Article

Influencing factors of blended learning in private universities: An empirical study based on structural model

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Abstract: With the continuous development and rapid progress of Internet technology, the technology of "Internet +" has been widely used in almost all walks of life, including education. The new learning mode of "Internet + education" is changing learners' learning habits, and this learning mode has become a hot issue that scholars pay attention to. Although there is much research on blended learning, the research on the influencing factors of blended learning in Chinese private colleges and universities is limited. In this paper, the questionnaire was designed based on the theory of planning behavior and the technical acceptance model theory, and distribute these questionnaires to undergraduates at Harbin Cambridge University, a private university in China, and 162 valid questionnaires were collected. Analysis was performed by multiple linear regression and structural equation model method. It is found that college students' blended learning effect is positively correlated with perceived usefulness, interactive behavior, and learning acceptance, while perceived ease of use and learning atmosphere have no significant influence on the learning effect. This study further found that perceived usefulness and interactive behavior can influence the effect of blended learning through the mediating effect of learning acceptance. The results of this study provide a new idea for the study of blended learning; that is, students will know how to improve the effectiveness of blended learning, and also provide a valuable reference for teachers to solve the problem of how to improve the quality and effectiveness of blended classroom teaching.

Keywords: internet education; blended learning; online learning

1. Introduction

The rapid development of Internet technology is also pushing forward innovation and change in the field of education. Mixed teaching and learning have now become an important part of higher education model reform (Wang et al., 2024). The main advantage of blended learning is that it breaks through the limitation of learning time and space, enables learners to experience a more open learning environment and a more diversified knowledge system, and is very conducive to cultivating a new type of interdisciplinary talent (Wang et al., 2024). At present, scholars have different degrees of research on "how to learn," "how to evaluate," and "what to learn" in blended learning, and have reached many valuable conclusions.

By constructing blended learning models or using existing models, we can verify a specific problem related to blended learning and then draw a scientific conclusion. By integrating TAM (The Technology Acceptance Model) and TPB (The Theory of Planned Behavior) models, Xu et al. (2024) found a significant positive correlation between college students' willingness to accept, perceived behavioral control, learning engagement, and deep learning. Perceived behavioral control and learning engagement play a mediating role between receptivity and deep learning, and both

play a role in chain mediating roles. Wang et al. (2024) constructed a model of influencing factors from the perspective of students and conducted an empirical study. The main findings include the impact of students' backgrounds, individual-related variables, and interactive variables on academic outcomes. The study points out that blended learning is the primary trend in higher education at present, but students need more Internet experience and information technology skills to improve academic results. Islam et al. (2022) discuss the importance of blended learning in higher education. Through a quasi-experimental approach, the researchers observed a course called "Bangladesh Studies" over one semester and came up with a model for better teacher-student interaction in both synchronous and asynchronous modes. The model consisted of three phases: referencing online peer group reviews in face-to-face classes, synchronous interaction outside of school, and asynchronous interaction outside of school. The study highlights the need for innovative pedagogy that engages students in collaborative learning and promotes cognitive development in a blended learning environment. Yulianti (2020) discusses the effectiveness of blended learning models in developing student character through the application of online and face-to-face learning. The study utilizes the ASSURE model (The ASSURE model is a teaching system design method that provides teachers with a structured framework for planning and implementing effective teaching to ensure that students can achieve the desired learning goals) and focuses on students taking character development courses at the Polytechnic University of Indonesia. The main findings showed that the blended learning model had a positive impact on the student's personality development. This research is important because it combines technology with traditional teaching methods to improve student learning outcomes and character development.

Some scholars have summarized the research results in the field of blended learning methods through the literature review method. Ashraf et al. (2021) systematically reviewed blended learning, focusing on the trends, gaps, and future directions in this field. The study notes that BL research comes mainly from developed countries, which highlights the need for cross-collaboration to promote BL adoption in developing countries. Teachers, students, and institutions all face challenges, such as a lack of ICT skills and infrastructure. Research issues addressed in the study include trends in BL research, subject areas covered, participants, research methods, design aspects, learning outcomes, and related challenges. The findings are aimed at facilitating the design and adoption of BL globally, particularly in response to health challenges such as the COVID-19 pandemic. Krismadinata et al. (2020) reviewed 45 publications on blended learning in vocational education, focusing on the design, implementation, and analytical aspects of research articles. The paper finds that the considerations for implementing blended learning include normal development of models, application of topologies, and understanding of the characteristics of institutions, providing different blended learning models such as rotational models, elastic models, self-mixing models, and rich virtual models. The paper proposes that blended learning can improve student performance, reduce class meetings, increase student engagement and learning outcomes, and highlights the importance of digital literacy skills, critical thinking development, and learning management in vocational education. A systematic review by Muller et al. (2021) explores the implications of

replacing classroom time with an online learning environment in higher education, with a focus on blended learning. Twenty-one effect sizes were analyzed in this study. The results showed that the overall difference between blended classroom learning and traditional classroom learning was slight, with comparable learning outcomes despite reduced classroom time. The review highlights the importance of providing flexibility and personalization in education to meet the demands of a digital society, especially in light of the COVID-19 pandemic. Blended learning, where classroom time is reduced by 30%–79%, is as effective as traditional classroom learning.

Most scholars test hypotheses or explore factors through quantitative analysis and empirical research methods. Arifin (2021) discusses a study on improving learning motivation through blended learning in the context of the Covid-19 pandemic. The study aims to address the lack of motivation in primary school students by implementing blended learning at levels II-A in SD Negeri 3 Pandean. The study utilizes classroom action research methods to collect data through observations and interviews. The results showed a significant increase in students' levels of motivation after using blended learning. The study highlights the importance of learning motivation and the effectiveness of blended learning in increasing students' engagement and independence in learning. Bouilheres et al. (2020) explored the benefits of blended learning in enhancing students' learning experience on the Australian University campus in Vietnam. The study aimed to assess the effectiveness of blended learning in facilitating interaction between students, faculty, and course materials. A survey of 66 students who participated in eight blended learning courses showed that students were positive about their learning experience, with factors such as engagement, learning flexibility, online learning experience, and self-confidence cited as the main benefits. The literature review highlighted the importance of student engagement, the role of technology in facilitating engagement, and the advantages of blended learning in enhancing interaction and creating an engaging learning process. Kumar et al. (2021) explores the concept of blended learning, which combines traditional face-to-face classroom instruction with an online learning experience. The study investigates a variety of tools, techniques, frameworks, and models useful for blended learning, with a focus on student, teacher, and administrative experiences of COVID-19 and the pre-COVID-19 period. The study aims to help staff, students, and management adopt new tools and ways of thinking to achieve positive outcomes in blended learning. Key points and arguments in the document include the benefits and challenges of blended learning, the comparison between traditional and blended learning programs, the importance of digital integration in teaching and learning, and the effectiveness of blended learning in emergency situations such as the COVID-19 pandemic. The document also discusses the importance of different blended learning practices, processes, tools, techniques, programs, and frameworks and presents case studies from two universities to analyze the implementation of blended learning during the pandemic. Puspaningtyas (2021) discusses a quantitative study to determine the impact of the use of animated video in blended learning on student learning outcomes. The study involved 35 students at the Polytechnic University of Indonesia taking a business mathematics course, comparing pre-test and post-test scores to assess learning improvements. The results showed a significant difference in scores,

suggesting that the use of animated videos could improve students' learning outcomes in business mathematics. The paper highlights the importance of adapting to different learning styles, integrating technology into education, and leveraging blended learning models to improve student engagement and understanding. Rafiola et al. (2020) explores the impact of learning motivation, self-efficacy, and blended learning on student achievement in the context of Industrial Revolution 4.0. The study was conducted in a public high school in Padang, Indonesia, using partial least squares (PLS) analysis. The main results of the study include: learning motivation has a positive and significant effect on student achievement, while self-efficacy has no significant effect, blended learning has a significant effect on student achievement, and learning motivation, self-efficacy, and blended learning have a significant effect on student achievement. The study highlights the importance of adapting educational practices to meet the challenges of the Fourth Industrial Revolution and highlights the role of technology in improving learning outcomes. Wang et al. (2024) studied the impact of mixed teaching mode on the teaching of pharmacological theory courses. By comparing the effects of traditional offline teaching and online and offline mixed teaching, they found that the mixed teaching mode has high application value in improving students' learning results and can be promoted. Specific research methods include selecting students from Class 1 and Class 2 of pharmacy major in grade 2021 as research objects and conducting comparative analysis on the teaching effects of the two groups of students. The results show that the mixed teaching mode has a significant impact on students' scores, especially in terms of midterm scores, final scores, and comprehensive scores. Wang et al. (2024) took 326 college students participating in blended learning as research objects through questionnaire survey and data analysis to explore the influence of peer assistance on self-regulated learning ability in the blended learning environment. It is found that in the blended learning environment, learners' self-regulated learning is at an average level as a whole, while peer mutual assistance has a significant positive impact on self-regulated learning and its dimensions. The results of this study provide references for teachers to effectively organize students to carry out peer mutual assistance learning activities in the blended learning environment so as to improve learners' self-regulated learning ability and learning efficiency. Luo and Zheng et al. (2024) studied the empirical impact of blended collaborative learning on the development of critical thinking. The research points out that blended collaborative learning can effectively promote the development of student's critical thinking, enable students to switch their critical thinking behaviors in an orderly and flexible manner, and reveal the development path of critical thinking contained in collaborative learning. The importance of this study lies in providing empirical support for the development of students' critical thinking by blended collaborative learning, which provides a useful reference for the field of education. Xie and Zhang (2024) took the blended teaching of medical immunology course at Xinxiang Medical College as an example to analyze the factors that affect students' academic achievement. Through formative assessment and "flipped classroom," this study explored the influence on students' academic achievement. The main contents include the characteristics of blended teaching, the implementation process, the evaluation system, and the main factors affecting the learning effect of students. The

quantitative analysis of the teaching data by statistical method provides a reference for improving the teaching effect of medical immunology and the reform of mixed teaching of similar courses. Yan and Zhao (2023) aim to improve the teaching quality of physiology in basic medical courses. By investigating and studying the learning status and evaluation of students in the offline and online mixed teaching mode of physiology in Luoyang Vocational and Technical College, Yan and Zhao (2023) aims to explore the best combination of teaching methods. In order to improve the teaching quality of physiology and other basic medical courses in vocational colleges. The survey results show that offline and online mixed teaching can promote the improvement of teaching effect and quality and cultivate students' comprehensive quality and ability. The main findings include that students' learning attitude is gradually correct, students' ability to adapt to the teaching mode is strong, independent learning ability and students' participation needs to be improved. These results provide empirical research materials for the reform and practice of health vocational education.

In summary, scholars mainly used TAM, TPB, and constructivism theories to verify the willingness of college students to accept blended learning and the influence of student interaction on learning outcomes. Most scholars believe that blended learning is now the mainstream form of higher education. The results of the literature review show that blended learning can improve student performance, even if the length of offline classes is reduced. However, some scholars have found that blended learning results in a higher enrollment rate than a higher pass rate. Scholars have not explored the factors that affect blended learning for the time being. By summarizing the research and analysis of scholars, it can be inferred that college students' blended learning effect is related to perceived usefulness, interactive behavior, learning acceptance, perceived ease of use, and learning atmosphere, and learning acceptance will play a mediating role between influencing factors and learning effect. Therefore, the following hypotheses are proposed in this study:

Hypothesis 1 (H1): Perceived ease of use positively affects learning effectiveness.

Hypothesis 2 (H2): Perceived usefulness positively influences learning effectiveness.

Hypothesis 3 (H3): Learning atmosphere positively influences learning effectiveness.

Hypothesis 4 (H4): Interaction positively influences learning.

Hypothesis 5 (H5): Learning receptivity positively influences learning effectiveness.

Hypothesis 6a (H6a): Learning receptivity plays an intermediary role between perceived ease of use and learning effectiveness.

Hypothesis 6b (H6b): Learning receptivity mediates perceived usefulness and learning effectiveness.

Hypothesis 6c (H6c): Learning receptivity mediates between learning atmosphere and learning effectiveness.

Hypothesis 6d (H6d): Learning receptivity plays a mediating role in the interaction behavior and learning effectiveness.

2. Method

This paper establishes a learning acceptance model and uses empirical research to verify the influences of simplicity, practicality, atmosphere, and interactivity on blended learning acceptance. It also determines the influencing factors of blended learning. In this paper, the Likert5 questionnaire design method is adopted to ensure the reliability and validity of the questionnaire. Twenty-five items are designed. Through consulting experts and testing, items with a load factor of less than 0.50 are removed, and the remaining 20 items are analyzed and studied in the next step. See **Table 1** for details.

Table 1. Variables and items.

Variables	Sources	Item	Coding
Perceived ease of use	Wu and Liu (2013)	1.BL platform is simple to operate	A1
		2.BL uses less time to acquire more knowledge	A2
		3.BL can acquire knowledge faster than traditional learning	A3
Perceived Usefulness	McGill TJ (2014)	1.BL has access to the latest and richest knowledge	B1
		2.BL can meet students' personalized learning needs	B2
		3.BL mode is more conducive to knowledge understanding and mastery	B3
		4.BL mode is more conducive to self-improvement	B4
Learning Atmosphere	Sher A (2009)	1.BL's offline classroom atmosphere is conducive to knowledge understanding and mastery	C1
		2. Online interactive discussion of BL is conducive to knowledge understanding and mastery	C2
Interactive behavior	Ali A (2011)	1.BL's interactive behavior is more conducive to sharing and collaboration among students	D1
		2.BL interactive behavior is more conducive to the communication between teachers and students	D2
		3.BL's interactive behavior is more conducive to the interaction between students and the platform	D3
Learning acceptance	Roca JC (2008)	1. I love using BL	E1
		2. I feel good about using BL	E2
		3. I feel it's good for me to use BL	E3
		4. I find the BL method attractive to me	E4
Learning effect	McGill TJ (2009)	1.BL improves my ability to learn independently	F1
		2.BL improves my problem solving ability	F2
		3.BL promotes my communication with classmates and teachers	F3
		4.BL enables me to master more subject knowledge	F4

Note: BL stands for Online and offline blended learning.

3. Data acquisition

In this paper, the students of Harbin Cambridge University in Harbin, Heilongjiang Province, were investigated. These college students all have blended learning courses in their existing courses. The survey started on 14 March 2024, and ended on 24 March 2024. A total of 162 questionnaires were collected.

3.1. Sample analysis

SPSS27 software was used to analyze the samples. All samples were from current

undergraduate students. 54.00% of the samples were girls, and 46% were boys. In terms of grade distribution, most of the samples are freshmen (52.00%), sophomores (20%) and juniors (28%). From the perspective of subject background, there are relatively more "science" subjects in the sample; the proportion is 52.00%. Moreover, 48.00% of the samples were from the liberal arts. Regarding the distribution of "the number of online and offline mixed courses learned," most of the samples are "3–4 courses"; the proportion is 43.00%. The sample distribution is reasonable.

3.2. Reliability test

The questionnaire was tested using SPSS27 software, and the results showed a Cronbach coefficient of 0.979, indicating good reliability.

3.3. Confirmatory factor analysis

Since clear theoretical hypotheses have been proposed in this study, confirmatory factor analysis can be used to check the structural validity of the questionnaire. According to the analysis, the absolute values of the standardized load system shown in the questionnaire survey data are all greater than 0.6 and show significance. The estimated P-values of the residual items are all less than 0.05, which means a good measurement relationship exists. Details can be seen in **Table 2**.

Table 2. Table of factor load coefficients.

Factor (latent variable)	Measure item (explicit variable)	Non-standard load factor (Coef.)	Standard error (Std.Error)	z (CR value)	p	Standard load factor (Std.Estimate)	SMC
Perceived Ease of use	A1	1.000	-	-	-	0.881	0.776
Perceived ease of use	A2	1.180	0.063	18.754	0.000	0.936	0.876
Perceived ease of use	A3	1.188	0.061	19.382	0.000	0.949	0.900
Perceived usefulness	B1	1.000	-	-	-	0.932	0.869
Perceived usefulness	B2	1.043	0.044	23.887	0.000	0.944	0.892
Perceived usefulness	B3	0.972	0.041	23.501	0.000	0.940	0.884
Perceived usefulness	B4	1.068	0.047	22.921	0.000	0.934	0.873
Learning atmosphere	C1	1.000	-	-	-	0.920	0.846
Study atmosphere	C2	0.983	0.056	17.621	0.000	0.875	0.766
Interactive behavior	D1	1.000	-	-	-	0.926	0.858
Interactive behavior	D2	0.986	0.051	19.200	0.000	0.895	0.801
Interactive behavior	D3	0.962	0.048	19.952	0.000	0.907	0.822
Learning acceptance	E1	1.000	-	-	-	0.912	0.831
Learning acceptance	E2	0.952	0.047	20.450	0.000	0.925	0.856
Learning effectiveness	F1	1.000	-	-	-	0.922	0.850
Learning effect	F2	1.072	0.048	22.143	0.000	0.942	0.887

Note: The bar '-' indicates that the item is a reference item.

According to the fitting index of the model, the $\chi2/df$ value was 2.303, which was less than 3; RMSEA was 0.090, less than 0.1; RMR is 0.012, less than 0.05; NFI value is 0.947, greater than 0.9; NNFI is 0.958, greater than 0.9; TLI is 0.958, greater than

0.9; IFI value is 0.969, greater than 0.9; PGFI value is 0.569, greater than 0.5; PNFI value is 0.702, greater than 0.5; PCFI value was 0.719, greater than 0.5. Through the model fitting index analysis, the model fit was good. See **Table 3** for details.

Table 3. Model fitting indicators.

Common indicators	chi-square	df	*p*	Chi-square DOF ratio χ2/df	GFI	RMSEA	RMR	CFI	NFI	NNFI
Judging criteria	-	-	> 0.05	< 3	> 0.9	< 0.10	< 0.05	>0.9	> 0.9	> 0.9
value	204.927	89	0.000	2.303	0.870	0.090	0.012	0.969	0.947	0.958
Other indicators	TLI	AGFI	IFI	PGFI	PNFI	PCFI	SRMR	RMSEA 90% CI		
Criteria for judgment	> 0.9	> 0.9	> 0.9	> 0.5	> 0.5	> 0.5	< 0.1	-		
value	0.958	0.802	0.969	0.569	0.702	0.719	0.018	0.074 to 0.106		

Note: χ2(120) = 3878.048, *p* = 1.000 for Default Model.

3.4. Correlation analysis

As can be seen from the following table, correlation analysis was used to study the correlation between perceived ease of use and perceived usefulness, learning atmosphere, interactive behavior, learning acceptance and learning effect, and Pearson correlation coefficient was used to represent the strength of the correlation. Specific analysis shows that: perceived ease of use and perceived usefulness, learning atmosphere, interactive behavior, learning acceptance and learning effect all show significant values, and the relative values are 0.919, 0.830, 0.865, 0.870 and 0.856, respectively, and the relative values are all greater than 0. It means that there is a positive correlation between perceived ease of use and perceived usefulness, learning atmosphere, interactive behavior, learning acceptance and learning effect. See **Table 4** for details.

Table 4. Pearson correlation-detailed format.

		Perceived Ease of use	Perceived usefulness	Learning atmosphere	Interactive behavior	Learning acceptance	Learning effectiveness
Perceived ease of use	Correlation coefficient	1					
	p values	-					
	Sample size	-					
Perceived usefulness	Correlation coefficient	0.919 * *	1				
	p value	0.000	-				
	Sample size	162	-				
Learning atmosphere	Correlation coefficient	0.830 * *	0.881 * *	1			
	p value	0.000	0.000	-			
	Sample size	162	162	-			
Interaction behavior	Correlation coefficient	0.865 * *	0.885 * *	0.874 * *	1		
	p value	0.000	0.000	0.000	-		
	Sample size	162	162	162	-		
Acceptance of learning	Correlation coefficient	0.870 * *	0.892 * *	0.865 * *	0.900 * *	1	
	p value	0.000	0.000	0.000	0.000	-	
	Sample size	162	162	162	162	-	

Table 4. (*Continued*).

		Perceived Ease of use	Perceived usefulness	Learning atmosphere	Interactive behavior	Learning acceptance	Learning effectiveness
	Correlation coefficient	0.856 * *	0.897 * *	0.837 * *	0.900 * *	0.934 * *	1
Learning effectiveness	*p* value	0.000	0.000	0.000	0.000	0.000	-
	Sample size	162	162	162	162	162	-

* *p* < 0.05 ** *p* < 0.01.

3.5. Regression analysis

Perceived ease of use, perceived usefulness, learning atmosphere, interactive behavior, and learning acceptance were taken as independent variables, while learning effect was taken as dependent variables for linear regression analysis. The results show that *the* regression coefficient value of perceived ease of use is $-0.055(t = -0.817, p = 0.415 > 0.05)$, which means that perceived ease of use has no influence on the learning effect. The regression coefficient value of learning atmosphere is $-0.093(t = -1.509, p = 0.133 > 0.05)$, which means that learning atmosphere has no influence on learning effect. Therefore, these two independent variables were deleted and re-analyzed. It can be seen from **Table 5** that the linear regression analysis is carried out with perceived usefulness, interaction behavior and learning acceptance as independent variables and learning effect as dependent variables. As can be seen from the above table, the formula of the model is as follows: Learning effect = $-0.118 + 0.371$* perceived usefulness + 0.224* interaction behavior + 0.417* learning acceptance, and the R-square value of the model is 0.903, which means that perceived usefulness, interaction behavior, and learning acceptance can explain 90.3% of the change of learning effect. During the *F*-test on the model, it was found that the model passed the *F*-test ($F = 298.507, p = 0.000 < 0.05$), which means that at least one of the items of perceived usefulness, interactive behavior and learning acceptance will have an impact on the learning effect.

Table 5. Results of linear regression analysis ($n = 162$).

	Nonnormalized coefficient		Coefficient of standardization	*T*	*P*	Collinearity diagnosis	
	B	Standard Error	Beta			2 VIF is based	Tolerance
Constant	−0.118	0.153	-	−0.773	0.441	-	-
Perceived usefulness	0.371	0.071	0.345	5.215	0.000 * *	4.340	0.230
Interactive behavior	0.224	0.065	0.229	3.472	0.001 * *	4.303	0.232
Learning acceptance	0.417	0.073	0.425	5.744	0.000 * *	5.435	0.184
R 2	0.903						
Adjust *R* 2	0.900						
F	*F* (3,96) = 298.507, *p* = 0.000						
D-W value	2.001						

Note: Dependent variable = Learning effect.
* *p* < 0.05 ** *p* < 0.01.

The final concrete analysis shows that the regression coefficient value of perceived usefulness is $0.371(t = 5.215, p = 0.000 < 0.01)$, which means that perceived usefulness will have a significant positive impact on the learning effect. The regression

coefficient value of interaction behavior is 0.224 ($t = 3.472$, $p = 0.001 < 0.01$), which means that interaction behavior will have a significant positive impact on learning effect. The regression coefficient value of learning receptivity is 0.417($t = 5.744$, $p = 0.000 < 0.01$), which means that learning receptivity will have a significant positive impact on learning effect.

In summary and analysis, it can be seen that perceived usefulness, interactive behavior and learning receptivity all have significant positive influences on learning effect. The influencing factor model of blended learning for undergraduates in private universities is shown in **Figure 1**.

Figure 1. Model of influencing factors of blended learning.

As can be seen from **Table 6**, with perceived usefulness, interactive behavior and learning receptivity as independent variables, and learning effect as dependent variable for linear regression analysis, it can be seen from the above table that the R-square value of the model is 0.903, which means that perceived usefulness, interactive behavior and learning receptivity can explain 90.3% of the changes in learning effect.

Table 6. Summary of the models (intermediate process).

R	R 2	Adjust R 2	Model error RMSE	DW value	AIC value	BIC value
0.950	0.903	0.900	0.230	2.001	−2.005	8.416

As can be seen from **Table 7**, when *F*-test was performed on the model, it was found that the model passed the *F*-test ($F = 298.507$, $p = 0.000 < 0.05$), which means that the model construction is meaningful.

Table 7. ANOVA table (Intermediate process).

	Sum of Squares	df	Mean square	F	*p*-value
Regression	49.417	3	16.472	298.507	0.000
Residual	5.298	96	0.055		
Total	54.715	99			

3.6. Intermediary relationship verification

According to the previous analysis, it is found that perceived ease of use and learning atmosphere have no significance for learning effectiveness. Therefore, the useless independent variables are eliminated for model measurement. The regression coefficient P values of the intermediary relationship model are all less than 0.05,

indicating that the model is significant. For details, see **Table 8**.

Table 8. Summary table of model regression coefficients.

X	→	*Y*	Non-standardized regression coefficient	*SE*	*z* (CR value)	*p*	Standardized regression coefficient
Perceived usefulness	→	Learning receptivity	0.342	0.108	3.155	0.002	0.339
Interactive behavior	→	Learning acceptance	0.611	0.107	5.725	0.000	0.643
Learning acceptance	→	Learning effectiveness	1.026	0.056	18.253	0.000	0.985
Perceived usefulness	→	B4	1.080	0.047	23.137	0.000	0.941
Perceived usefulness	→	B3	0.969	0.043	22.490	0.000	0.934
Perceived usefulness	→	B2	1.050	0.044	23.645	0.000	0.947
Perceived usefulness	→	B1	1.000	-	-	-	0.928
Interactive behavior	→	D3	0.983	0.050	19.600	0.000	0.914
Interactive behavior	→	D2	1.004	0.054	18.725	0.000	0.900
Interactive behavior	→	D1	1.000	-	-	-	0.914
Learning acceptance	→	E2	1.085	0.057	19.012	0.000	0.910
Learning acceptance	→	E1	1.000	-	-	-	0.902
Learning acceptance	→	E4	1.039	0.052	20.116	0.000	0.929
Learning acceptance	→	E3	1.069	0.056	18.987	0.000	0.910
Learning effectiveness	→	F4	1.032	0.049	21.034	0.000	0.935
Learning effect	→	F3	1.014	0.053	19.316	0.000	0.909
Learning effect	→	F2	0.969	0.048	20.076	0.000	0.921
Learning effect	→	F1	1.000	-	-	-	0.910

Note: → Indicates regression influence relationship or measurement relationship.
The bar '-' indicates that this item is the reference item.

According to **Table 9**, the chi-square DOF ratio χ2/df is 2.777, which is less than 3; The RMR value was 0.014, less than 0.05; CFI is 0.958, greater than 0.9; The values of NFI, NNFI, TLI and IFI are all greater than 0.9; PGFI, PNFI and PCFI values were all greater than 0.5; The SRMR values were 0.02 and less than 0.1. The model fit was good. See **Figure 2** for the specific model.

Table 9. Model fitting index.

Common Indicators	chi-square	df	*p*	Chi-square DOF ratio χ2/df	GFI	RMSEA	RMR	CFI	NFI	NNFI
Judging criteria	-	-	> 0.05	< 3	> 0.9	< 0.10	< 0.05	> 0.9	> 0.9	> 0.9
value	238.786	86	0.000	2.777	0.852	0.105	0.014	0.958	0.937	0.949
Other indicators	TLI	AGFI	IFI	PGFI		PNFI	PCFI	SRMR	RMSEA 90% CI	
Criteria for judgment	> 0.9	> 0.9	> 0.9	> 0.5		> 0.5	> 0.5	< 0.1	-	
value	0.949	0.793	0.959	0.610		0.767	0.785	0.020	0.089 to 0.121	

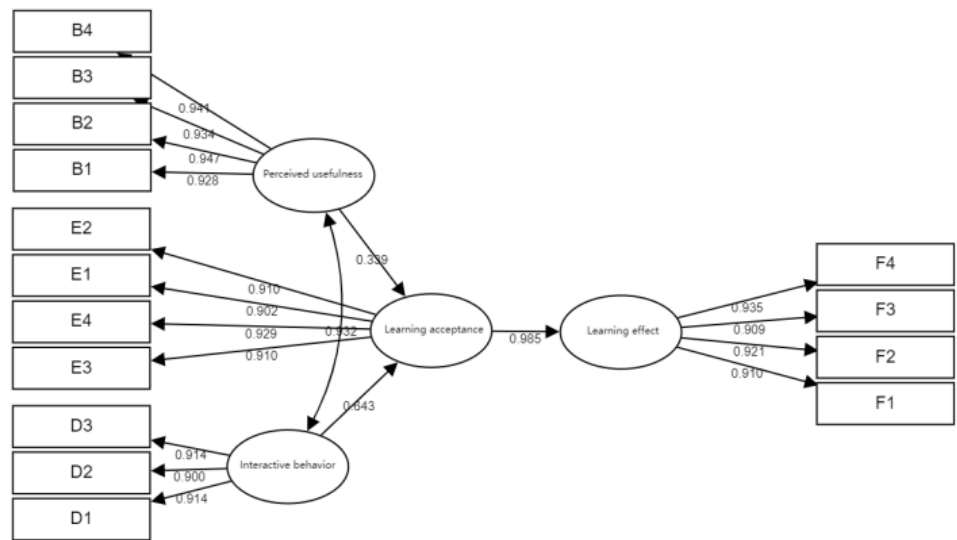Note: χ2(105) = 3781.021, *p* = 1.000 for Default Model.

Figure 2. Mediating role model of learning acceptance.

4. Discussion

The development of the Internet and information technology has changed the generation mode, development process, acquisition means, and transmission of knowledge, and the human learning mode and education model will also change (Ashraf et al., 2021). We should not regard blended learning as a technological invention or innovation. It is the inevitable outcome of developing the Internet and information technology to a certain stage and a new stage in the history of human learning (Cronje, 2020). Blended learning, which closely combines information technology, Internet resources, and education, is an important innovation and educational progress. Blended learning breaks the knowledge barriers between different countries and different schools, making high-quality resources no longer the exclusive right of elite universities and playing a more significant role in education equity. Blended learning focuses on cultivating students' learning initiative and arousing their interest, placing students in the center of teaching activities, and understanding students' learning status in time through extensive data mining and analysis of the learning process, thus improving the quality of education (Wu and Meng, 2024). In other words, blended learning is not only a brand new way of learning but also a brand new concept of learning, which has a significant and far-reaching impact on the current teaching mode, teaching method, and education concept.

This paper uses the structural equation model to determine the influential factors of blended learning. It is verified that in China's private colleges and universities, the perceived usefulness, interactivity, learning acceptance, and other factors are positively correlated with the acceptance of blended learning, which allows teachers to rethink teaching methods and optimize teaching practices. However, perceived ease of use and atmosphere have no significant impact on the blended learning effect of undergraduates in private universities, which also provides an essential reference for the platform focusing on MOOC course development. More importantly, the results of this study will be very helpful for Chinese private universities to answer the questions about how to improve the learning effect of students.

5. Conclusion

From the perspective of learners, this paper takes undergraduates of Harbin Cambridge University as a sample to conduct a questionnaire survey, build a theoretical model, test the hypothesis, and evaluate the critical factors of the blended learning effect. In the blended learning environment of private universities in China, college students' blended learning effect is positively correlated with perceived usefulness, interactive behavior, and learning acceptance, while perceived ease of use and learning atmosphere have no significant impact on it. This study further found that perceived usefulness and interactive behavior can influence the effect of blended learning through the mediating effect of learning receptivity, indicating that student receptivity plays an essential role. Blended learning aims to integrate online technology with traditional classroom instruction, improving instruction quality and enhancing students' sense of participation and flexibility. This positive attitude of acceptance can significantly promote learning outcomes and, at the same time, provide thinking space for teachers to innovate in teaching methods and practices (Wang et al., 2024).

5.1. Limitation

Further research is needed on the factors that influence the blended learning effect on undergraduate students in private universities in China. Although this study has carried out a relatively scientific study on the factors affecting the blended learning effect of undergraduates in private colleges and universities, it is still more scientific regarding sample selection and the number of questionnaires.

The applicability of blended learning requires further exploration. Given that each student has a distinct learning style and diverse needs, the suitability of blended learning for individual students varies significantly. Moreover, different courses present disparate application scenarios as well.

The evaluation of blended learning needs further improvement. Evaluating the effect of blended learning is a complicated process, which requires summative evaluation, formative evaluation, and students' self-evaluation.

5.2. Future study

Blended learning is one of the essential directions of future education, and there are various ways to achieve it. This paper focuses on the platform design and teaching process, and future research needs to delve into other areas, such as AI. Traditional face-to-face teaching has advantages in efficiency and completion rate, but drawbacks include relying on a teacher level, ignoring personalized learning, single content, and rigid evaluation methods. Online learning is flexible and economical, but it requires students to have the ability to study independently. New technologies, such as virtual reality, have begun integrating into blended learning and will become more widespread. The sustainable development of blended learning requires exploring successful business models, but the commercial value and market prospects should be covered in this paper. Future research will expand this area.

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