INVESTIGATING VARIABLES AFFECTING BUSINESS STUDENTS' LEARNING OUTCOMES IN BLENDED LEARNING

Ying Zhang*, Ocean University of China
Jie Hu, Ocean University of China

ABSTRACT

Although the education community has recently given significant attention to blended learning as an instructional approach that combines traditional classroom instruction with online learning, there has been limited in-depth study on how learning occurs in a blended learning environment. Based on ecosystem theory and Biggs' 3P learning model, we explore the influence of teaching engagement, learning motivation, and student engagement on learning outcomes, while also considering the moderating role of academic self-efficacy. One-way ANOVA and comparison analysis results demonstrated that the learning impact of blended learning was superior to that of both offline and online learning. The results of our study indicate that: (1) Student engagement partially mediates the relationship between teacher engagement and learning outcomes. Teaching engagement has a strong positive impact on both student engagement and learning outcomes. (2) Learning motivation has a significant positive effect on student engagement and learning outcomes. Student engagement partially mediates the relationship between learning motivation and learning outcomes, with internal learning motivation having a stronger direct effect on learning than external learning motivation. (3) Academic self-efficacy negatively moderates the paths from learning motivation to student engagement and from learning motivation to learning outcomes. The study's findings advance empirical research on the pathways influencing students' learning outcomes in blended learning contexts and provide theoretical support and practical insights for enhancing teaching quality and learning outcomes.

Keywords: Blended Learning, Teaching Engagement, Learning Motivation, Student Engagement, Learning Outcome, Academic Self-Efficacy

INTRODUCTION

With a range of instructional strategies and tools, blended learning—a novel kind of instruction that blends traditional in-person instruction with online learning—offers students a more flexible and individualized learning experience. Blended learning has gradually taken over in educational practice due to the current rapid growth of information technology. The blended learning approach has garnered significant attention from the academic community for its significant role in advancing education, bringing about reform in the teaching profession, and enhancing the quality of instruction (Yao & Zheng, 2020). It primarily concentrates on the following three research orientations in the realm of higher education: mining of learning paths for online or blended learning (Chen et al., 2020; Han et al., 2022); construction and empirical examination of blended teaching models based on online learning platforms (Xing, 2020; Wu et al., 2021); construction and empirical examination of the learning experience and analysis of learning outcomes in online or blended teaching (Li & Zhu, 2023; Han & Ellis, 2023). The

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first two types of studies are more focused on the design and implementation of blended teaching modes and learning paths, aiming to validate the effectiveness of blended teaching modes and blended learning paths through empirical tests and provide insights into teaching reform. In contrast, the third type of studies focus on the experience and effects of learners under these modes, exploring learners' subjective feelings as well as learning outcomes. Nevertheless, a review of the literature reveals a lack of empirical studies examining students' learning experiences and outcomes in blended learning contexts, as well as a shortage of quantitative analysis. Research on the factors influencing learning outcomes in these contexts lacks depth and primarily focuses on the general student population at colleges and universities, with little attention to specific groups.

The choice and application of the teaching mode directly affect the quality of teaching, and the quality of teaching reflects the adaptability and effectiveness of the teaching mode. The most direct reflection of teaching quality is the learning outcomes of students (Douglass et al., 2012; Guo et al., 2020; Zhu & Hang, 2023). Learning outcomes are not only a measure of a student's mastery of knowledge and application abilities but also an important indicator of teaching quality. Both domestic and international research indicates that there are two primary sources of factors impacting students' learning outcomes: personal and environmental variables (Lee & Shute, 2010; Xu & Li, 2021). Regarding individual factors, students' cognitive abilities, such as attention, memory, and reasoning (Sternberg, 2003), and non-cognitive abilities, such as motivation and self-efficacy (Liang & Zhou, 2023), significantly affect their learning outcomes. While existing studies have extensively explored the influence of cognitive abilities (Stadler et al., 2016), there are relatively few studies on the mechanisms through which non-cognitive abilities impact learning outcomes. In addition, environmental factors influencing learning primarily stem from the social environment, classroom, and school environment (Lee & Shute, 2010; Dotterer & Lowe, 2011; Dima et al., 2022). These factors not only affect students' learning experiences and engagement (Yang et al., 2022; Li & Zhu, 2023) but are also closely related to various teaching methods, instructional design, and resource allocation (Han, 2023; Zhou, 2023). Most research on the impact of environmental factors on learning outcomes has focused on traditional teaching settings. In a blended learning environment, these factors can be more complex and variable, making it crucial to create an environment that is conducive to learning and improves teaching quality.

Regarding the measurement of students' learning effectiveness, most existing research focuses on academic achievement and academic performance. Academic achievement is a direct reflection of a student's mastery of knowledge and application abilities and is a key indicator for evaluating learning effectiveness. Its main assessment methods include standardized test scores (Tao et al., 2022), Grade Point Average (Guo & Ji, 2019), and academic performance ranking (Liang & Zhou, 2023). Some studies divide academic effectiveness into three dimensions: academic achievement, generic skills development, and learning satisfaction (Guo et al., 2022). Additionally, some scholars measure learning outcomes by critical thinking development and academic performance (Bu et al., 2022). These studies show that the dimensions and indicators of learning effectiveness are gradually becoming more diversified. Learning effectiveness is not only limited to academic performance but also includes students' learning ability. Therefore, when measuring students' learning effectiveness, it is necessary to consider multiple aspects to reflect students' learning outcomes more comprehensively. In this paper, we plan to use two dimensions—academic performance and learning ability improvement—to measure learning outcomes.

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Based on ecosystem theory and Biggs' 3P learning model, this paper examines the influence of environmental factors (teaching engagement) and individual factors (learning motivation, academic self-efficacy). It explores the relationships between teaching engagement, learning motivation, student engagement, and learning outcomes (learning performance and learning ability improvement) in the context of blended teaching, and investigates the moderating role of academic self-efficacy. We will use questionnaire research and empirical analysis to identify the factors influencing learning effectiveness and the action paths, with current college students majoring in business as the research subjects. The purpose of this article is to investigate two questions: first, how individual and environmental factors affect learning outcomes; and second, how individual academic self-efficacy affects learning outcomes. Through this study, we aim to provide theoretical support and practical guidance for improving teaching quality and learning effectiveness.

THEORETICAL BACKGROUND AND RESEARCH HYPOTHESIS

Ecosystem Theory and Biggs 3P Learning Model

Ecosystem theory was first proposed by Bronfenbrennr (1986), who argues that human development in a complex system of relationships is determined by the multi-level environment, emphasizing the dynamic interaction and mutual influence between humans and their environment. Based on this theory, the influence of external environmental factors, such as social environment and learning environment, on academic achievement has been widely emphasized by scholars. On the one hand, the influence of environmental factors mainly comes from the instrumental, emotional, informational, and accompanying support given by parents, schools, and peers (Wu et al., 2023; Zhao et al., 2022). Among them, teacher support is the most critical factor that affects students' learning effectiveness and teaching quality (Tao et al., 2022). On the other hand, the learning environments under the blended teaching model are increasingly diversified. Particularly, the technical learning environment and affective learning environment have a particularly significant impact on learning outcomes through the provision of technical support, the application of intelligent learning tools, a favorable classroom atmosphere, cooperative learning opportunities, and positive teacher-student interactions (Zhou, 2023). It is thus clear that the role and input of the teacher become particularly important in the blended learning model. Teachers' input is not only reflected in the delivery of teaching content but also in how they effectively utilize and integrate various learning environment resources and how they create conditions conducive to students' learning and development. Therefore, this study will introduce the variable of teaching engagement to explore the mechanism of its influence on learning outcomes.

To further investigate the connection between learning styles and learning outcomes, Biggs proposed the 3P model of "*presage-process-product*" in 1993. In this model, the antecedent variables mainly include students' personality traits, environment, and school factors; the process variables are mainly learning styles, and the outcome variables refer to students' learning outcomes. Individual students and environmental factors in the antecedent variables affect their learning process, which in turn has an impact on learning outcomes; and antecedent variables also have a direct effect on learning outcomes (Diseth, 2007; Guo et al., 2017; Trigwell et al., 2013). Previous studies have confirmed that perceived learning environments (e.g., course structure, course design, and teaching methods) can have a significant positive effect on student engagement, which in turn affects academic performance,

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learning ability enhancement, and learning satisfaction (Bu et al.,2022; Li & Zhu, 2023; Guo et al.,2022). Based on this, this paper proposes the following hypotheses H1a and H1b:

> ***H_{1a}**: Teaching engagement has a significant positive effect on student engagement.*
> ***H_{1b}**: Teaching engagement has a significant positive effect on learning outcomes (academic performance, learning ability improvement).*

Learning Motivation

The realization of students' academic achievement goals is importantly related to the external environment and the individual's factors, of which the individual factors mainly include prior knowledge and experience, learning motivation, etc. (Zakariya et al., 2023; Hua & Wang, 2024; Han, 2023). Learning motivation is an intrinsic motivation that is guided, stimulated, and sustained by learning goals or objects for individual behavioral activities. Uguroglu & Walberg (1979) have long researched the relationship between motivation and academic achievement, and the results of a comprehensive analysis showed that motivation can positively predict academic achievement. In recent years, numerous studies have supported similar findings. Learning motivation as an antecedent variable can have a direct or indirect positive effect on student engagement and learning outcomes (Li & Zhu, 2023; Liang et al. 2020). Additionally, based on the "Working Preference Inventory" developed by Amabile in 1994, motivation is categorized into internal and external motivation. Internal motivation refers to the motivation generated by the value and meaning of the learning behavior itself, such as intrinsic interest and challenge-seeking; external motivation refers to a kind of motivation triggered by results other than the learning activity, which usually includes achieving results, obtaining recognition, and earning rewards, etc., and the subsequent research has confirmed the applicability of the scale in the learning situation of students in different countries (Loo, 2001; Chi & Xin, 2006). Research has shown that internal motivation has a positive effect on learning outcomes (Bu et al., 2022) and that internal and external motivation have differential effects on learning outcomes (Guo & Cao, 2019).

The existing studies on learning motivation are rich in content, but there are also areas to be explored. First, there are differences in the research conclusions reached by different scholars, and the effects of internal and external learning motivation may be different, which need to be further explored; second, existing studies have mainly focused on traditional educational contexts, and the mechanism of learning motivation in blended teaching contexts is not yet clear. Therefore, this study will investigate the influence of individuals' learning motivation on their student engagement and learning outcomes based on the categorization criteria of internal learning motivation and external learning motivation. Based on this, this paper proposes the following hypotheses H_{2a}, H_{2b}:

> ***H_{2a}**: Learning motivation has a significant positive effect on student engagement.*
> ***H_{2b}**: Learning motivation has a significant positive effect on learning outcomes (academic performance, learning ability improvement).*

Mediating Role of Student Engagement

In Biggs' 3P model, student engagement is often used as a process variable. Student engagement is a key variable that influences learning outcomes. Related studies have pointed out that students' online learning readiness and affective competence are positively correlated with online learning achievement (Wang et al., 2023). In addition, student engagement can

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positively affect students' transferable skill development (Li & Zhu, 2023), and can also significantly predict learning outcomes and positively affect learning achievement, learning satisfaction, and learning ability (Carini et al., 2006; Guo, 2018; Guo et al., 2020; Wang & Hofkens, 2020). Thus, student engagement, as a core process variable of learning, is the key to understanding the mechanisms and effects of student learning. Taking student engagement as a mediating variable can reveal more deeply the intrinsic path mechanism of different factors affecting learning outcomes. Based on this, this paper proposes the following hypotheses H_{3a} and H_{3b}:

> ***H_{3a}**: Student engagement mediates the relationship between teaching engagement and learning outcomes (academic performance, learning ability improvement).*
> ***H_{3b}**: Student engagement mediates the relationship between learning motivation and learning outcomes (academic performance, learning ability improvement).*

The Moderating Role of Academic Self-Efficacy

Self-efficacy refers to a person's ability to engage in a certain behavior in a specific situation and achieve the desired results, which refers to people's confidence or belief in their ability to achieve behavioral goals in a specific area. The concept of "*self-efficacy*" was first introduced by Bandura in the 1970s, and by the end of the twentieth century, it had become a key concept in education. When the concept of self-efficacy was applied to the field of education, the concept of academic self-efficacy arose. Schunk (1989) suggested that academic self-efficacy refers to a learner's level of confidence in his or her ability to perform academic tasks. Self-efficacy is a key factor contributing to individual development and influencing learning outcomes (Heckman et al., 2006; Yu, 2022), and also serves as a key psychological variable mediating the relationship between social support on an individual's well-being in learning, academic achievement, and behavioral performance (Siu et al., 2023; Wang et al., 2023). In addition, studies have shown that academic self-efficacy has a significant effect on student engagement, learning satisfaction, and academic performance (Fredricks et al., 2004; Sökmen, 2021; Liang & Zhou, 2023).

In the current research, academic self-efficacy is mostly used as a mediator variable, while not many studies have used academic self-efficacy as a moderator variable to explore its influence mechanism. Given the differences in the levels of academic self-efficacy among individuals, this paper argues that in-depth research on academic self-efficacy as a moderating variable can provide a more accurate insight into its differentiated impact on student engagement and learning outcomes at different levels. This paper argues that when academic self-efficacy is used as a moderating variable, when students' academic self-efficacy is enhanced, on the one hand, they will overestimate their abilities and ignore potential problems and difficulties in learning, thus reducing their commitment to and preparation for learning, and affecting their learning outcomes. On the other hand, with increased self-efficacy, students may adjust their learning goals and expectations, and unrealistically high goal setting may trigger frustration and anxiety, weakening the impact of learning motivation on student engagement and effectiveness. Based on this, this paper proposes the following hypotheses H_{4a} and H_{4b}:

> ***H_{4a}**: Academic self-efficacy negatively moderates the pathway from learning motivation to student engagement.*
> ***H_{4b}**: Academic self-efficacy negatively moderates the pathway from learning motivation to learning outcomes (academic performance, learning ability improvement).*

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In summary, this paper constructs the theoretical model shown in Figure 1 below.

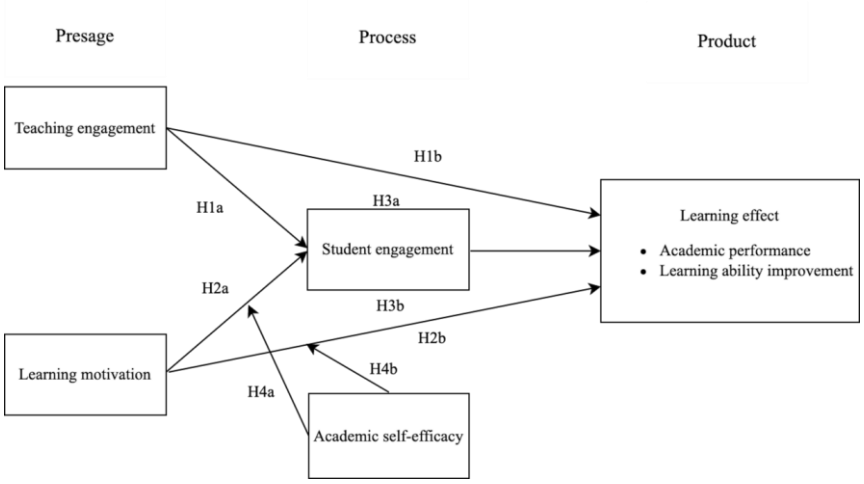

FIGURE 1
THEORETICAL MODEL DIAGRAM

STUDY DESIGN

Subjects and Methodology

The present study was conducted on university students enrolled in business studies, and the questionnaire was distributed nationwide. A total of 1,285 questionnaires were collected, and after excluding invalid questionnaires, a total of 1,017 valid questionnaires were obtained, with the sample covering the whole country. In terms of gender, there are 578 male students and 439 female students in the sample, with a male-to-female ratio of 1.3:1, indicating a balanced distribution of male to female ratio in the sample. From the distribution of majors, the number of business majors in business, management, and marketing is relatively high, accounting for 15.4%, 20.7%, and 17.4% respectively, while the number of students in economics, finance, tourism, and hotel management is in the middle of the list, accounting for 14.2% and 10.0% respectively. In addition, the forms of course design also differed, and the number of people whose courses were designed for blended teaching totalled 457 (44.9%), indicating that blended teaching has gradually become mainstream in China. In addition, 338 and 222 students, accounting for 33.2% and 21.8% respectively, adopted traditional offline teaching mode and online teaching.

Research Tools

As shown in Table 1, this study selected four authoritative scales and localized them to develop and form the questionnaire. After the completion of the preliminary questionnaire, this study conducted a pre-survey and adjusted the questionnaire items based on the results of the pre-survey to form the final questionnaire. For example, teaching engagement includes questions related to the use of online platforms (Tencent Conference, Enterprise WeChat, Nail, etc.) to assist teaching, the use of live broadcasts, recorded broadcasts, and other forms of teaching, and the provision of rich teaching materials (PPT courseware, videos, etc.). Internal motivation includes interest-driven, enjoying the challenge, and mastering knowledge and skills; external motivation includes achievement, for higher education exams, future career development, and so on; student engagement includes pre-course,

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classroom, and post-course commitment. The scales selected in this study were all based on a five-point Likert scale.

Table 1
SCALE SOURCES

Research Variables	Scale source
Teaching Engagement	Trigwell, K., & Prosser, M. (2004) Guo, J. P., Chen, J., & Gan, Y. J., et al. (2020)
Learning Motivation	Amabile, T. M., Hill, K. G., Hennessey, B. A., & Tighe, E. M. (1994) Chi, L. P., & Xin, Z. Q. (2006)
Academic Self-Efficacy	Pintrich, P. R., & De Groot, E. V. (1990)
Student Engagement	Guo, J., Yang, L., & Shi, Q. (2017)

RESULTS

Treatment of Variables and Descriptive Statistics

In this study, the independent variable of learning motivation is divided into internal and external learning motivation. The dependent variable, learning outcome, is measured by two dimensions: academic performance and learning ability improvement. Academic performance is assessed by students' academic ranking, divided into six segments: below 70%, 50-70%, 30-50%, 10-30%, 5-10%, and the top 5%, with scores assigned from 1 to 6, respectively. Learning ability improvement is measured through self-assessment in six dimensions: independent learning ability, logical thinking ability, organization and coordination ability, teamwork ability, language expression ability, and social practice ability. The question items are rated on a five-point scale, for example, "*Through the existing teaching mode, my independent learning ability has been greatly enhanced*." Descriptive analysis of the core variables in the total sample is presented in Table 2 below.

Table 2
DESCRIPTIVE STATISTICS FOR THE TOTAL SAMPLE (*N*=1017)

Variable category	Variable name	Variable symbol	*M*	*S.D*
Independent variables	Teaching engagement	*TENG*	3.7397	0.0326
	Learning motivation (internal, external)	*ILM*	3.7815	0.0318
		ELM	3.7603	0.0323
Mediating variable	Student engagement	*SENG*	3.7674	0.0321
Dependent variables	Academic performance	*ACP*	3.7139	0.0427
	Learning ability improvement	*LABI*	3.7032	0.0328
Moderator variable	Academic self-efficacy	*ASE*	3.7467	0.0326

Comparative Analysis of Students' Learning Outcomes Under Different Teaching Methods

In this paper, SPSS 22.0 was used to conduct descriptive statistics and one-way ANOVA on three groups of subsamples under different teaching modes. The conclusions are presented in Table 3. It can be seen that the learning outcomes of students in the blended teaching mode (academic performance: M=3.8534, learning ability improvement: M=3.7531) are higher than those in traditional offline instruction (academic performance: M=3.5473,

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learning ability improvement: M=3.6967) and online instruction (academic performance: M=3.6802, learning ability improvement: M=3.6104). This indicates that students learn better in the blended mode of instruction. The results of the one-way ANOVA showed a significant between-group difference in academic performance under different teaching modes (P=0.0070<0.05), while there was no significant between-group difference in students' learning ability improvement under different teaching modes (P=0.2460>0.05).

Table 3
ONE-WAY ANOVA RESULTS

Learning outcome	Teaching method			F	P
	Blended learning (*n*=457)	Traditional offline teaching (*n*=338)	Online teaching (*n*=222)		
Academic performance	3.8534± 0.0629	3.5473± 0.0747	3.6802± 0.0910	5.0290	0.0070
Learning ability improvement	3.7531± 0.0477	3.6967± 0.0562	3.6104± 0.0746	1.4050	0.2460

Analysis of Questionnaire Data

Reliability and validity analysis

As shown in the conclusions in Table 4, the Cronbach's alpha coefficients for each variable and the overall Cronbach's alpha coefficients are significantly higher than 0.7, indicating that the instrumental scale in this paper has good reliability. Additionally, exploratory factor analysis of the scale items yielded a KMO=0.972, which is greater than 0.7, and the P-value of Bartlett's sphericity test was less than 0.001, indicating suitability for principal component analysis or factor analysis. The factor loadings of each variable item, shown in Table 5, range from 0.692 to 0.770, indicating good structural validity. The average variance extracted (AVE), square root of AVE, and composite reliability (CR) of each variable were calculated based on the factor loading. As shown in Table 5, the AVE of each variable is greater than 0.5, and the CR is more than 0.7, indicating good convergent validity of the questionnaire. Furthermore, as shown in Table 5 and Table 6, the square root of AVE for each variable is significantly greater than the Pearson correlation coefficient between that variable and other variables, indicating good discriminant validity of the questionnaire. In conclusion, the validity of the questionnaire scale is confirmed to be good.

Table 4
VARIABLE *CRONBACH'S ALPHA* COEFFICIENTS

Measured variables	Cronbach's Alpha	Number of questions
Overall	0.961	23
TENG	0.889	4
ILM	0.907	5
ELM	0.884	4
ASE	0.910	5
SENG	0.905	5

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Table 5
VARIABLE FACTOR LOADINGS, *AVE* VALUES, AND *CR* VALUES

Measured variables	Measurement term	Factor loading	*AVE*	*CR*	$\sqrt{AVE}$
TENG	TENG1	0.757	0.5490	0.8295	0.7409
	TENG2	0.756			
	TENG3	0.716			
	TENG4	0.734			
ILM	ILM1	0.707	0.5016	0.8342	0.7082
	ILM2	0.704			
	ILM3	0.698			
	ILM4	0.723			
	ILM5	0.709			
ELM	ELM1	0.708	0.5485	0.8292	0.7406
	ELM2	0.770			
	ELM3	0.755			
	ELM4	0.728			
ASE	ASE1	0.736	0.5344	0.8516	0.7310
	ASE2	0.731			
	ASE3	0.717			
	ASE4	0.730			
	ASE5	0.741			
SENG	SENG1	0.721	0.5068	0.8370	0.7119
	SENG2	0.726			
	SENG3	0.709			
	SENG4	0.692			
	SENG5	0.711			

Table 6
VARIABLE *PEARSON* CORRELATION COEFFICIENTS

	TENG	ILM	ELM	ASE	SENG
TENG	1	0.653	0.634	0.635	0.653
ILM	0.653	1	0.657	0.7	0.707
ELM	0.634	0.657	1	0.618	0.647
ASE	0.635	0.700	0.618	1	0.688
SENG	0.653	0.707	0.647	0.688	1

Mediated Effects Test

Firstly, the mediating effect of student engagement between instructional inputs and learning outcomes was tested, and hypotheses H_{1a}, H_{1b}, and H_{3a} were verified, and the results are shown in Table 7.

Table 7
MEDIATED EFFECTS TEST

Trails	Effect	Standard error	*P*	95% CI
Aggregate effect				
TENG→ACP	0.6088	0.0364	0.0000	[0.5374, 0.6803]
TENG→LABI	0.6859	0.0231	0.0000	[0.6406, 0.7311]
Direct effect				

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TENG→ACP	0.3677	0.0467	0.0000	[0.2760, 0.4593]
TENG→LABI	0.4017	0.0272	0.0000	[0.3483, 0.4551]
Indirect effect				
TENG→SENG	0.6421	0.0234	0.0000	[0.5962, 0.6879]
SENG→LABI	0.4426	0.0277	0.0000	[0.3883, 0.4970]
SENG→ACP	0.3756	0.0475	0.0000	[0.2824, 0.4688]
TENGa→SENGa→ACP	0.2412	0.0344	/	[0.1774, 0.3146]
TENGa→SENGa→LABI	0.2842	0.0274	/	[0.2336, 0.3389]

The results shown in Tables 4-6, indicate that the effect value of teaching engagement on student engagement is 0.6421, with a P-value is less than 0.001. This signifies that teaching engagement has a significant positive effect on student engagement, thus supporting hypothesis H_{1a}. The direct effect of teaching engagement on academic performance and learning ability improvement are 0.3677 and 0.4017, respectively, both with P-values less than 0.001. This indicate that the direct effect of teaching engagement on learning outcomes is positive and significant, thus supporting hypothesis H_{1b}.

The mediating effect was tested and analyzed as follows: the effect value of the path "*teaching engagement → student engagement → academic performance*" is 0.2412, with a confidence interval of [0.1774, 0.3146], indicating that the mediating effect is significant. This means that teaching engagement positively affects academic performance by influencing student engagement. Since the direct effect of teaching engagement on academic performance is significant, it shows that student engagement plays a partial mediating role. The indirect effect accounts for 39.62% of the total effect. Similarly, the effect value of the path "*teaching engagement → student engagement → learning ability improvement*" is 0.2842, with a confidence interval of [0.2336, 0.3717], indicating that the mediating effect is significant. This means that teaching engagement positively influences learning ability improvement by influencing student engagement. Since the direct effect of teaching engagement on learning ability improvement is significant, it shows that student engagement plays a partial mediating role, and the indirect effect accounts for 41.43% of the total effect. In conclusion, hypothesis H_{3a} is supported.

Moderated (academic self-efficacy) mediating effect test

The individual's academic self-efficacy was used as a moderating variable to test the mediating effects with moderating effects, and hypotheses H_{2a}, H_{2b}, H_{3b}, H_{4a}, and H_{4b} were tested to obtain the results in Table 8 below.

Table 8
MEDIATION EFFECT TESTS WITH MODERATING EFFECTS (ACADEMIC SELF-EFFICACY)

Trails	Effect	Standard error	*P*	95% CI
Direct effect				
ILM→ACP	0.3553	0.0516	0.0000	[0.2541, 0.4565]
ILM→LABI	0.4654	0.0295	0.0000	[0.4075, 0.5233]
ELM→ACP	0.3208	0.0472	0.0000	[0.2281, 0.4135]
ELM→LABI	0.3751	0.0277	0.0000	[0.3207, 0.4295]
Indirect effect				
ILM→SENG	0.7098	0.0862	0.0000	[0.5407, 0.8790]
ASE→SENG	0.6443	0.0884	0.0000	[0.4708, 0.8178]
Int_1 (ILM×ASE)	-0.0797	0.0245	0.0012	[-0.1279, -0.0316]

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SENG→ACP	0.3702	0.0512	0.0000	[0.2697, 0.4708]
SENG→LABI	0.3825	0.0293	0.0000	[0.3250, 0.4400]
ELM→SENG	0.8499	0.0790	0.0000	[0.6948, 1.0050]
ASE→SENG	0.9442	0.0779	0.0000	[0.7913,1.0971]
Int_2 (ELM×ASE)	-0.1445	0.0219	0.0000	[-0.1875, -0.1016]
SENG→ACP	0.4108	0.0475	0.0000	[0.3176, 0.5041]
SENG→LABI	0.4651	0.0279	0.0000	[0.4103, 0.5198]

The results shown in Table 8 indicate that the effect values of internal and external learning motivation on student engagement are 0.7098 and 0.8499, respectively, with P-values less than 0.001. This indicates that learning motivation has a significant positive effect on student engagement, thus supporting hypothesis H_{2a}. The direct effect values of internal learning motivation on academic performance and learning ability improvement are 0.3552 and 0.4654, respectively, with P-values less than 0.001, indicating that internal learning motivation significantly positively affects academic performance and learning ability improvement. Additionally, the direct effect values of external learning motivation on academic performance and learning ability improvement are 0.3208 and 0.3751, respectively, with P-values less than 0.001, indicating that external learning motivation also significantly positively affects academic performance and learning ability improvement. It can be seen that internal learning motivation has a stronger direct effect on learning effectiveness. Thus, hypothesis H_{2b} is supported.

In addition, the effect values of the interaction terms (ILM×ASE) and (ELM×ASE) between learning motivation and academic self-efficacy are -0.0797 and -0.1445, respectively, with P-values less than 0.05, indicating a negative moderating effect. The mediating effect of the moderating effect is examined as shown in Table 9 and is analyzed as follows: the mediating path effect value of academic self-efficacy on the moderating effect of "*internal learning motivation → student engagement → academic performance*" is -0.0295, with a confidence interval of [-0.0586, -0.0032], indicating that the mediating path with a moderating effect is negative and significant. The effect value of academic self-efficacy on the mediating path of "internal learning motivation → student engagement → learning ability improvement" is -0.0305, with a confidence interval of [-0.0608, -0.0051], indicating that this mediating path of the moderating effect is negative and significant. Similarly, academic self-efficacy has a negative and significant effect on the two mediating paths of "*external learning motivation → student engagement → academic performance*" and "*external learning motivation → student engagement → learning ability improvement*." To summarize, hypotheses H_{3b} and H_{4a} are verified.

Table 9
MEDIATION EFFECT TESTS FOR DIFFERENT LEVELS OF ACADEMIC SELF-EFFICACY

Independent variables	Dependent variables	Moderator variable (ASE)		Effect	Standard error	95% CI
ILM	ACP	-(*SD*)	2.7070	0.1829	0.0325	[0.1300, 0.2607]
		M	3.7467	0.1522	0.0270	[0.1062,0.2156]
		+(SD)	4.7864	0.1215	0.0287	[0.7047, 0.1958]
Moderated mediating effect				-0.0295	0.0140	[-0.0586, -0.0032]
ILM	LABI	-(*SD*)	2.7070	0.1890	0.0273	[0.1432, 0.2513]
		M	3.7467	0.1573	0.0239	[0.1195, 0.2150]
		+(*SD*)	4.7864	0.1255	0.0283	[0.0803, 0.1947]
Moderated mediating effect				-0.0305	0.0138	[-0.0608, -0.0051]

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ELM	ACP	-(*SD*)	2.7070	0.1884	0.0282	[0.1364, 0.2469]
		M	3.7467	0.1267	0.0197	[0.0918, 0.1676]
		+(*SD*)	4.7864	0.0650	0.0190	[0.0328, 0.1085]
Moderated mediating effect				-0.0594	0.0133	[-0.0856, -0.0352]
ELM	LABI	-(*SD*)	2.7070	0.2133	0.0236	[0.1716, 0.2635]
		M	3.7467	0.1434	0.0174	[0.1126, 0.1826]
		+(*SD*)	4.7864	0.0735	0.0207	[0.0386, 0.1192]
Moderated mediating effect				-0.0672	0.0133	[-0.0951, -0.0435]

The results shown in Tables 9 indicate that, at any level of an individual's academic self-efficacy, student engagement significantly affects the positive correlation between internal learning motivation and learning outcomes (academic performance and learning ability improvement), with the confidence interval excluding 0. The effect coefficient is lower when an individual's academic self-efficacy is stronger, indicating that academic self-efficacy negatively moderates the positive correlation between internal learning motivation and learning outcomes. Similarly, at any level of academic self-efficacy, the positive correlation between student engagement, external learning motivation, and learning outcomes (academic performance and learning ability improvement) is significant, with the confidence interval excluding 0. The stronger the academic self-efficacy, the lower the effect coefficient, indicating that academic self-efficacy negatively moderates the pathway from external learning motivation to learning outcomes. Furthermore, based on the variation in the effect coefficient under different levels of academic self-efficacy, individual academic self-efficacy has a more pronounced negative moderating effect on external learning motivation. In summary, hypothesis H4b is verified.

CONCLUSIONS

Based on the ecosystem theory and Biggs' 3P learning model, this study constructs a theoretical model of the learning outcome in a blended teaching context. Taking the group of college students majoring in business as the research object, and 1017 valid questionnaires were recovered. Through the comparative analysis of the learning outcomes under different teaching modes, it was found that the learning outcome under the blended teaching mode was better than that of the traditional offline teaching and online teaching mode. In addition, by analyzing the total sample data, the following conclusions are drawn: Firstly, teaching engagement has a significant positive effect on student engagement and learning outcomes; and student engagement plays a partly mediating role between teaching engagement and learning outcomes. Secondly, learning motivation has a significant positive effect on student engagement and learning outcome. Moreover, student engagement partially mediates the relationship between learning motivation and learning outcomes. In addition, the direct effect of internal learning motivation on learning outcome is stronger than that of external learning motivation, which is consistent with the findings of past scholars. Lastly, academic self-efficacy negatively regulates the paths of "*learning motivation to student engagement*" and "*learning motivation to learning outcomes*".

The theoretical contributions are mainly reflected in the following aspects. Firstly, this study enriches the empirical research on students' learning outcomes in blended teaching contexts. This paper explores the role of environmental and personal factors on the learning outcome of business undergraduates in a blended teaching context, which is a good supplement

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to the existing research in this field. Secondly, referring to previous studies by scholars, this study diversified the dimensions and indicators for assessing academic effectiveness and measured the variable of learning effectiveness in terms of both academic performance and learning ability improvement. The effects of environmental factors and individual factors on student engagement and learning outcome were verified, which is in line with the views of previous scholars. Finally, in this study, academic self-efficacy was used as a moderating variable, and it was verified that individuals with different levels of academic self-efficacy had different influences on student engagement and learning outcomes, which provided new research perspectives and ideas for subsequent studies.

IMPLICATIONS

The following practical guidance is provided to improve teaching quality and learning effectiveness:

Promote blended teaching mode. Colleges should encourage and support teachers to adopt the blended teaching mode and provide richer and more flexible learning resources and interactive methods.

Increase investment in teaching. Schools should increase investment in teaching resources, including teaching equipment, teaching platforms, teaching materials, etc., to provide teachers with sufficient teaching support. Teachers need to enhance their enthusiasm and professionalism in teaching and stimulate students' interest and enthusiasm in learning through well-designed teaching activities and interactions. In addition, teachers can guide students to actively participate in classroom learning and extracurricular extension activities through group discussions, case studies, practical research, and other rich ways.

Establish a learning incentive mechanism. Teachers should pay attention to students' learning needs and cultivate students' internal learning motivation by guiding them to discover the intrinsic value of learning. Schools and society should provide appropriate external rewards and recognition, such as setting up scholarships and organizing academic competitions, to encourage students to invest more time and energy in learning; they can also stimulate students' external learning motivation through internship opportunities and employment recommendations.

Pay attention to individual learning psychological differences. For students with high self-efficacy, more challenging tasks can be provided, while emphasizing the importance of self-reflection and continuous learning. Additionally, for students with low academic self-efficacy, teachers should help them build up self-confidence in learning by providing positive feedback and evaluations; the school can provide psychological counseling and academic guidance services to solve students' learning difficulties and problems, reduce learning anxiety and enhance learning confidence.

Competing Interests

The authors have no competing interests to declare that are relevant to the content of this article.

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Author Contributions

Data curation, formal analysis, investigation, writing–original draft: Jie Hu; methodology, funding acquisition, project administration, supervision: Ying Zhang; conceptualization, writing – review and editing: Ying Zhang and Jie Hu. All authors have read and approved the final manuscript.

Data Availability Statement

All data that support the findings of this study are included in this manuscript.

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