, online and offline blended teaching, which was forced by the epidemic, provides an important opportunity for teaching mode reform and the development of teaching practice. On the other hand, due to the differences in different course contents, teaching links, student majors, etc., it also brings new challenges to teaching activities under the blended teaching mode. Teachers should combine the characteristics of the curriculum and students' majors, fully utilize the advantages of online and offline blended teaching models in time, space, and different resource platforms.
- Research has shown that curriculum and environmental factors mediate the relationship between teacher factors, individual factors, peer factors, and learning engagement. On the one hand, for platform designers, although the increasingly abundant platform resources have overcome the drawbacks of traditional classroom teaching dominated by teachers and students passively receiving knowledge, teachers still play an important role in inspiring, guiding, and monitoring the process for students. The advantages of teachers' "rule by man" cannot be ignored. On the other hand, while ensuring a smooth online environment, online platforms require teachers to pay attention to enriching teaching content, constructing diverse teaching forms, and activating the classroom atmosphere during the blended teaching process, so that students can have a good learning experience to improve their level of learning engagement and reduce excessive dependence on teacher and peer factors.

In addition, teachers' subjective initiative and students' active engagement cannot be separated from school level support. On the one hand, schools should encourage teachers to innovate teaching models and actively participate in teaching innovation and exploration. On the other hand, schools should strengthen students' adaptability to hybrid teaching and information literacy training, so that schools, teachers, and students can participate in the reform of hybrid teaching models and embrace reform and common development.

Authorship Contribution

Yanbo Wang: Methodology, Validation, Writing - original draft, Writing - review & editing, Supervision. Yonghong Zhu: Conceptualization, Software, Resources, Project administration. Jingjing Liu (Corresponding author): Validation, Data curation, Visualization.

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