

Research on the Model of Learning Involvement and Learning Effect in the Blended Learning Environment

—A Case Study of MOOC Blended Learning in Modern Educational Technology

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Abstract: Based on Eduard Deci's self-determination and Kuhn's learning input and harvest theory, this paper constructs the conceptual model of the learning effect of normal school students in a blended teaching environment. The results show that basic psychological needs, blended teaching, autonomous learning motivation, and technology acceptance have significant positive effects on learning engagement, while controlled learning motivation has no significant effects on learning engagement. Based on this, it is proposed that more attention should be paid to normal students' controlled learning motivation in the blended teaching environment, so as to promote the effect of the course.

1. Introduction

With the rapid development of information technology and artificial intelligence education and the proposal of the 2035 strategic plan of China's education modernization, the Ministry of Education has paid more and more attention to the cultivation of information technology application ability of primary and secondary school teachers, and has issued a series of policies. In May, 2014, the Ministry of Education promulgated the Standards of Information Technology Application Ability of Primary and Secondary School Teachers (Trial). In March 2018, the Ministry of Education and other five departments issued a notice on the "Teacher Education Revitalization Action Plan (2018-2022)", stating that "researching and formulating the information technology application standards for normal students will improve the information literacy and information teaching ability of normal students." [2] In April 2018, the notice of "Educational Informationization 2.0 Action Plan" issued by the Ministry of Education put special emphasis on strengthening the training of normal students' information literacy and informatization teaching ability in the information literacy comprehensive improvement action section [3]. In February 2019, the Central Committee of the Communist Party of China and the State Council issued two important

documents, "China's Education Modernization 2035" and "Implementation Plan for Accelerating Education Modernization (2018-2022)", among which "vigorously promoting education informationization" and "accelerating education reform in the information age" were listed separately. Emphasize that the key to educational informationization lies not only in promoting the deep integration of information technology and education and teaching, but also in accelerating the reform of personnel training mode by using modern information technology, implementing artificial intelligence education to boost the construction of teachers, and gradually realize the full coverage of information teaching and learning application. In March 2019, the Ministry of Education issued the "Opinions on Implementing the National IT Application Ability Enhancement Project for Primary and Secondary School Teachers 2.0" (Teacher [2019] No.1), which proposed to build a new mechanism for teachers' IT literacy development based on school, classroom teaching, application-driven, innovation-oriented and accurate evaluation, so as to enhance the informatization leadership of principals, teachers' informatization teaching ability and training team's informatization leading ability. In September 2020, the Ministry of Education and other six departments issued the "Opinions on Strengthening the Construction of Rural Teachers in the New Era", proposing that new technologies such as artificial intelligence and Internet Plus should play a boosting role, deepen the curriculum reform of normal students, and incorporate information-based teaching ability into the training of basic skills of normal students [4].

2. Study the theoretical basis

2.1. Self-determination theory from the perspective of learning effect research

American psychologists Ryan Richard M. and Deci Edward L. put forward the Self-decision Theory (SDT), which holds that human beings are active organisms with a positive tendency of self-integration, self-improvement and continuous learning, emphasizing human autonomy and paying attention to whether human behavior is voluntary or self-determined. However, these decisions do not occur naturally, but only with the support of social environment[5]. After decades of development, it has developed into six branches: organic integration, basic psychological needs, causal orientation, cognitive evaluation, target content and relationship dynamics theory [6]. Self-determination theory can help researchers explore the mechanism of strengthening or restraining the learning motivation of blended learners, and improve the learning effect through environmental factors [7]. According to the basic psychological needs theory of psychology, the three basic psychological needs for individual survival (including independent needs, ability needs and relationship needs) are also the needs to promote people's positive development. When individual's psychological needs are met, it can actively promote healthy growth and positive development, otherwise, the individuals will develop negatively. The need for autonomy means that students feel they can control their learning behavior. Competency requirement refers to students' feeling that they can complete learning tasks and activities. Relationship demand means that students feel that they have the support and concern of teachers and peers. Introducing self-determination theory into the study of normal students' learning engagement and learning effect in blended teaching environment is mainly based on the following considerations: First, from the key factors affecting learning effect, students must have learning motivation factors in blended teaching environment, which directly affect students' learning engagement and learning behavior. Self-determination theory (SDT) is the authority to study the influence of learning motivation factors, learning engagement and learning behavior on learning effect. Secondly, according to the characteristics of students in the blended teaching environment, students' independent inquiry learning and team cooperation learning are emphasized in the blended teaching environment, which is consistent with students' own independent needs, relationship needs and ability needs, and these basic

psychological needs also affect the input and learning effect of learning.

2.2. Study on Learning Effect from the Perspective of Learning Engagement Theory

Academic circles have not yet reached a consensus on the concept of learning engagement. In the 1930s, psychologist Taylor put forward the concept of "student participation" for the first time, which was defined as "time to complete tasks", describing how much time students spent on learning and its influence on learning [8]. In 1984, Astin put forward the concept of "quality of effort" and "investment theory", which strengthened the quality of time investment from both psychological and behavioral aspects, and studied the learning effect of students. The results show that there is a close positive correlation between learning input, learning result and learning effects [9]. George Kuh further perfected the input theory on the basis of Easton's input theory. Student input refers to the time and energy that students put into related activities (these activities help the school to achieve the expected results), and the measures that the school encourages students to participate in these activities [10]. Learning engagement mainly refers to students' behavior intensity, emotional quality and cognitive strategies, which is generally divided into three dimensions: behavior, emotion and cognition [11]. At present, researchers at home and abroad mainly evaluate students' investment in deep learning in the form of scale, and conduct empirical research on it. The study on the influencing factors of learning input in blended learning shows that students' gender, classroom role and teacher-student relationship directly influence the level of learning input. Previous studies have found that there is a significant correlation between the input of blended learning and students' learning styles [12]. By studying the effect and influencing factors of online discussion in blended teaching classroom, Wu Xiaomeng and others learned about students' learning engagement in blended teaching environment from three aspects: cognition, behavior and emotional engagement, and studied the influencing factors of students' learning engagement from four dimensions: students, teachers, schools and media, and finally found that learning engagement is related to problem difficulty and students' personality [13]. The essence of teaching under the mixed environment is online and offline classroom teaching, especially online learning. To a great extent, the learning effect depends on students' learning input, which is mainly reflected in three aspects: cognition, emotion and behavior in students' learning activities. If students actively study and take part in learning activities, they can get good learning results. On the contrary, students who are not active or passive in learning will show bad learning behavior, improper learning methods and even low learning mood, which will definitely lead to poor academic performance. This paper introduces the theory of learning engagement into the blended teaching environment, and investigates the influence of learning engagement on learning effect from the dimensions of students' own characteristics, cognition, emotion and behavior, so as to more comprehensively and objectively analyze the relationship between various influencing factors and learning engagement [14].

2.3. Study on Learning Effect from the Perspective of Technology Acceptance Mode

Technology Acceptance Model (TAM) was developed by American scholar Fred D. Davis in 1986 on the basis of rational action (tra) theory, which is mainly used to predict and explain people's acceptance of information technology. The perceived usefulness and ease of use in TAM play a decisive role in people's acceptance of technology, which can predict users' behavioral intentions to a certain extent, thus affecting the use of technology, and the learning behavior and learning effect of using technology [15]. A large number of studies have confirmed that the mode of technology acceptance is positively correlated with the learning effect, and the usefulness and ease of use perceived by learners are directly proportional to learning effect [16].

3. Research design and method

3.1. Research question

In order to explore the influencing factors of normal students' learning effect of modern educational technology courses under blended teaching environment, and deeply analyze the influence of teaching mode, technology acceptance, learning motivation, learning input and other factors on learning effect, so as to further optimize online and offline blended teaching, it is suggested to focus on solving the following problems: First, deeply analyze the direct and key factors affecting normal students' learning input under blended teaching environment; The second is to explore the influence of learning involvement theory, self-determination theory and technical acceptance on learning effect in the blended teaching environment. The third is to construct the learning effect model under the blended teaching environment and explore effective ways to improve the learning input level.

3.2. Questionnaire design

In order to ensure the reliability, validity and operability of the questionnaire, the reliability and validity of the questionnaire were tested before it was distributed, and exploratory factor analysis, factor analysis and path analysis were conducted for the whole questionnaire. According to the analysis results, problems with similar eigenvalues and insignificant factor contribution rates are eliminated, and the accuracy of the test data is ensured. Intrinsic reliability refers to the inherent consistency between the questions in the questionnaire. Commonly used indexes are Cronbach coefficient and semi-reliability. Repeat the measurement and then calculate the degree of agreement [17]. Through data processing, the coefficient value of the questionnaire is 0.973, indicating that the questionnaire has good internal consistency. The content design of the questionnaire is mainly composed of three parts: the first part is the investigation of the present situation of learning input in blended teaching, which is divided into three dimensions: behavioral input, cognitive input and emotional input. A total of 12 questions, using Likert five-level scale. In order to improve the reliability and validity of the questionnaire, Cronbach's coefficient value of this part is 0.967. The second part is to investigate the students' self-determination level in the blended teaching environment, including two dimensions of basic psychological needs (autonomous needs, ability needs and relationship needs) and learning motivation (controllable learning motivation and autonomous learning motivation), and 24 small questions [18]. Cronbach's coefficient value of this part is 0.938, indicating that the questionnaire is good in terms of internal consistency and reliability. The third part examines the theory of the technology acceptance model, and tests perceived usefulness and perceived ease of use with the research tools developed by Davis, including four dimensions of satisfaction and 18 sub-questions of technology acceptance (perceived usefulness and perceived ease of use), teaching quality, learning effect and learning situation. The value of Cronbach coefficient in this part is 0.940, as shown in Table 1.

Table 1: Scale of learning input and learning effect in a blended teaching environment.

First-order latent variable	Description of the questionnaire items	No
Autonomy needs	Be able to decide your learning time	E1
	Be able to decide on your own learning style	E2
	Be able to decide on your learning content	E3
Ability needs	Ability to learn relevant knowledge	E4
	Ability to complete your learning tasks	E5
	Ability to use the knowledge to solve learning problems	E6
Relational needs	Need to discuss and communicate with your teachers and classmates	E7

	Need the help of your teachers and classmates	E8
	Need a good teacher, classmate relationship	E9
Identity regulation	It is considered important to learn modern educational technology courses	E10
	Think that learning modern educational technology courses can increase knowledge	E11
	It es that learning modern educational technology courses can improve the application of information technology	E12
Integrated adjustment	Learning modern educational technology courses makes my learning more meaningful	E13
	Learning modern educational technology courses is part of my course study	E14
	Learning modern educational technology courses helps to enrich my learning career	E15
Internal adjustment	Learn modern educational technology courses out of my interest	E16
	Learning a modern educational technology course is to enjoy the fun of learning	E17
	Learning modern educational technology courses can make me feel happy inside	E18
External adjustment	A modern educational technology course is studied because of the credit requirements	E19
	Learning modern educational technology courses is conducted because of the teacher's requirements	E20
	Take modern educational technology courses to gain recognition from others	E21
Internal shot adjustment	Learning modern educational technology courses will make the teacher feel that I am an excellent student	E22
	Modern education technology curriculum is bad will feel guilty	E23
	Learning modern educational technology courses will make others feel that it is my interest	E24
Teaching design	Pre-class teaching objectives are clear, in line with the students' learning situation	E25
	Pre-class learning tasks are reasonable, and the troubleshooting channels are unblocked	E26
	Rich in teaching resources, easy to access and understand	E27
Online teaching	The teaching method is appropriate and highly enlightening	E28
	Can answer questions in time	E29
	Students will guide guided to study independently and cooperate	E30
Evaluation and reflection	The assigned assignment is flexible and effective	E31
	Course assessment is scientific and fair	E32
	Can adjust the teaching strategies according to the teaching situation	E33
Cognitive input	Will try to use the knowledge you have learned to solve new problems	E34
	Will preview before class and prepare relevant materials	E35
	Will discuss what you learned in class	E36
	The job is done in the best way	E37
Emotional input	Interested in modern educational technology courses	E38
	Very impressed with learning modern educational technology courses	E39
	Like the teaching method of blended teaching	E40
	Like to work with the students together very group study	E41
Behavior input	Focus on listening and listen carefully	E42
	Course assignments or learning tasks are completed on time	E43
	They will actively post questions and also answer questions actively	E44
	Will share, communicate and discuss the knowledge they have learned with the classmates	E45
Learning effect	Increased my knowledge and awareness of information technology application	E46
	Improved my digital learning ability and information technology application ability	E47
	Enhanced my learning autonomy	E48
Learning satisfaction	Modern am satisfied with modern modern modern me satisfied	E49
	I am happy with the mixed learning of modern educational technology	E50
	I am satisfied with the mixed learning of modern educational technology	E51
Technical acceptance degree	Modern educational technology courses are useful and helpful for my future development	E52
	Modern educational technology courses are novel and are often easy to use in life and study	E53
	The operation of Xueyin online platform (Learning Tong) is easy	E54

3.3. Research samples and methods

The second-year normal students and learners of off-campus courses in the "Modern Educational Technology" MOOC course on the "Study Bank Online" platform are the subjects of investigation. The course is offered by the Information Technology Teaching Fusion and Innovation Team of Neijiang Normal University, using quantitative research methods. , Collect data by issuing questionnaires through the network platform. A total of 382 copies of this questionnaire were distributed. After excluding inconsistent options and other invalid questionnaires, a total of 355 valid questionnaires were obtained, with an effective rate of 92.9%, which meets the requirements

of educational research samples.

3.4. Theoretical model construction and research hypothesis

Through self-determination theory, technology acceptance model theory, learning input theory and the learning effect of modern educational technology courses in a blended teaching environment, fully considering the characteristics of blended learning, on the basis of existing research, 8 second-order variables and 17 A conceptual model of first-order variables and 8 research hypotheses are proposed, as shown in Figure 1:

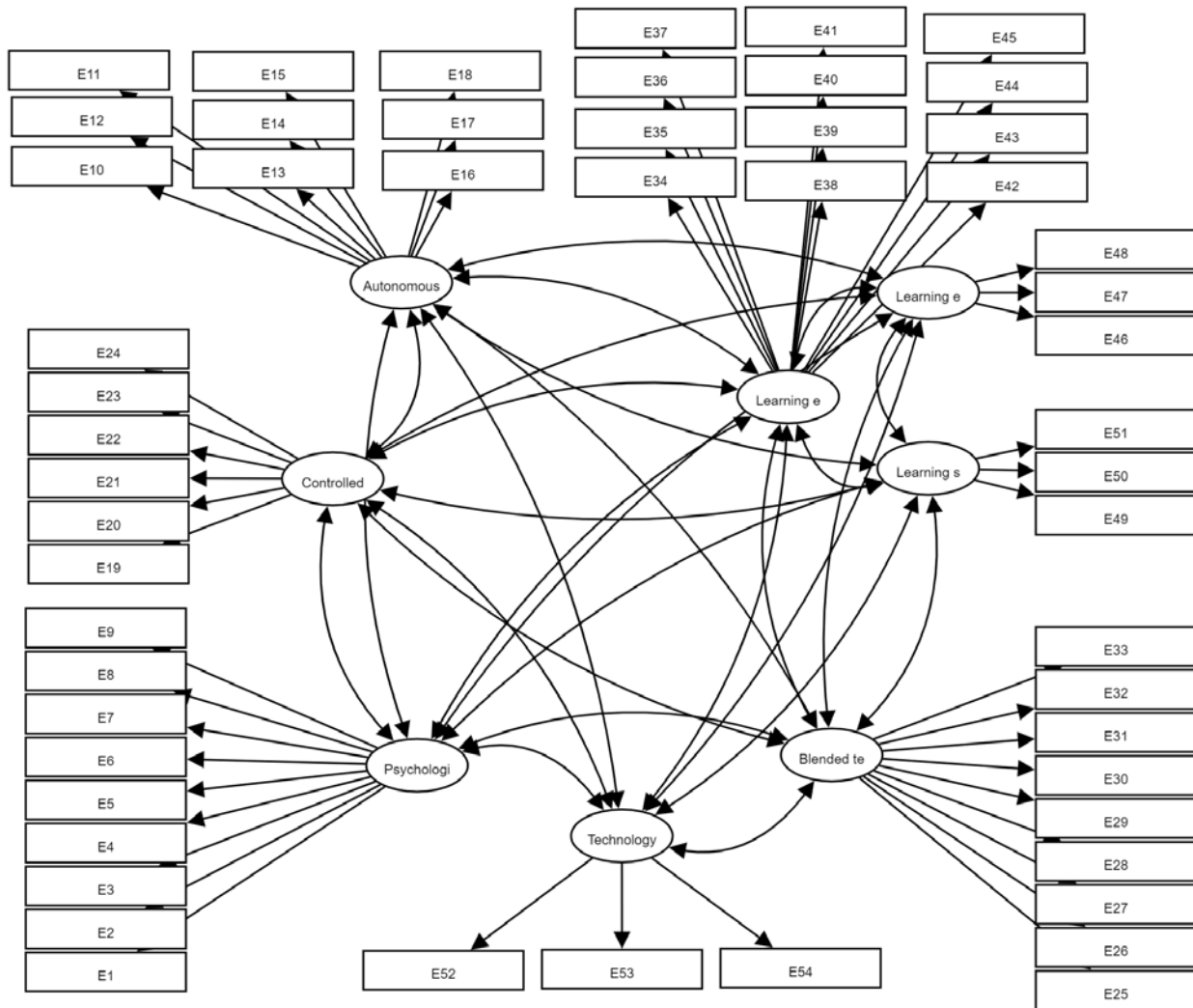


Fig.1 The conceptual model of the mixed classroom learning input and learning effect of normal students' application of information technology

Basic psychological needs: including self-determination, ability and emotion. According to related theories, basic psychological needs are regarded as second-order variables, while independent needs, ability needs and emotional needs are regarded as first-order variables. Sulea found that autonomy, ability and relationship needs have a positive impact on Romanian college students' learning input. Karimi's research on Iranian college students' learning input proves that independent demand, ability demand and emotional demand have a positive impact on learning input.

Hypothesis H1: Basic psychological needs have a positive impact on learning engagement.

Learning motivation: Learning motivation includes autonomous learning motivation and controlled learning motivation. According to the theory of self-determination, autonomous learning motivation is regarded as a second order variable. The motivation of autonomous learning comes from students' learning interest and the intrinsic value of students' identity learning. Identity regulation, integration regulation and internal regulation, as first-order variables, affect the motivation of autonomous learning together. Controlled learning motivation: Controlled learning motivation includes external regulation and internal regulation, mainly from external pressure, such as academic requirements. Taking external adjustment and internal adjustment as first-order variables, they have influence on learning motivation. Therefore, college students' learning motivation is an important factor that influences the input level of blended learning. The research also shows that learning motivation is the basis of learning input, and its function is to improve students' learning participation and learning input level, so as to make students get better learning results [20]. Phyllis Blumenfeld From the perspective of designing learning activities, learning activities such as truth, inquiry, cooperation and technical support can stimulate students' learning motivation and promote students' participation in learning[21].

Hypothesis H2: Autonomous learning motivation has a positive impact on learning engagement.

Hypothesis H3: Controlled learning motivation has a negative impact on learning engagement.

Blended teaching: Blended teaching refers to teachers' teaching activities before, during and after class. Blended teaching is regarded as the second-order variable, and the design of pre-class teaching activities, online teaching in class and evaluation reflection after class are regarded as the first-order variables affecting the quality of blended teaching. Rasheed Abubakar pointed out that blended teaching poses many challenges to teachers, including teachers' technical knowledge and operation, information teaching ability, online video production, and the positive influence of mixed learning resources on learning input [22]. Patricia McGee pointed out that the online learning design to promote students' learning input should have the following characteristics: first, the learning process should not be isolated, but should be socialized, encourage multiple interactions, and timely feedback and evaluation; Secondly, the design of learning activities should pay attention to the cooperation and participation of students, so as to promote the understanding, application and evaluation of knowledge through participation, cooperation and sharing [23].

Hypothesis H4: Blended teaching positively affects learning input.

Learning engagement: According to the three-dimensional division of learning engagement by Jennifer A Fredricks and others, learning engagement is defined as the general term of students' cognition, emotion and behavior in mixed learning activities [24]. According to mature theories and literature, learning input is regarded as the second-order variable, and cognitive input, emotional input and behavioral input are regarded as the first-order variables. Chris Dede pointed out in his research that technology can promote students' learning input by enriching teaching resources, optimizing teaching methods, improving teaching evaluation, and expanding cooperation and exchange space [25]. Learning involvement has a positive effect on learning effect. Murillo proved that learning involvement has a positive impact on learning effect and learning satisfaction in the study of flip classroom [26]; As for the relationship between perceived ease of use and learning effect, Adobor proved the positive correlation between perceived ease of use and learning effect in blended learning [27].

Hypothesis H5: Perceived usefulness and perceived ease of use positively affect learning input.

Hypothesis H6: Learning involvement positively affects learning effect.

Learning effect: Learning effect refers to students' perception of using blended learning to improve knowledge and skills. Students perceive that they have learned effective, useful and easy-to-use knowledge in blended learning, and they will naturally have a sense of learning satisfaction.

For example, according to Liaw's research, the perceived usefulness of college students in blended learning is positively correlated with learning behavior and learning effect.

Hypothesis H7: Learning engagement positively affects learning satisfaction.

Hypothesis H8: Learning effect positively affects learning satisfaction.

4. The results and discussion

4.1. Reliability test

In order to test the reliability of the designed questionnaire, the consistency of this questionnaire is tested according to Cronbach. α reliability coefficient, which is the most common test method of reliability. The research shows that Cronbach. α 's α coefficient is acceptable between 0.65 and 0.7, quite good between 0.7 and 0.8, and very good above 0.8. The reliability analysis module of online SPSSAU is used to test the reliability of the questionnaire. The Cronbach. α coefficient of the total questionnaire is 0.974, and the Cronbach. α coefficients of 17 latent variables are all greater than 0.8, indicating that each factor has high reliability and the reliability of the questionnaire is good, as shown in Table 2.

Table 2: Factor load, CRonbach. α coefficient, Cr, AVE value.

First-order latent variable	No	Cronbach. α	AVE	CR
Independent needs	E1	0.924	0.799	0.922
	E2			
	E3			
Ability is required	E4	0.917	0.779	0.914
	E5			
	E6			
Relationship required	E7	0.724	0.705	0.877
	E8			
	E9			
Identity regulation	E10	0.927	0.806	0.926
	E11			
	E12			
Integrated adjustment	E13	0.925	0.805	0.925
	E14			
	E15			
Internal adjustment	E16	0.929	0.811	0.928
	E17			
	E18			
External adjustment	E19	0.879	0.728	0.889
	E20			
	E21			
Internal shot adjustment	E22	0.830	0.681	0.855
	E23			
	E24			
Teaching design	E25	0.920	0.791	0.919
	E26			
	E27			
Online teaching	E28	0.946	0.854	0.946
	E29			
	E30			
Evaluation and reflection	E31	0.932	0.811	0.928
	E32			
	E33			
Cognitive input	E34	0.917	0.799	0.922
	E35			
	E36			
	E37			

Emotional input	E38	0.919	0.743	0.920
	E39			
	E40			
	E41			
Behavior input	E42	0.918	0.746	0.921
	E43			
	E44			
	E45			
Learning effect	E46	0.929	0.808	0.927
	E47			
	E48			
Learning satisfaction	E49	0.967	0.899	0.964
	E50			
	E51			
Technical acceptance degree	E52	0.938	0.835	0.938
	E53			
	E54			

4.2. Validity test

In order to verify the structural validity of the questionnaire, SPSSAU is used to test the KMO test coefficient and Bartlett sphere (significant probability of χ^2 statistical Barletts (Bartlett sphere test), and to analyze and judge whether the questionnaire data are suitable for factor analysis. According to the viewpoint of statistical research, the value of KMO test coefficient is above 0.7, which shows that the sample data has good validity. After Bartlett's sphericity test of the research data, it is found that P value is less than 0.05, which shows that the research data is suitable for factor analysis. The value of KMO test coefficient is 0.956, which is greater than 0.7, which satisfies the precondition of factor analysis and can be used in factor analysis. In addition, considering the aggregation degree and discriminant validity of the model, if the CR value (combination reliability) is greater than 0.7 and the AVE value (average extraction variance) is greater than 0.5, then the aggregation validity is better. When the square root of AVE value of each factor is higher than the correlation coefficient of other factors, it shows that the scale has good discriminant validity. It can be seen from table 2 that the CR value of each factor is greater than 0.7, and the AVE value is greater than 0.5, indicating that the model has good aggregation validity. Confirmatory Factor Analysis (CFA) is a research method used to measure whether the corresponding relationship between measurement factors and measurement items is consistent with the researcher's prediction, and it is mainly used to distinguish validity research. AVE value obtained by confirmatory factor analysis, the diagonal in the table is the square root value of AVE, and the other is the correlation coefficient between factors. AVE square root value can represent the aggregation of the factor, and correlation coefficient represents correlation. If the degree of aggregation of this factor is higher and obviously stronger than that of other factors, it indicates that it has discriminant validity. If the square root value of a factor AVE is higher than the absolute value of the correlation coefficient between the factor and other factors, if all factors come to such a conclusion, it means that it has good discriminant validity. After analyzing the factor coefficients of the data, it is found that the square root of AVE value of each factor is larger than the correlation coefficient, which shows that the model has good discriminant validity, as shown in Table 3.

Table 3: Discrimination validity: Pearson correlation and square root value of AVE.

	Psychological needs	Autonomous learning motivation	Controlled learning motivation	Learning engagement	Blended teaching	Learning effect	Learning satisfaction	Technology acceptance
Psychological needs	0.778							
Autonomous	0.725	0.839						

	Psychological needs	Autonomous learning motivation	Controlled learning motivation	Learning engagement	Blended teaching	Learning effect	Learning satisfaction	Technology acceptance
learning motivation								
Controlled learning motivation	0.391	0.402	0.810					
Learning engagement	0.679	0.775	0.442	0.863				
Blended teaching	0.643	0.674	0.374	0.828	0.894			
Learning effect	0.622	0.733	0.399	0.888	0.769	0.903		
Learning satisfaction	0.575	0.689	0.403	0.837	0.744	0.855	0.949	
Technology acceptance	0.284	0.362	0.236	0.386	0.364	0.418	0.394	0.915
Note: The oblique diagonal number is the AVE square root value								

According to the discriminant validity analysis, the square root value of AVE for psychological needs is 0.778, which is greater than the maximum value of absolute value of correlation coefficient between factors, which means that AVE has good discriminant validity. For autonomous learning motivation, the square root value of AVE is 0.839, which is larger than the maximum value of absolute value of correlation coefficient between factors, which means that AVE has good discrimination validity. For controlled learning motivation, the square root value of AVE is 0.810, which is larger than the maximum value of absolute value of correlation coefficient between factors, which means that AVE has good discrimination validity. For Learning engagement, the square root value of AVE is 0.863, which is less than the maximum value of absolute value of correlation coefficient between factors, indicating that its discriminant validity is not good, so it can be considered to remove the lower term of standard load coefficient and re-analyze. For blended teaching, the square root value of AVE is 0.894, which is larger than the maximum value of absolute value of correlation coefficient between factors, which means that it has good discriminant validity. For the Learning effect, the square root value of AVE is 0.903, which is larger than the maximum value of absolute value of correlation coefficient between factors, which indicates that AVE has good discriminant validity. As far as learning satisfaction is concerned, the square root value of AVE is 0.949, which is larger than the maximum value of absolute value of correlation coefficient between factors, which means that AVE has good discriminant validity. As for technical acceptance, the square root value of AVE is 0.915, which is larger than the maximum value of absolute value of correlation coefficient between factors, which means that it has good discriminant validity.

4.3. Model evaluation

Fit test: Fit is the fitness or fit of the model. As far as fitness evaluation is concerned, if the higher the fitness of the model, the better the model can meet the requirements, and the more meaningful the parameter estimation is. The commonly used measurement indexes are divided into three categories: absolute fitting index, value-added fitting index and simplified fitting index. The square root of approximate error (RMSEA) is less than 0.05, which indicates that the data is fitted with respect to the freedom model. Under 90% confidence level, if the RMSEA value is less than 0.08, it means that the hypothesis can not be rejected at 0.01 confidence level; The closer the goodness-of-fit index of GFI, AGFI, NFI, NNFI, RFI, CFI and IFI is to 1, the better the model fit; If greater than 0.8, it is acceptable; If it is greater than 0.9, it means better fitting degree. PNFI and PGFI are larger than 0.5, which means that the model is very suitable. It is acceptable that the chi-square ratio of freedom is less than 5, and less than 3 is a good representation of the model fitting

degree. According to the analysis results of the model fitting degree, except that AGFI is 0.895, which belongs to the acceptable range, all other indexes well express the model fitting degree.

Table 4: Model fitting index

Common indicators	χ^2	<i>df</i>	χ^2/df	GFI	RMSEA	RMR	CFI	NFI	NNFI
Judgment criteria	-	-	<3	0.9	<0.10	<0.05	0.9	0.9	0.9
Correct the model test value	4892.541	1911	2.560	0.954	0.093	0.043	0.929	0.981	0.913
Other indicators	TLI	AGFI	IFI	PGFI	PNFI	SRMR	RMSEA 90% CI		
Judgment criteria	0.9	0.9	0.9	0.9	0.9	<0.1	-		
Correct the model test value	0.913	0.895	0.930	0.989	0.916	0.076	0.083~0.098		

Path analysis: the path coefficient calculated by SPSSAU can better reflect the correlation and influence of potential, as shown in Table 5. It can be seen from Table 4 that the influences of autonomous learning motivation, controlled learning motivation, basic psychological needs, blended teaching and technical acceptance on learning input are significant at 0.05 level, and the standardized path coefficients are 0.316, 0.104, 0.102, 0.494 and 0.063 respectively, which means autonomous learning motivation, controlled learning motivation, basic psychological needs, blended teaching and technical acceptance respectively. At the same time, learning engagement has a significant positive impact on learning effect and learning satisfaction. In addition, learning effect has a significant positive impact on learning satisfaction.

Table 5: Summary table of model regression coefficient

X	→	Y	Non-normalized regression coefficient	SE	Z (CR value)	<i>p</i>	Standardized regression coefficient
Autonomous learning motivation	→	Learning input	0.299	0.046	6.515	0.000	0.316
Controlling learning motivation	→	Learning input	0.077	0.024	3.154	0.002	0.104
psychological needs	→	Learning input	0.085	0.037	2.272	0.023	0.102
blended teaching	→	Learning input	0.466	0.048	9.732	0.000	0.494
Technical acceptance degree	→	Learning input	0.025	0.013	1.949	0.048	0.063
Learning input	→	Learning effect	0.986	0.052	18.842	0.000	0.926
Learning input	→	Learning satisfaction	0.421	0.134	3.141	0.002	0.325
Learning effect	→	Learning satisfaction	0.702	0.129	5.452	0.000	0.576

Note: → indicates the regression-impact relationship

The path coefficient of structural equation model is shown in figure 2. The results show that basic psychological needs, autonomous learning motivation, controlled learning motivation and blended teaching have significant positive effects on learning engagement. Learning engagement has a positive impact on learning effect and learning satisfaction, while learning effect has a positive impact on learning satisfaction. For example, the path coefficient of autonomous learning motivation to learning input reaches 0.316, that is, every standard deviation of students' autonomous learning motivation increases the learning input of normal students in online and offline mixed learning by 0.316 standard deviation.

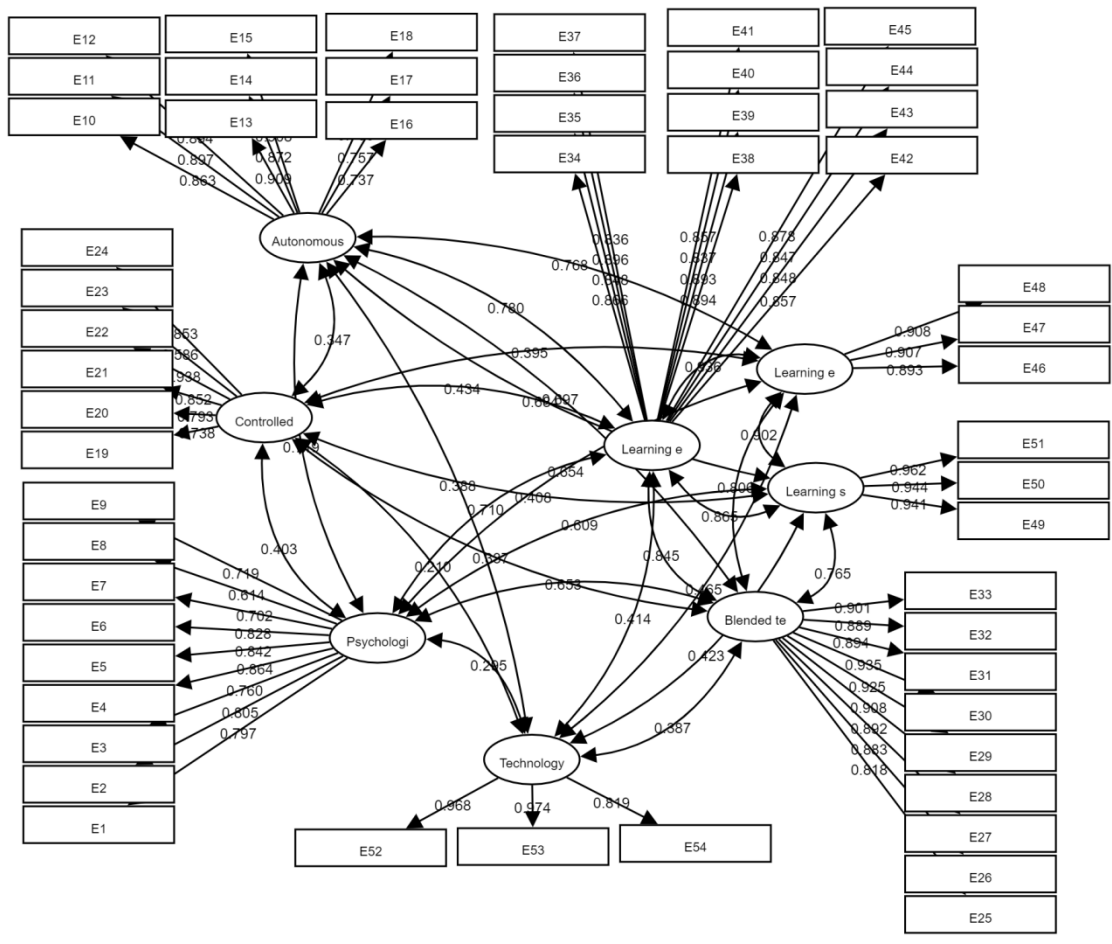


Fig. 2 Path coefficient diagram of structural equation model

5. Conclusions

5.1. The relationship between basic psychological needs and learning input in a blended teaching environment

The data in this paper show that the basic psychological needs in the blended learning of modern educational technology have a positive impact on learning input, that is, the more basic psychological needs are met, the greater the learning input. When the demand for autonomy affects learning input, the value of the standardized path system is $0.403 > 0$, and the path has an obvious level of $0.01 (z=402.012, p=0.000 < 0.01)$, which indicates that the demand for autonomy has a significant positive effect on learning input. Influence the relationship. When it has an impact on learning input, the value of the standardized path system is $0.422 > 0$, and the path has an obvious level of $0.01 (z=7.114, p=0.000 < 0.01)$, indicating that ability requirements has a significant positive impact on learning input relationship. When the relationship requirement have an impact on the learning input, the standardized path system has a value of $0.289 > 0$, and the path has an obvious level of $0.01 (z=5.895, p=0.000 < 0.01)$, which indicates that the relationship requirement have a significant positive impact on the learning input. Relationship. Generally speaking, when the basic psychological needs affect learning input, the value of standardized path system is $0.679 > 0$, and at the level of $0.01 (z=17.421, p=0.000 < 0.01)$, it shows that the basic psychological needs have a significant positive influence on the learning input.

Reeve believes that if learning activities can meet students' basic psychological needs, students' investment in learning will increase [28]. On the contrary, if learning activities can't meet students' basic psychological needs, then the students' learning input will be weakened. In the blended teaching of modern educational technology, teachers should realize the importance of satisfying students' basic psychological needs. First, to meet the independent needs of students teachers should give students the opportunity to choose learning methods and materials freely to meet their independent needs. For example, in blended teaching, teachers encourage students to explore independently and discuss in groups, thus creating a diversified learning atmosphere. In the resource design of the hybrid learning platform, we can adopt layered design resources, and also increase extended learning resources. Students can access the extended learning resources and choose their own learning materials according to their own situation. Second, it is necessary to meet the needs of students' ability, reasonably set up basic and challenging learning tasks or assignments with progressive difficulty, and provide students with opportunities to show their learning ability. Third, to meet students' emotional needs, it is necessary to strengthen students' learning support, actively participate in students' discussions, answer difficult questions, and establish a learning mechanism for students to help each other and share, such as using QQ and WeChat to establish a learning exchange group for students to exchange and discuss and cultivate their emotional needs in exchange and sharing.

5.2. The relationship between learning motivation and learning input in a blended teaching environment

Self-regulated learning motivation: the standardized path coefficient is $0.334 > 0$, and the path is obviously 0.01 ($z=91.948$, $p=0.000 < 0.01$), indicating that identity regulation has a significant impact on self-regulated learning motivation. In the aspect of autonomous learning motivation, the influence factor of integration adjustment is $0.329 > 0$, and the path is obviously at 0.01 level ($z=80.224$, $p=0.000 < 0.01$) which indicates that integration adjustment has a significant positive effect on autonomous learning motivation. As for the influence of the standard path system on autonomous learning motivation, the value is $0.409 > 0$, and the level of path is obviously 0.01 ($z=160.760$, $p=0.000 < 0.01$), which shows that internal regulation has a significant positive influence on autonomous learning motivation. In a word, the standardized path coefficient of the influence of autonomous learning motivation on learning input is $0.775 > 0$, and the path is at a significant level ($z=23.130$, $p=0.000 < 0.01$), indicating that autonomous learning motivation has a significant positive influence on learning input.

Controlled learning motivation: When external adjustment has an impact on learning input, this path is not significant ($z=-1.327$, $p=0.185 > 0.05$), which shows that external adjustment has no significant impact on learning input. In terms of learning input, the standardized path coefficient of the internal adjustment is $0.586 > 0$, which shows that the internal adjustment has a significant positive impact on learning input ($z=2.977$, $p=0.003 < 0.01$). This control of learning motivation has no obvious impact on learning input, so it has no obvious impact on learning input ($z=0.434$, $p=0.664 > 0.05$). Controlling learning motivation has no significant effect on learning input. Students with controlled learning motivation leading to learning will have a lower level of learning motivation after achieving the external goals, while students with autonomous learning motivation leading to learning will continue to learn regardless of whether the external goals are achieved. Under the blended teaching environment, teachers should make use of new technologies, new media and new teaching methods to promote the transformation from controllable learning motivation into autonomous learning motivation and enhance the positive influence of autonomous learning motivation. Teachers can use intelligent learning tools such as study passes and rain

lessons to record study records and points, and reward students with good performance for learning points. It is also possible to help students learn actively by self-adaptive learning and teaching students in accordance with their aptitude.

5.3. The Relationship between Teaching Design, Online Teaching, Evaluation Reflection and Learning Engagement in the blended teaching Environment

In the covariance relationship (correlation) between evaluation reflection and instructional design, the standardized path coefficient is 0.504, which is significant at the level of 0.01 ($z=12.330$, $p=0.000<0.01$), indicating that there is a significant positive covariance correlation between evaluation reflection and instructional design. In the covariance relationship between teaching mode and teaching design, the value of standardized path coefficient is 0.532, which is significant at the level of 0.01 ($z=12.597$, $p=0.000<0.01$), indicating that there is also a significant positive covariance correlation between teaching mode and teaching design. In the covariance relationship (correlation) between teaching mode and evaluation reflection, the value of standardized path coefficient is 0.587, which is significant at the level of 0.01 ($z=12.766$, $p=0.000<0.01$), indicating that there is a significant positive covariance correlation between teaching mode and evaluation reflection. In the covariance relationship (correlation) between blended teaching and learning input, the standardized path coefficient is 0.002, which is significant at the level of 0.01 ($z=8.686$, $p=0.000<0.01$), indicating that there is a significant positive covariance correlation between blended teaching and learning input. When instructional design influences the blended teaching environment, the standardized path coefficient value is 0.337, which is obviously significant at the level of 0.01 ($z=38.500$, $p=0.000<0.01$), which also shows that instructional design has a significant positive influence on blended teaching. When evaluating the influence of reflection on blended teaching, the standardized path coefficient is 0.333, which is significant at the level of 0.01 ($z=32.318$, $p=0.000<0.01$), indicating that evaluation reflection will have a significant positive influence on blended teaching. When the teaching mode influences the blended teaching, the standardized path coefficient is 0.367, which is significant at the level of 0.01 ($z=31.516$, $p=0.000<0.01$), which also shows that the teaching mode has a significant positive influence on the blended teaching. When evaluating the influence of reflection on learning input, the value of standardized path coefficient is 0.590, which is significant at the level of 0.01 ($z=7.372$, $p=0.000<0.01$), indicating that evaluation reflection will have a significant positive impact on learning input. When the teaching mode affects the learning input, the standardized path coefficient is 0.196, which is significant at the level of 0.05 ($z=2.447$, $p=0.014<0.05$), indicating that the teaching mode has a significant positive impact on the learning input. The standardized path coefficient is 0.828, which is significant at the level of 0.01 ($z=27.816$, $p=0.000<0.01$), thus indicating that the blended teaching has a significant positive impact on the learning input.

Instructional design is the core of blended teaching mode, which depends on the combination of online teaching and offline teaching to a great extent. First, the pre-class teaching design of the blended teaching mode. First, it is necessary to formulate clear and feasible teaching objectives, that is, to cultivate normal students' ability to acquire and process information teaching resources, information teaching design, information technology and discipline integration; Second, it is necessary to arrange the pre-class tasks reasonably so that they are mainly practical and discursive; Third, we should fully prepare learning materials, and take audio-visual materials, teaching materials, expanding resources and academic frontiers as online teaching resources, so that students can choose freely. Second, the blended teaching organization form. First, teachers analyze and explain the common problems in online students' homework before class, and use intelligent learning tools such as rain class and learning to answer questions; The second is to carry out

autonomous learning, in which teachers inspire students to think by asking questions in class and play a supervisory and guiding role; Third, cooperative learning, forming study groups, assigning learning tasks, sharing, discussing and practicing with the study groups, and finally reporting the learning results. Teachers play a guiding and supporting role. Third, in the reflection of after-school evaluation, firstly, students participate in curriculum evaluation, report their learning satisfaction and learning quality, and teachers adjust teaching strategies according to students' feedback results and opinions; secondly, homework is arranged, and students' ability to use their knowledge to solve practical problems is assessed in various forms such as tests, cases, reports and self-reports.

5.4. The Relationship among Learning Engagement, Learning Effect and Learning Satisfaction in Blended Teaching Environment

The standardized path coefficient is 0.888, which is significant at 0.01 level ($z=36.335$, $p=0.000<0.01$), indicating that learning input has a significant positive influence on learning effect. When learning engagement affects learning satisfaction, the standardized path coefficient is 0.837, which is significant at 0.01 level ($z=28.846$, $p=0.000<0.01$), indicating that learning engagement has a significant positive impact on learning satisfaction. In the covariance relationship (correlation) between learning effect and learning satisfaction, the standardized path coefficient is 0.060, which is significant at the level of 0.01 ($z=7.643$, $p=0.000<0.01$), indicating that there is a significant positive covariance correlation between learning effect and learning satisfaction.

In mixed learning input, teachers' teaching behavior, teacher-student relationship and teachers' knowledge level are the main factors affecting learning input; Peer is another important factor affecting learning input, and the support and cooperation among students also affect learning input. To improve learning input, we can start from the following aspects: First, pay close attention to students' learning performance, give comprehensive learning support, teach students learning experience, strategies and skills, help students solve problems in learning and practice, and increase cognitive input and behavioral input; Second, treat students sincerely, be more friendly to students, and create a relaxed and happy classroom atmosphere. By actively observing students' psychological performance, we can provide psychological counseling and psychological care to students who have learning burnout and learning anxiety, so as to convey emotional support and promote emotional input. From the perspective of peers, we can improve learning input from the following aspects: first, organize learning groups to form a learning community, and cooperate with group members to learn, discuss and reflect, and complete learning tasks together; Second, create an exchange environment for students to learn and share, advocate students to share with each other, and promote students to establish a good relationship with their peers.

5.5. The relationship between technology acceptance model and learning effect in blended teaching environment

In the covariance relationship (correlation) between curriculum usability and curriculum usefulness, the standardized path coefficient is 1.843, which is significant at the level of 0.01 ($z=12.670$, $p=0.000<0.01$), indicating that there is a significant positive covariance correlation between curriculum usability and curriculum usefulness. In the covariance relationship (correlation) between technical acceptance and curriculum usefulness, the standardized path coefficient is 0.438, which is significant at the level of 0.01 ($z=7.735$, $p=0.000<0.01$), indicating that there is a significant positive covariance correlation between technical acceptance and curriculum usefulness. In the covariance relationship (correlation) between technology acceptance and curriculum usability, the standardized path coefficient is 0.382, which is significant at 0.01 level ($z=6.819$, $p=0.000<0.01$), which indicates that there is a significant positive covariance correlation between

technology acceptance and curriculum usability. The standardized path coefficient is 0.987, which is significant at the level of 0.01 ($z=117.945$, $p=0.000<0.01$). It also shows that technical acceptance has a significant positive impact on learning effect.

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