Self-efficacy in Home-based Online Learning Environments

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Abstract

In 2020, the unexpected outbreak of COVID-19 has brought a new challenge to education and provided a revolutionary opportunity to integrate ideas for building an information society. Meanwhile, the new learning mode of home-based online learning has imposed new requirements on university students; on the other hand, the question of how to improve the learning effect has also led to new thinking for teachers. On this basis, this paper conducts in-depth exploration from the perspective of students' self-efficacy, extending the four dimensions of online learning: a sense of effort, a sense of control, a sense of participation, and a sense of environment. Following this, we analyze and study the five factors of learning attitude, learning strategy, learning interaction, learning evaluation, and learning environment. At the end of the study, four strategies are given to improve the effectiveness of learning. First, they stimulate students' sense of independent and autonomous learning under a sense of effort. Second, students' self-management ability is cultivated under a sense of control. Third, each student is given the opportunity to better reflect the characteristics of diversity in the process of participating in interactive learning. Fourth, the great advantage of intelligence in online classrooms is demonstrated in the existing teaching environment.

Keywords: Online learning, Self-efficacy, Efficiency in learning, Home based learning

1 Introduction

In the current vigorous development of network information technology, the new technology has promoted digitalization, simplification, fragmentation, and structural development of knowledge, which has become the "booster" for the rapid development of online education. At the same time, with the popularization and promotion of the concepts of Education for All and Lifelong Education, online learning is becoming increasingly popular and widely used [1]. As noted in the 44th China Internet Network Development Statistics Report released by the China Internet Information Center, the number of online education users in China has reached 232 million as of June 2019, an increase of 15.4% over 2018, accounting for 27.2% of the total netizens. The form of online learning has become an important part of people's learning activities, and some scholars have pointed out that learning in the 21st century is a kind of information-based learning, which is based on the network [2]. What is the effect of online learning for learners in such an advantageous context? How can we guarantee its learning effectiveness? How does deep learning develop? Researchers need to pay close attention to these issues.

In the specific implementation process of home-based online learning, the lack of understanding and lack of innovation in teaching ideas, leads to the problems of teaching evaluation, making it easy to ignore students' main position [3].

On this basis, this study is intended to carry out an empirical study on the effectiveness of learning in the online learning of college students, specifically the following aspects. First, from the perspective of learners' self-efficacy, the study models the influencing factors and performance dimensions of online learning effectiveness. Second, the empirical research method is used to test the theoretical model. The research hypothesis is put forward, and the learning data are collected and analyzed in the form of a questionnaire to verify the theoretical model. Third, the research hypothesis is tested, and its theoretical model is adjusted. Finally, the results are attributed and discussed, and learning-targeted promotion strategies are proposed to promote the further development of online learning.

2 Related Works

Domestic research on the effectiveness of online learning also includes basic theoretical research and practical application research, but more research has been based on the course and learning work practice to analyze the factors affecting the effectiveness of online learning and to put forward improvement strategies.

For example, N. Tang and S. Yan used the method of the questionnaire survey to study the influencing factors of virtual learning effectiveness. It also points out that learners' characteristics, sense of efficacy, attitude toward virtual learning, technical reliability, and other factors are significantly related to the effectiveness of virtual learning to different degrees [4]. From the perspective of student subjectivity, teacher leadership, learning resources, network interaction, and platform support services, Ning Wang proposed five aspects for a strategy to improve the Moodle platform distance learning effectiveness strategy [5]. On the basis of the knowledge contextualization theory and peer evaluation method, Xinyi Shen et al. designed a series of strategies, including recognition assignment, peer recommendation, and asking questions, to improve the participation and effect of online learning, and analyzed and discussed the effectiveness of the strategies [6].

During outbreak control, a number of domestic scholars have also emerged to study the problems of network learning. Some scholars take Tsinghua University as an example, starting with the big data generated by the log of the teaching course selection system, the study found that college students' learning activities and enthusiasm decreased significantly during online study at home [7]. In this context, some scholars also consider global digital learning. This paper constructs a new framework of digital learning in the post-epidemic era, and discusses the scene, tools, curriculum, learning strategies, and teachers' professional development of digital learning [8].

At the same time, as regards learners' self-efficacy in the learning process to promote the network learners' learning effectiveness, the research of domestic scholars such as Wang and Feng [9], Tong et al. [10], Yin and Xu [11] and Joo et al. [12], Liang et al. [13], Tsai [14] illustrates the important factors influencing the network learning and the learning motivation is the self-efficacy of students.

In general, from the perspective of learners' self-efficacy, no systematic research has been conducted to explore the factors influencing the effectiveness of college students' home-based online learning.

3 Model Construction of Online Learning Effectiveness

3.1 Definition of Online Learning Effectiveness

The effectiveness of learning is the essence of teaching, the central idea of current education, and the essential requirement of students' development. Effective learning is also key to a vibrant classroom environment [15]. Professor Qiping Kong of East China Normal University noted that the effectiveness of classroom teaching should be considered from the perspective of student participation, including behavioral participation, cognitive participation, and emotional participation, in order to pay attention to the different roles of these three kinds of participation and ensure their balanced extension [16]. Home-based online learning also needs to achieve the same efficiency, from learning to scientific knowledge and students' own development to an in-depth study of the concept of learning effectiveness. The goal of learning is to achieve effective deep learning. How to promote the effectiveness of college students' online learning, not only in the shallow sense of learning, but also actively construct the discipline structures, so as to transfer more accurately and improve the problem-solving skills. The development of higher-order abilities such as metacognition, problem solving, and critical thinking is engaged [17]. As for the evaluation system of deep learning, some scholars have pointed out that it is basically consistent with the standard of general learning evaluation, and they have used Bloom's target classification system for reference to evaluate learning objectives from the three fields of cognition, emotion, and motor skills [18]. Therefore, the effectiveness of home-based online learning for college students can also be evaluated from the three dimensions of cognition, emotion, and skill, so as to make a reasonable evaluation of students' learning effects.

3.2 Structural Analysis of Students' Online Learning Under Self-efficacy

Online learning, as a new ideal learning mode in modern information technology, has three distinct characteristics: "isolated" teaching and learning between teachers and students, "conscious" management of students, and "bullet-screen" communication among students. In the learning process, students' sense of self-efficacy directly or indirectly affects the performance of individuals' dynamic psychology in the implementation of learning activities, thus affecting actual learning activities [19]. While new behavioral psychologist Albert Bandura proposed the three-yuan interaction theory, emphasizing that the three decisive factors of internal factors, people's behavior, and the external environment have a strong foothold in people's psychological function, and demonstrated a continuous interactive process between the three factors, the process of human behavior can influence people's cognitive and affective faculties. When studying the correlation between college students' self-efficacy and deep learning in an e-learning environment [20], scholar Qi Zhang proposed four dimensions of college students' online self-efficacy: sense of self-competence, sense of self-effort, sense of environmental control, and sense of behavioral control.

Therefore, from the perspective of students' self-efficacy and based on the ternary interaction theory, this paper starts from the "sense of effort" of students'

behavior, "sense of participation" of students' behavior, "sense of control" of students themselves and "sense of environment" of students' online learning. These four dimensions were used to analyze the factors affecting college students' online learning. Among them, the "sense of effort" of student behavior is whether the learner has ensured his/her learning attitude and put himself/herself into the learning process. College students with a strong sense of self-efficacy in online learning can give play to their interest in learning and have a strong degree of concentration in learning. Student "sense of participation" is about whether the learner actively participates in the learning process. The interactive process of online learning, including teacher–student interaction, student–student interaction, and the interaction between students and learning resources are all specific components of college students' online learning self-efficacy. Students' sense of control is mainly reflected in learning strategies, including whether there is a clear learning plan and whether learning resources are well utilized and shared to ensure that both the goal of online learning and the expected effect of learning are achieved. Online learning's "sense of environment" refers to learners' sense of external environment and self-control. For online home learning, the environment can be divided into the teaching environment, home environment, and

network environment. The specific performance measure is whether the students quickly adapt to the changes in teachers' teaching methods, whether they communicate with parents in learning, and whether the network conditions in the learning process are guaranteed.

3.3 The Model and Assumptions of Students' Online Learning Under Self-efficacy

To sum up, this study analyzed the influencing factors and effectiveness of home-based online learning for college students from the perspective of self-efficacy, as shown in Table 1 below. The first-level dimension of factors affecting learning effectiveness is summarized in four aspects: sense of effort, sense of participation, sense of control, and sense of environment. The second-level dimension is divided into five aspects: learning attitude, learning interaction, learning evaluation, learning strategy, and learning environment. The three dimensions include learning interest, learning input, teacher–student interaction, student–student interaction [21], resource interaction, homework, pre-study, average length of online learning, parent collaboration, network conditions, and teacher ability.

Table 1. Effectiveness model of home online learning for college students under self-efficacy

Influencing Factor			Learning Effect
Sense of Effort	Learning Attitude	Learning interest	Cognitive Domain Emotion Domain Skills Domain
		Learning engagement	
Sense of Participation	Learning Interaction	Teacher-Student interaction	
		Student-Student interaction	
		Student-Resources interaction	
	Learning Evaluation	Homework	
Sense of Control	Learning Strategies	Preview and Review	
		Average time spent studing	
Sense of Environment	Learning Environment	Parents accompany	
		Network conditions	
		Teaching environment	

Some scholars have discovered three factors that influence learners' depth of online learning. The first set of factors are students' self-regulation, motivation, deep learning methods, input, and other behavioral factors. The second set of factors are the interaction between students and teachers, students, content, and other behavioral factors. Third are environmental factors [22].

Based on the above analysis and the concerns of this study, the main research questions are defined as follows: the attitude of college students' towards home online learning, interaction behavior, learning evaluation, and use of learning strategies can have an impact on students' cognition, emotions, and skills, and whether the environment faced by college students' home online learning has an effect on

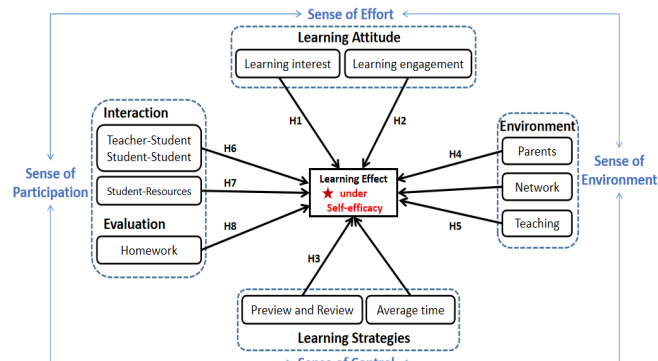learning. The specific hypothesis approach is shown in Figure 1.

Figure 1. The relationship between the factors predicts the initial path model diagram

3.3.1 The Sense of Effort in Online Learning

In terms of learning interest, students' learning attitude toward online learning can be reflected in whether the teaching approach arouses students' curiosity and everyone's interest. It directly changes the interaction between teachers and students, and then indirectly changes the learning effect of students. Therefore, hypothesis 1 (H1) is proposed. In addition, learning attitude is reflected in learning engagement. Domestic scholars have studied the factors that influence students' learning engagement: teacher factors (teacher support, educational concepts, and behaviors, etc.), peer factors, and class environment factors [23]. For home-based online learning, mainly for the analysis of learning engagement, hypothesis 2 (H2) is proposed.

H1: For college students' attitude toward home-based online learning, the more interested students are in the teacher's teaching content and form, the more obvious is the learning interaction process.

H2: The more favorable the students' attitude toward home-based online learning and their concentration on course content and correct guidance from teachers is, the more obvious the learning effect will be.

3.3.2 The Sense of Control in Online Learning

The sense of control is mainly reflected in the learning strategies used by college students in the process of autonomous learning at home and online. Empirical research by Huang et al. [24] found that the ability to learn independently has a significant impact on the effect of online learning, of which the experience of education is an indirect effect that exists in the middle. Among them, if students have previewed in advance and reviewed after class, such a learning plan will make the communication in the classroom smoother and more orderly, which will affect their own learning effects. Hypothesis 3 (H3) is proposed specifically.

H3: As for the home-based online learning strategy of college students, if students do pre-review before class, the frequency of learning interaction can be improved.

3.3.3 The Sense of Environment in Online Learning

Three environmental factors influence the online home environment. One is the "online" network environment, whether students have Wi-Fi or sufficient traffic to study online. The second is the "home" learning environment: whether the learning environment can guarantee students' efficient learning, and whether parents play a key role in providing favorable guidance for students, and put forward hypothesis 4 (H4). The third environmental factor is the "online learning" teaching environment. The information technology

ability of teachers in the teaching process will also affect the effectiveness of learning, specifically, hypothesis 5 (H5).

H4: In the home-based learning environment of college students, parents' guidance to students can ensure college students' participation in learning interaction, thus enhancing the learning effect.

H5: In the home-based online teaching environment, when teachers become more proficient in the application of information technology, college students will have a stronger learning effect.

3.3.4 The Sense of Participation in Online Learning

In terms of self-efficacy, college students' sense of participation in online learning is mainly reflected in their interaction during the learning process and the evaluation after learning. The process of learning interaction includes teacher–student interaction, student interaction, and interaction between students and learning resources. Some domestic scholars have studied strategies of online learning participation to improve the learning effect from the perspective of knowledge contextualization theory and peer evaluation. Foreign scholars Zirkin and Sumler have pointed out that once timely interactive activities can be carried out, the students' sense of participation can be enhanced, thereby improving the effect of learning. Zhang et al. from Tsinghua University found that multi-level and extensive interaction between online learners and learning media, peers, and teachers can enhance the effect of deep learning [25]. Thus, hypotheses 6 (H6) and 7 (H7) are proposed. In addition, the learning evaluation in the learning process may also become a major factor influencing the learning effect, so hypothesis 8 (H8) is proposed.

H6: In home-based online learning, the higher the frequency of learning interaction (student–teacher interaction or student interaction), the more significant the learning effect of college students will be.

H7: For college students' home-based online learning strategies, rational use and sharing of online learning resources can improve the effect of home-based online learning.

H8: In home-based online learning, the more reasonable the amount of homework assigned by teachers, the more significant the learning effect of college students is.

4 Methodology

4.1 Research Subjects

This study selected undergraduates and postgraduates of Anhui Normal University as the research subjects, including 304 male students and 1,062 female students. In the research, Anhui Normal University has carried out online teaching in an all-round way.

4.2 Instruments

Because of the impact of the epidemic, this study mainly used the questionnaire method to investigate and analyze the factors affecting college students' home-based online learning. The measurement tool used in this study is the Questionnaire on Home Online Learning of College Students under an epidemic situation. Based on the four dimensions of self-efficacy, the questionnaire was incorporated five factors: learning attitude, learning strategy, learning interaction, teacher factors, and environmental factors, from within the three fields of cognition, emotion, and skill of Bloom's target classification theory. Finally, the questionnaire asked 21 questions.

4.3 Data Collection

The data were collected using the questionnaire star platform to form an online questionnaire. The research team shared the questionnaire link and QR code through the QQ and WeChat groups, and randomly invited students from Anhui Normal University to fill in the questionnaire. We collected a total of 1,366 questionnaires. After excluding 320 invalid questionnaires, we were finally left with 1,046 valid questionnaires. The effective recovery rate was 88%.

5 Results

In the process of data analysis, the reliability and validity of the collected data were first analyzed by SPSS26.0, and then the structural equation model was analyzed and modified by AMOS24.0.

Reliability can be defined as when the researcher uses the same method to carry out repetitive measurements on the same object, and the results are consistent. In this study, the reliability coefficient method was used for the reliability analysis of questionnaire data, and the reliability of Cronbach's alpha coefficient value provided by SPSS26.0. The results of the analysis are shown in Table 2. According to exploratory research, Cronbach's alpha coefficient value is above 0.6, which is considered to represent high artificial credibility. The larger the coefficient, the higher the reliability [26]. Cronbach's alpha coefficient of this study was 0.909, greater than 0.7, indicating good questionnaire consistency and factor analysis.

Table 2. Cronbach's alpha coefficient value analysis results

Cronbach's Alpha coefficient	Number of Terms
0.909	38

Through the analysis of KMO value and Bartlett's test in factor analysis, the KMO value is 0.955, greater than 0.9, indicating that the data are suitable for factor analysis, and the chi-square value in Bartlett's spherical test is 31438.150, P <0.01, indicating that the validity of the questionnaire was good. The specific analysis results are shown in Table 3.

Table 3. KMO and Bartlett tests

Number of KMO sampling appropriateness		0.955
Bartlett test for sphericity	The approximate chi-square	31438.150
	Degrees of freedom	703
	Significant	0.000

5.1 Analysis of Structural Equation Models of Online Learning Effectiveness Research Data

The research uses the structural equation model constructed by AMOS24.0 to analyze the confirmatory factor, which can ensure the validity of the research scale. From the convergence validity measurement, the convergence validity of each latent variable in the measurement model was evaluated by standardized factor load, combined reliability value, and average extracted variation [27]. See Table 4. The standardized load values of the three observed variables corresponding to the six latent variables in the model are all greater than the recommended value of 0.5, indicating that the scale has good convergence. Through related calculations, the combined reliability of latent variables in this study is greater than 0.7, and most of the AVE values are greater than 0.5, which indicates that the measurement model has better internal consistency and good convergence.

5.2 Model Integral Fitting Evaluation of Online Learning Effectiveness Research Data

The overall fitting evaluation and hypothesis testing of the model were carried out using AMOS24.0 structural equation model analysis software. A part model fitting the overall evaluation by the fit of the six indicators to examine the research model and the adaptation degree of data [28], the six fitting degree index of difference divided by the number of degrees of freedom (CMIN/DF), goodness-of-fit indices (GFI), adjust the goodness of fit index (AGFI), and compare fitness index (CFI), incremental fitness index (IFI), and root mean square error (RMSEA). The recommended values of the six fitting degree indicators are listed in Table 5. It can be seen from the table that all the fitting indexes of this research model meet the recommended values except CMIN/DF. In order to ensure a good fitting degree for the research model, MI modification is required for the model structure.

Table 4. Model analysis of structural equation

The Research Variables	Measuring Item	Standardized Factor Load	Combined Rellability (CR)	Average Extraction Variance	Measurement Factor Reliability (Alpha)
Attitude	A1: Interest	0.750	0.729	0.4792	0.719
	A2: Engagement	0.544			
	A3: Energy	0.761			
Strategy	B1: Preview and Review	0.724	0.8339	0.6271	0.810
	B2: Study plan	0.788			
	B3: Study hours	0.858			
Interaction	C1: Teacher-student	0.806	0.7968	0.5711	0.770
	C2: Student-student	0.836			
	C3: Student-Resource	0.604			
Evaluation	D1: Homework	0.646	0.8434	0.6464	0.843
	D2: Logical Thinking	0.896			
	D3: Innovation Ability	0.848			
Environment	F1: Home Environment	0.798	0.7975	0.5682	0.700
	F2: Network Environment	0.715			
	F3: Teaching Environment	0.746			
Effect	G1: Knowledge	0.790	0.8713	0.6938	0.868
	G2: Skills	0.904			
	G3: Emotional	0.800			

Table 5. Degree of model fit

Fit Index	CMIN/DF	GFI	AGFI	CFI	IFI	RMSEA
Suggestive Value	<5	>0.8	>0.8	>0.9	>0.9	<0.1
The Model Value	8.999	0.948	0.923	0.910	0.910	0.087

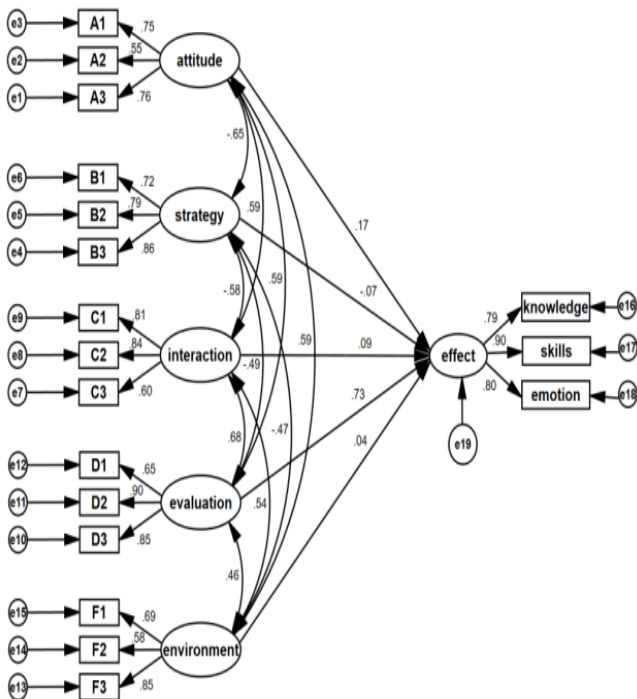The standardized path coefficient of structural equation model analysis is shown in Figure 2.

Figure 2. Model standardized path coefficient diagram

5.3 Hypothesis Testing of Factors Affecting Online Learning Effectiveness

The standardized path coefficient in this research model was analyzed. The standardized path coefficient between each latent variable is used to measure the degree of influence between variables. If its value is between (-1, 1) and the coefficient is positive, it indicates that the independent variable has a positive influence on the dependent variable; otherwise, the coefficient is negative, which means that the independent variable has a negative influence on the dependent variable. In general, if the absolute value of the standardized path coefficient is larger, it indicates that the independent variable has a greater influence on the dependent variable. In addition, the P value is used to test the statistical significance of the path coefficient/load coefficient. The smaller the p value, the more significant is the influence of the independent variable on the dependent variable. It is generally believed that a P value less than 0.05 indicates a significant level [29].

5.3.1 Analysis on the Hypothesis of Effort and Learning Effectiveness

It can be seen from the data in Table 6 that learning attitude has a positive influence on learning effect (β= 0.171, p < 0.001), and reached a significant level in the latent variables of learning attitude, A1, A2, and A3; the return of the weighted values is significant, said internal good quality model, and the students' learning interest and learning of the input is higher, the study effect, the more obvious, hypotheses 1 and 2 were established.

Table 6. Correlation coefficient path value between variables in the model

Path	Unstandardized Cofficients	C.R.	P	Standardized Coefficient
Effect←attitued	0.127	4.708	***	0.171
Effect←strategy	-0.058	-2.331	0.020	-0.065
Effect←evaluation	0.574	20.521	***	0.729
Effect←environment	0.035	1.613	0.107	0.042
Effect←interaction	0.090	2.676	0.007	0.086
A3←attitude	1.000			0.765
A2←attitude	0.714	16.008	***	0.546
A1←attitude	0.933	21.097	***	0.746
B3←strategy	1.000			0.859
B2←strategy	1.202	28.291	***	0.788
B1←strategy	1.065	23.071	***	0.723
C3←interaction	1.000			0.604
C2←interaction	1.349	17.597	***	0.837
C1←interaction	1.214	17.553	***	0.805
D3←evaluation	1.000			0.849
D2←evaluation	1.027	36.106	***	0.896
D1←evaluation	0.715	22.945	***	0.646
F3←environment	1.000			0.846
F2←environment	0.891	17.084	***	0.584
F1←environment	1.061	19.090	***	0.690

Note. ***denotes $P < 0.001$.

5.3.2 Analysis on the Hypothesis of Control and Learning Effectiveness

In terms of control of online learning students, learning strategy, as an observed variable, has a negative impact on learning effect and reaches a significant level (β=-0.65, P =0.020<0.05), while the regression weighted values of the three observed variables of learning strategy all reach a significant level, so hypothesis H3 is not valid. A possible reason is that college students are not used to learning plans to support the online learning process. Only a few college students who have a strong sense of control and self-discipline with regard to their own learning can do a good job in learning strategies.

5.3.3 Analysis on the Hypothesis of Participation and Learning Effectiveness

College students feel a sense of interaction through home online learning and learning evaluation as the observation variable analysis; the study in Table 6 shows that interaction between learning and performance is positive and has a significant effect (β = 0.086, p = 0.007 < 0.05); the learning interaction, resources, teachers, and the three interaction processes and learning effects are positively related, hypothesis 6 and 7 were established. Meanwhile, learning evaluation and learning effect also showed a positive influence (β=0.729, p < 0.001). The quality of homework in online learning is regarded as an observed variable in learning evaluation, and the regression weighted value in the data shows significance. Hypothesis 8 is true.

5.3.4 Analysis on the Hypothesis of Environment and Learning Effectiveness

All three observational variables of home-based online learning environment have significant effect on the regression weighting of environmental sense, where weighted value had a positive influence on the environment and learning effect between (β= 0.042, p = 0.107 > 0.05), but less than a significant effect. The reason may be that an external uncontrollable factor for the environment is unstable, but the environment is still one of the reasons influencing the learning effect. Hypothesis 4 and Hypothesis 5 were established.

5.4 Model Modification of Factors Affecting Online Learning Effectiveness

Based on the above analysis hypothesis of Amos 24.0 structural equation model, MI modification was made to the original model. After four modifications, the parameters of the model and the overall fitting evaluation passed the test, as shown in Figure 3.

6 Conclusion

According to the above-mentioned revised model, four factors affect the effectiveness of online learning at home: 1. sense of effort–learning attitude, 2. sense of participation–learning interaction, 3.sense of participation–learning evaluation, 4.sense of environment–learning environment influence on the learning effect will be, according to the size of the influence of learning evaluation (0.78), learning interactive (0.11), learning environment (0.07), and learning attitude (0.03).
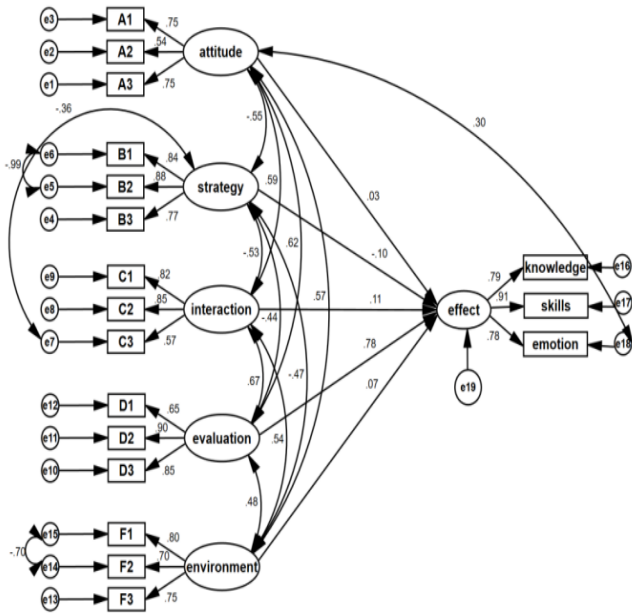
Figure 3. The revised model standardized path coefficient graph

The epidemic has revived education. In the post-epidemic era, online education as a means of education reform and how to improve the quality of education through online education is a big test of future education. Through the research and analysis of the factors affecting the effectiveness of home-based online learning under the self-efficacy of college students, several effective strategies can be proposed to deal with it.

To stimulate students' sense of self-directed learning efforts with metacognition as the core, cognitive psychologists have found that autonomous learning and metacognition are closely related [30]. Metacognition includes learners' recognition of their own learning interest, learning investment, and learning energy, and students' ability to clearly adjust their sense of effort in learning according to their own conditions is a strong guarantee of autonomous learning ability. For teachers, students can set learning goals suitable for themselves before class, so that students are willing to actively participate in online classes. Only when learning goals suit their own interests can every student be willing to work hard for their learning goals.

The key is to cultivate students' sense of self-management control with learning efficiency. Despite a negative relationship between sense of control and learning effectiveness in the study, through the MI correction in the data analysis, we find that learning strategies indirectly affect the learning effect in the process of influencing the interaction between students and learning resources. Home-based online learning has strong requirements for students' ability to manage themselves. Teachers can use online platforms to sign in after class, before class attendance, homework, and monitoring functions, such as cultivating students' self-

control. The learning strategy is to examine whether online or offline learning is able to test students' behavior with regard to the key factors; teachers should, according to different students, offer guidance to achieve the goal of effective management.

The goal is to promote students' sense of multiple interactive participation with output evaluation. The biggest advantage of online learning and traditional teaching compared with openness and individuation, learning and resources more widely, is that the range of content form is more diverse, to improve students' learning engagement [31], through the online platform of effective interactive function of the realization of the function of the rich class, for the evaluation of learning is not only the teacher the evaluation of a person, can include students' self-evaluation and mutual, and the assignments online platform evaluation function, through comprehensive, objective and fair evaluation, learning through learning, mastering knowledge, improving ability in the output.

To create a student-centered intelligent environment in the online classroom, given that the sense of environment is a major factor affecting the effectiveness of home-based online learning for college students, the environmental atmosphere of online classes is very important for improving learning efficiency [32]. At present, online teaching platforms emerge in an endless stream with rich functions. Teachers can combine several sets of high-quality combination methods when choosing teaching platforms to build an online teaching environment.

Although home-based online learning is only a timely response to education in the context of the epidemic. In today's rapidly developing age of information technology and artificial intelligence technology, online learning will become a breakthrough in traditional teaching and learning because of its unique advantage of the study method. How to effectively improve the learning outcomes of students in the online teaching process will be the main question to be addressed by researchers and teachers [33-35].

We conclude that learning evaluation is an important factor affecting learning effectiveness in the process of online learning at home. British distance education experts have compared the characteristics of online learning between Chinese and Western students, and concluded that the overall performance of Chinese students indicates "lack of autonomy, independence, and self-control learning ability." Basically, the evaluation mechanism of online learning is the key and core of online learning. In this study, the factors of learning evaluation are attributed to the students' sense of learning participation, and the evaluation system of online learning is inadequate by taking the problem of the rationality of homework as the only feedback of the evaluation results. Subsequent research will increase the abundance of the construction of the evaluation system, make full use of the advantages of the current

computer network technology, and discover what is the main factor affecting the effectiveness of learning evaluation [36].

This study will continue to focus on the factors affecting the learning effect of learning strategies and learning interactions among college students and on the construction of the model to determine whether the two affect the learning effect from the indirect relationship and find the corresponding supporting theory [37].

Acknowledgments

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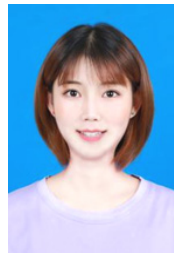
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Appendix

Questionnaire of variables

Construct	Item
Learning Attitude (A)	A1: The form of online learning can arouse by interest in course learning.
	A2: In the process of online learning, I will do things that have nothing to do with the course, so that I missed part of the course content.
	A3: When learning online, I can maintain the same learning energy as when learning offline.
Learning Strategy (B)	B1: During the online learning at home, I will review the content before and after class.
	B2: I will watch the course replay video by myself, and collect the materials by myself where I did not understand.
	B3: During the epidemic, I guaranteed the length of online learning on average every day.
Learning Interaction (C)	C1: In online classes, I will actively participate in interactive activities organized by the instructor.
	C2: In online classes, I will actively communicate, communicate and collaborate with my classmates.
	C3: I will often read and use the teaching resources provided by teachers.
Learning Evaluation (D)	D1: After online learning, the homework assigned by the teacher is consistent with the objectives and difficulty of the course.
	D2: My logical thinking ability has been improved.
	D3: My innovation ability has been improved.
Learning Environment (F)	F1: When I study online at home, my parents will collaborate and communicate with me.
	F2: I am quite satisfied with the network conditions and learning environment.
	F3: With the development of teaching activities, teachers are becoming more and more proficient in the use of online teaching tools.