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Factors affecting online learners' continuous learning intention: Structural equation based on expectation-confirmation model

العوامل المؤثرة على نية التعلم المستمر لدى المتعلمين عبر الإنترنت: المعادلة البنائية المبنية على نموذج التوقع والتأكيد

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Abstract

As the number of online learning users continues to grow, exploring how to generate and maintain users' willingness to continue learning and improving user retention rates has become an important condition for the effective development of online learning. Based on the Expectation -Confirmation Model perspective, this study explores the impact of expectation confirmation, learning satisfaction, perceived usefulness, curiosity, and attitude on online learners' willingness to continue learning. Using structural equation model analysis, it is found that attitude has an important impact on continued learning willingness. Expectation confirmation, learning satisfaction, and curiosity have a certain impact on continuous learning intention, while perceived usefulness has no impact on continuous learning intention. Based on the above research findings, this study puts forward four suggestions to enhance online learners' willingness to continue learning.

Keywords: Continuous Learning Intention, Structural Equation, Expectation -Confirmation Model, online learning, continued learning willingness.

الملخص

مع استمرار نمو عدد مستخدمي التعلم عبر الإنترنت، أصبح استكشاف كيفية توليد والحفاظ على رغبة المستخدمين في مواصلة التعلم وتحسين معدلات الاحتفاظ بالمستخدمين شرطًا مهمًا للتطوير الفعال للتعلم عبر الإنترنت. استنادًا إلى منظور نموذج التوقع والتأكيد، تستكشف هذه الدراسة تأثير تأكيد التوقع والرضا عن التعلم والفائدة المدركة والفضول والاتجاه على رغبة المتعلمين عبر الإنترنت في مواصلة التعلم. باستخدام تحليل نموذج المعادلة البنائية، وجد أن الاتجاه له تأثير دال على رغبة التعلم المستمر. إن تأكيد التوقع والرضا عن التعلم والفضول لها تأثير معين على نية التعلم المستمر، في حين أن الفائدة المدركة ليس لها تأثير على نية التعلم المستمر. بناءً على نتائج البحث المذكورة أعلاه، تطرح هذه الدراسة أربعة اقتراحات لتعزيز رغبة المتعلمين عبر الإنترنت في مواصلة التعلم.

الكلمات المفتاحية: نية التعلم المستمر، المعادلة البائية، نموذج التوقع والتأكيد، التعلم عبر الإنترنت، الرغبة فى التعلم المستمر.

Introduction

During the epidemic, online education applications showed explosive growth, and the number of online learning users surged (Demir & İlhan, 2022). Relevant scholars pointed out that in future education and teaching, online learning is bound to become the "normal" of teaching and learning (Aristovnik et al., 2023; Mhlanga, 2024). Although online education is developing rapidly and the number of online learning users is also increasing year by year, serious practical problems have also been exposed in the prosperous development situation, namely, the problem of high learner participation rate, low completion rate and extremely high dropout rate (Demir et al., 2023; Yakar, 2021).

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These practical problems will not only affect the future development model and application practice of courses, but may even hinder the sustainable development of online education. It can be said that learners' participation in online learning has only made preliminary progress, and learners' continuous learning online can maximize the value of online educational resources (Timuçin & Tatlı, 2024). Researchers have carried out relevant research on the issue of learners' continuous learning online (Gündoğan, 2021). Most of them are mainly based on different theoretical foundations and research frameworks, and have conducted relevant empirical research from the perspective of factors affecting online learners' willingness to continue learning and proposed corresponding strategies and suggestions to promote learners' continuous learning behavior (Özkan et al., 2023; Tahoon, 2021).

However, some of the learners' own factors, who are the main body of online learning, are often easily overlooked, and these overlooked factors may be the key factors that affect online learners' willingness to continue learning (Kahramanoğlu & Dursun, 2022). Based on this, this study takes the Expectation Confirmation Model (ECM; Hariguna et al., 2023), which is widely used in various information systems to influence individuals' continued use intentions, as the theoretical basis, and introduces two learners' own factors, attitude and curiosity, to expand the ECM, explore the factors and variables that affect online learners' willingness to continue learning, in order to provide reference for subsequent research.

In the Arabic world, there is no study to my knowledge that dealt with factors affecting online learners' continuous learning intention based on expectation-confirmation model. The contribution of this study is that it analyzes the influencing factors and influencing mechanisms of online learners' willingness to continue learning . It is important to help online learners to generate continuous learning intention and maintain learning behavior. Therefore, improving the degree of consistency between individual expectations and reality, maintaining individual desire for knowledge and exploration, and improving online learning satisfaction can have a certain impact on online learners' willingness to continue learning.

Literature Review

Research on online learners' willingness to continue learning

The online learner's willingness to continue learning refers to the learner's willingness and intention to continue participating in the online learning until completion and to participate in the next online learning after participating in an online learning session. The generation of continuous learning intention is an important prerequisite and foundation for the generation of online learners' continuous learning behavior (Özkan et al., 2023). Researchers have conducted research on the relationship between relevant variables and online learners' willingness to continue learning from different theoretical perspectives. Based on the theoretical framework in the field of psychology about the individual's psychological decision-making process after being stimulated, namely "stimulus-organism-response" (S-O-R), from the teacher's online learning support, the learner's perceived interactivity, perceived usefulness and perceived ease of use (Hossain et al., 2024).

The flow experience of the learning process, and the technical environment characteristics of the MOOC platform to explore the impact mechanism of these variables on MOOC course learners' learning intention (Liu et al., 2023). Based on an improved technology acceptance model, namely the Integrated Technology Acceptance Model (UTAUT), the impact of performance expectations, effort expectations, community response, cooperation, and perceived value on online learners' willingness to continue learning was explored (Patil & Undale, 2023). From the theoretical perspective of psychological resistance, the impact of perceived scarcity, perceived lack of control, psychological resistance, and focused video lectures on MOOC learners' continuation intentions was explored (Azevedo et al., 2024). Or it integrates multiple theoretical models and explores the impact of each variable in the integrated model on MOOC learners' willingness to continue learning (Zhang et al., 2022).

In addition, there are studies that attribute the variables that affect MOOC learners' willingness to continue learning to the learners' own subjective factors such as learner motivation, personal experience, and perception, as well as the objective factors of teaching and management such as course design and platform management (Ram et al., 2023). Throughout the existing research, domestic and foreign researchers have determined the relationship between corresponding variables and online learners' willingness to continue learning from different theoretical perspectives and integrated models. Among them, the Technology Acceptance Model (TAM), S-O-R, and Flow Experience. There are many applications of theoretical

models, and judging from the current research results, research results are more abundant than domestic ones (Marikyan & Papagiannidis, 2023). It can also be seen that the change in research perspective provides a possible direction for further exploration of this topic.

Although some researchers have explored the influencing factors of continuous learning intention in MOOC environments based on ECM, such as exploring the impact of MOOC learners' expectation confirmation, learners' perceived usefulness, perceived ease of use and learning satisfaction on their continuous learning intention (Alhwaiti, 2023; Cheng, 2023), but first of all, ECM was initially used in the field of marketing, and the application of its model should be examined and explored when introduced in the field of education. sexual issues, and existing research has not explained the rationality of the ECM architecture; secondly, in the existing related research that explores learners' continuous learning willingness in online learning environments based on the ECM model, few consider learners' participation in online learning. Specific intrinsic driving forces, such as curiosity, may directly affect learners' willingness to continue learning, and all of the above research topics can be further explored.

ECM and its application research

ECM, the expectation confirmation model, is a theoretical model proposed by Bhattacherjee (2001) based on the expectation confirmation theory of Oliver (1980) (see Figure 1). This model believes that when information technology users consider continued use decisions, they are similar to consumers' re-consumption and purchase decisions in the field of marketing. Information system users' expectations for the information system and the actual experience results of the first use are both. The difference will affect the user's decision and intention to use again or continue to use. In addition, Bhattacherjee uses the perceived usefulness of the technology acceptance model to represent the cognitive expectations of information system use, and believes that this cognitive expectation will guide or influence the subsequent process of intention formation (Shukla et al., 2023). Currently, ECM has been used by researchers to explore issues related to users' continued use decisions and intentions in information systems or information technology, such as explaining and predicting learners' continued use intentions of digital textbooks, online education platform users' continued use intentions, and network Learners' willingness to continue using the learning space, etc. Therefore, this study will explore the continuous learning intention of online learning users, that is, online learners, based on ECM theory.

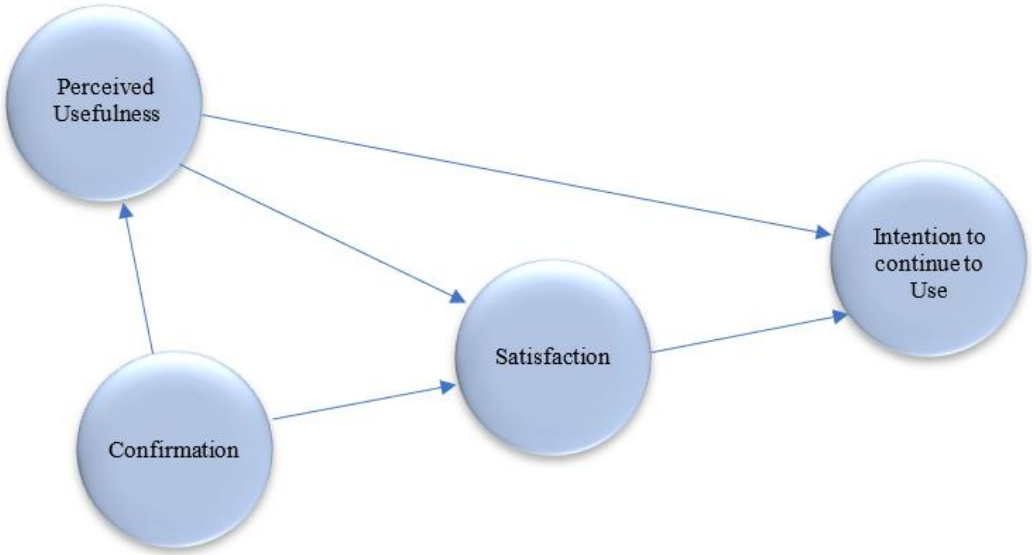


Figure 1. Expectation confirmation model
Source: (Bhattacherjee, 2001)

In ECM, Bhattacherjee & Premkumar (2004) used the perceived usefulness in TAM proposed by Davis (1989) to represent the initial expectations in the expectation confirmation theory, and believed that the perceived usefulness of information system users will affect the formation of their satisfaction, but Bhattacherjee & Premkumar (2004), in subsequent research, deleted the relationship path between perceived usefulness and satisfaction. In addition, some relevant researchers found that the relationship between perceived usefulness and satisfaction was not significant (Lin &Yu, 2023). Based on the above

discussion, this study believes that perceived usefulness has no impact on satisfaction and proposes the following hypothesis:

H1: Expectation confirmation has a significant positive impact on learning satisfaction.
H2: Expectation confirmation has a significant positive impact on perceived usefulness.
H3: Perceived usefulness has a significant positive impact on online learners' willingness to continue learning.

Attitude

Some studies believe that the role of satisfaction in ECM is similar to the role of attitude in TAM, and is a prerequisite for influencing users' continued use intention (Liu et al., 2023). Some researchers also believe that attitude is an emotional response based on satisfaction (Baba-Nalikant et al., 2023), and in order to improve the accuracy of behavioral prediction, the measurement of behavioral intention must be consistent with the specific behavioral response, while attitude is an emotional response to a specific behavior, may be more effective than satisfaction in measuring behavioral intention (Sarintohe et al., 2023).

Based on this, this study believes that compared with satisfaction, attitude is a factor variable that more directly affects individual behavioral intention, and the impact of satisfaction on individual behavioral intention is transferred through attitude. In addition, based on the conclusion that attitude in TAM can be used as a mediating variable to link individuals' perceived usefulness and intention to continue using (Davis et al., 1989), this study proposes the following hypothesis:

H4: Perceived usefulness has a significant positive effect on attitude.
H5: Satisfaction has a significant positive effect on attitude.
H6: Attitude has a significant positive effect on online learners' willingness to continue learning.

Curiosity

Studies have shown that most learners' motivation to participate in online learning is driven by interest (Hellín et al., 2023), and curiosity is found to be the internal motivation for learners to participate in and complete online learning (Dubey et al, 2023), and is also an important reason that affects learners' continuous learning (Ainley et al., 2002). It can be said that for some online learners, the desire for knowledge in a certain field or topic, that is, curiosity, may be an important internal driving force for them to participate in and complete online learning (Watted & Barak, 2018). Based on this, this study integrates the variable of curiosity into ECM and assumes that it serves as an intrinsic motivation and works together with the extrinsic motivation of perceived usefulness to influence attitude and continuous learning intention. In addition, based on the classification of curiosity, this study uses cognitive curiosity, which is more relevant to online course learning, as the main measurement variable and puts forward the following hypotheses:

H7: Curiosity has a significant positive impact on attitude.
H8: Curiosity has a significant positive impact on online learners' willingness to continue learning.

Collectively, literature shows a lot of factors affecting the willingness to continue using online learning. For example, the results of Bajaber (2024) show that the greatest influence on willingness to continue using online learning is ability, then motivation, and finally opportunity. Interests and hobbies among motivation factors, course quality, perceived cost, and social influence among opportunity factors, and learners' self-efficacy and meta-recognition among ability factors all have a significant impact on learners' continued willingness to learn online, knowledge needs, and achievements. However, no other study constructed a research model on factors influencing online learners' continuous learning intention from the perspective of ECM in Saudi Arabia.

Based on the above discussion, analysis and related assumptions, this study constructed a research model on factors influencing online learners' continuous learning intention from the perspective of ECM (see Figure 2).

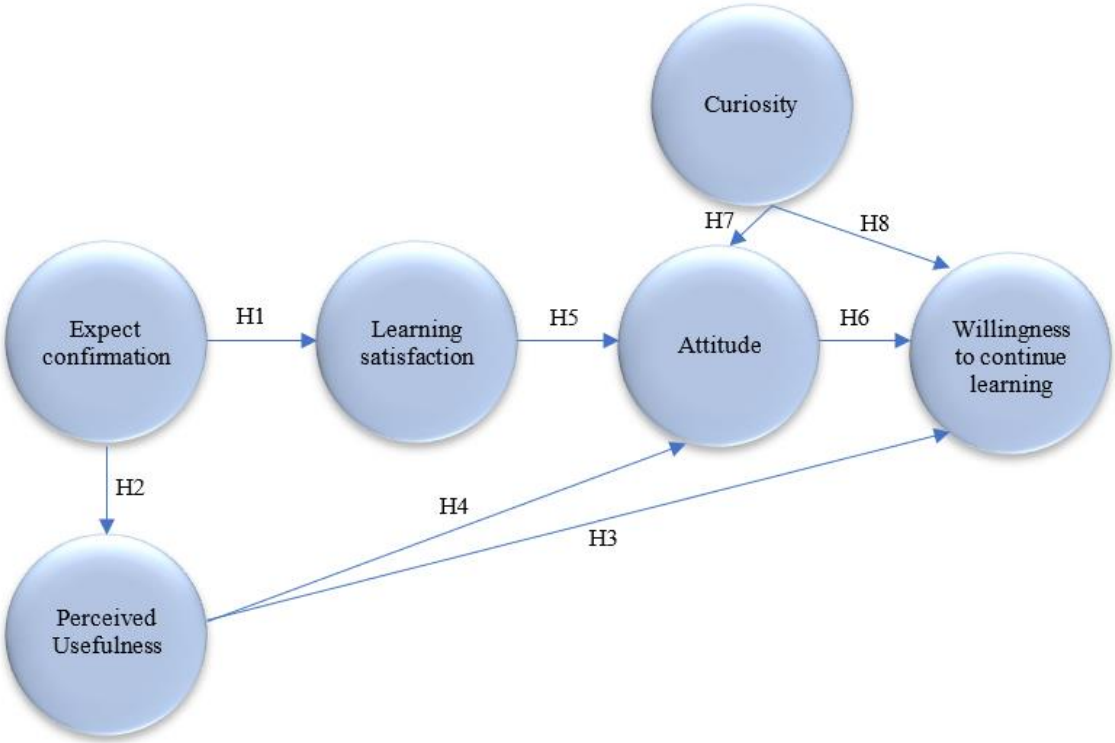


Figure 2. Research model on factors influencing online learners' willingness to continue learning.

Method

This survey study was used to explain factors affecting online learners' continuous learning intention based on expectation-confirmation model. Analysis of the structural model and hypotheses testing were used.

Participants and procedures

A total of 490 electronic questionnaires were collected. Based on the screening criteria of having online learning experience and excessive repetition of answers to measurement questions, 430 valid questionnaires were finally obtained, with an effective rate of 87.07%. The sample data has a balanced proportion of males and females (n=210; 48.08% and ,220, 51.02% respectively). Students participated from King Saud University, aged from 18 to 21 years old. Inclusion criteria were as follows: 1) Students King Saud University, 2) aged from 18 to 21 years old, and 3) willing to participate in the study. Unwilling to participate in the study was the exclusion criterion. Overall, the sample structure is reasonably distributed and representative.

Ethical procedures

Participants were told that their answers would keep confidential and secret for the purpose of the research only. They were told also that they could withdraw at any time Written informed consent was obtained from the children's parents.

Measures

Survey

This research design compiled the "Investigation Scale on Factors Influencing Online Learners' Continuous Learning Willingness" and tested the validity of the scale through pilot testing. After reasonable modification of the scale through the analysis results of the test data, the scale has high reliability and validity and can be distributed and recycled on a wide scale. The final setting and reference basis of the scale items are shown in the table 1.

Table 1.
Measurement items and reference basis for latent variables

Latent variable	Coding	Items	Reference
Expect confirmation	EC1	I think the actual experience of using this online course was better than I expected	(Bhattacherjee, 2001)
	EC2	I think the gains and benefits of using this online course are better than I expected	
	EC3	I think the quality of the courses offered by this online course is better than I expected	
	EC4	Overall, the use of this online course basically met my expectations.	
Learning satisfaction	LS1	I found the learning experience using this online course to be enjoyable	(Çakmakkaya et al., 2024)
	LS2	I think using this online course has given me a sense of satisfaction	
	LS3	I think the learning effect of using this online course is satisfactory	
	LS4	Overall, I am satisfied with the process of using this online course	
Willingness to continue learning	CLI1	I plan to continue studying in this online course and not drop out	(Jiang et al, 2022)
	CLI2	I intend to stick with this online course and not use other alternatives	
	CLI3	I will recommend this online course to my classmates or friends.	
Perceived usefulness	PU1	Using this online course will improve my academic performance	(Davis et al., 1989)
	PU2	Using this online course can improve my learning efficiency	
	PU3	Using this online course has broadened my knowledge horizons	
	PU4	Overall, using this online course is valuable to my study and life	
Curiosity	CU1	I'm interested in discovering how things work	(Ho et al., 2021)
	CU2	When I encounter a difficult problem, I like to imagine the answer	
	CU3	When I get a complex thing, I like to ask others how it works	
	CU4	When I'm stumped by a puzzle, I'm interested in trying to solve it	
Attitude	AT1	I think it's a good idea to study in this online course	(Alharbi, 2023)
	AT2	I feel that studying in this online course is a wise choice	
	AT3	I would like to study in this online course	

Data analyses

This study uses SPSS 20.0 and AMOS 21.0 software to perform statistics and analysis on the collected sample data.

Common method deviation test

Generally, since the same scale is filled in by all subjects, subjects under the influence of the same background, the same environment, and the same measurement items will more or less have common method bias. The degree of common method bias depends on a certain extent, it will affect the survey results and even reduce the reliability of the researchers' research conclusions. Therefore, it is necessary to conduct a test for common method bias. This study used single-factor confirmatory factor analysis to test for common method deviation. After single-factor confirmatory factor analysis, it was found that the fitting degree was not ideal ($\chi 2/df=5.842$, RMSEA=0.133, CFI=0.835, GFI =0.648, NFI=0.809), indicating that the common method bias of the sample is not serious.

Results and Discussion

Measurement model testing

This study tested the reliability and validity of the measurement model respectively. As can be seen from Table 2, the Cronbach's α value, factor loading and combined reliability of each variable are all greater than 0.7, and the average variance improvement is greater than 0.5. This shows that the measurement model of this study has good reliability and convergence effect. Since the correlation coefficient of the latent variables in this study is large (>0.7), the Bootstrap method is used to test the discriminant validity of the

measurement model. The test standard is: calculate the confidence interval of the correlation number between each latent variable. If the correlation coefficient If the confidence interval does not include 1, it indicates good discriminant validity; otherwise, it indicates poor discriminant validity (Cheung et al., 2023).

As can be seen from Table 3 on the next page, the Bootstrap confidence intervals of the correlation coefficients between variables do not contain 1, indicating that the measurement model has good discriminant validity. Based on the above measurement results, the reliability and validity of the quantitative model in this study are good, and the structural equation model can be fitted.

Table 2.
Measurement model reliability and convergent validity test

Latent variable	Observed variables	Factor loadings	*p*	Cronbach's α coefficient	Composite reliability	Average variance extraction
Expect confirmation	EC1	0.905		0.888	0.893	0.805
	EC2	0.921				
	EC3	0.879				
	EC4	0.883				
Learning satisfaction	LS1	0.869		0.857	0.861	0.820
	LS2	0.925				
	LS3	0.952				
	LS4	0.935				
Willingness to continue learning	CLI1	0.816		0.863	0.886	0.723
	CLI2	0.868				
	CLI3	0.865				
Perceived usefulness	PU1	0.814		0.883	0.912	0.723
	PU2	0.787				
	PU3	0.891				
	PU4	0.903				
Curiosity	CU1	0.862		0.853	0.889	0.666
	CU2	0.809				
	CU3	0.774				
	CU4	0.818	***			
Attitude	AT1	0.934		0.843	0.851	0.827
	AT2	0.973				
	AT3	0.887				

Table 3.
Discriminant validity test of measurement model

Related variables	Correlation coefficient	Bootstrap confidence interval			
		Calibration Deviation	P	percentile	P
Expectation Confirmation <-->Learning satisfaction	0.856	[0.796,0.911]		[0.794,0.910]	
Expectation Confirmation<-->Perceived Usefulness	0.941	[0.888,0.984]		[0.888,0.983]	
Expectation Confirmation <-->willingness to continue learning	0.777	[0.676,0.854]		[0.683,0.860]	
Expectation Confirmation<-->Curiosity	0.755	[0.656,0.838]		[0.656,0.837]	
Expectation confirmation<-->attitude	0.793	[0.704,0.869]		[0.704,0.869]	
Learning satisfaction <--> Willingness to continue learning	0.895	[0.838,0.940]		[0.843,0.944]	
Learning Satisfaction<-->Perceived Usefulness	0.936	[0.884,0.976]		[0.884,0.976]	
Learning Satisfaction<-->Curiosity	0.702	[0.585,0.813]		[0.586,0.814]	**
Learning Satisfaction<-->Attitude	0.882	[0.835,0.926]		[0.834,0.924]	
Perceived usefulness <--> Willingness to continue learning	0.854	[0.777,0.917]		[0.780,0.918]	
Perceived usefulness<-->Curiosity	0.809	[0.717,0.877]	**	[0.717,0.877]	
Perceived usefulness<-->attitude	0.837	[0.754,0.902]		[0.754,0.902]	
Willingness to continue learning<-->Curiosity	0.748	[0.595,0.867]		[0.596,0.869]	
Willingness to continue learning<-->attitude	0.940	[0.889,0.979]		[0.891,0.983]	

Note: *p<0.05, **p<0.01, ***p<0.001.

Structural equation model fitting test and hypothesis verification

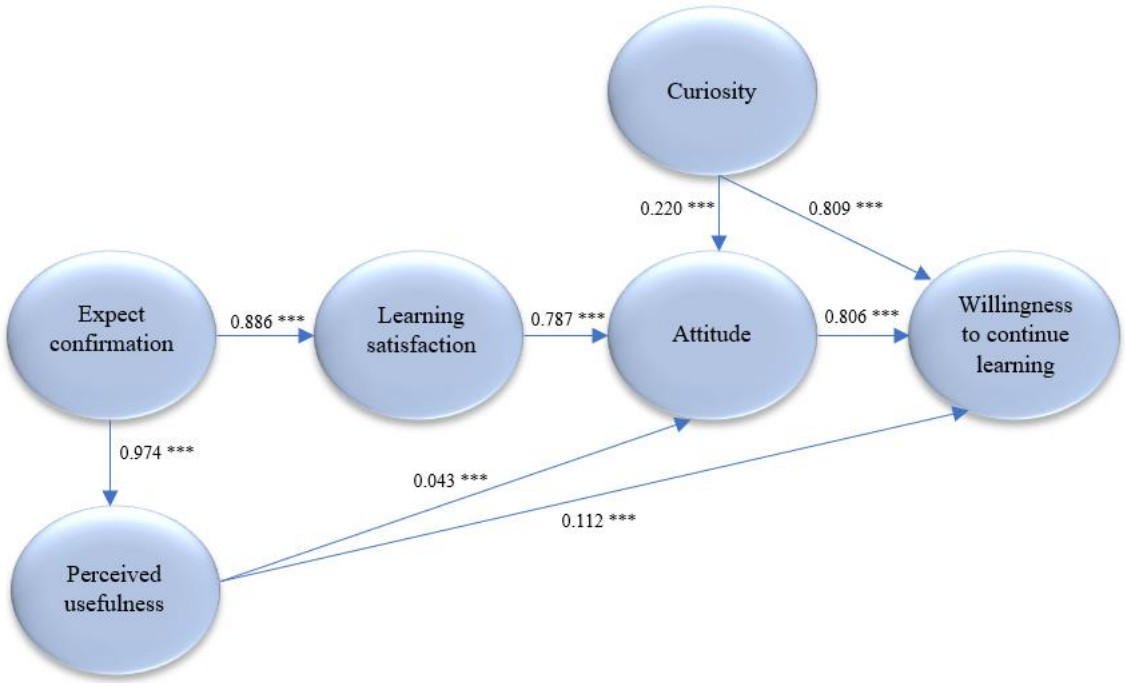
AMOS is used to test the fit of the theoretical model of factors influencing online learners' willingness to continue learning, and to evaluate the fit of the measurement model based on the parameter standards of

evaluation indicators such as CMIN/DF, RMSEA, SRMR, CFI, IFI, TLI, and GFI. The results are shown in Table 4. The results of the first model integration test showed that the parameter values of some evaluation indicators did not reach the standard reference values. Therefore, the MI correction index of the root structural equation model was modified to the original model. After the correction, each evaluation index of the model fit met its standard. Reference value, which shows that the overall fitting degree of the model is good, and this model can better explain the continuous learning intention of online learners.

Table 4.
Structural equation model fitting test results

Fit index	CMIN/DF	RMSEA	SRMR	CFI	IFI	TLI	GFI
Reference	<3.0	<0.08	<0.08	>0.90	>0.90	>0.90	>0.80
Actual value	3.444	0.099	0.249	0.913	0.914	0.900	0.812
Correction value	2.654	0.079	0.039	0.944	0.945	0.936	0.838

The verification of the research hypothesis is determined by the standardized path coefficients between potential variables and their significance. The numerical values of the standardized path coefficients are shown in Figure 3 on the next page. It can be seen from Figure 3 that there are positive correlations between expectation confirmation and learning satisfaction (β =0.899, p<0.001) and perceived usefulness (β =0.983, p<0.001). Hypotheses 1 and 2 are supported. Learning satisfaction (β=0.766, p< 0.001), curiosity (β=0.208, p<0.001) can positively predict attitude, hypothesis 5 and 7 are supported; the influence relationship between perceived usefulness and attitude is not significant (β=-0.040, p=0.684>0.05), hypothesis 4 is not supported. Attitude has a positive impact on willingness to continue learning (β =0.799, p<0.001), hypothesis 6 is supported. The relationship between curiosity and willingness to continue learning is not significant (β =0.082, p=0.206>0.05), perceived usefulness and willingness to continue learning. The relationship between them is not significant (β=0.107, p=0.148>0.05), and hypothesis 8 is not supported.



*Note: *p<0.05, **p<0.01, ***p<0.001*
Figure 3. Path coefficients of the modified model.

Table 5 shows the summary of results

Table 5.
Summary of results and hypotheses supporting

The results	Procedures	Status of Hypotheses
There are positive correlations between expectation confirmation and learning satisfaction and perceived usefulness	Standardized path coefficients	Hypotheses 1 and 2 are supported
Learning satisfaction, curiosity can positively predict attitude	Standardized path coefficients	Hypothesis 5 and 7 are supported
The influence relationship between perceived usefulness and attitude is not significant	Standardized path coefficients	Hypothesis 4 is not supported
Attitude has a positive impact on willingness to continue learning	Standardized path coefficients	Hypothesis 6 is supported
The relationship between curiosity and willingness to continue learning is not significant, perceived usefulness and willingness to continue learning. The relationship between them is not significant.	Standardized path coefficients	Hypothesis 8 is not supported

Starting from the perspective of ECM, this study introduced the two variables of attitude and curiosity on the basis of analyzing the rationality of the ECM structure, so that the research model can be expanded and better applied to related research in online or network learning environments. As indicated by the results, there is a positive correlation between expectation confirmation and learning satisfaction. Bhattacherjee (2001) found that expectancy performance could be an important determinant of satisfaction, because expectancy beliefs were the benchmarks that users used as reference judgments for assessing satisfaction. Cheng et al. (2016) proposed from the perspective of expectation value theory that student satisfaction depended on students' expectancy beliefs prior to learning. Appleton-Knapp & Krentler (2006) also proposed that when students' expectations were met, it was a positive predictor of satisfaction. Ye et al the expectancy value belief was positively related with theoretical course satisfaction.

There is a positive correlation between expectation confirmation and perceived usefulness. Satisfaction is affected by users' perceived usefulness and confirmation; perceived usefulness is affected by users' confirmation. However, some other studies found that perceived usefulness and satisfaction have significant effects on students' continuance intention while perceived usefulness has no significant effects on students' satisfaction (Daneji et al., 2019).

learning satisfaction and curiosity can positively predict attitude. von Stumm et al. (2011) have shown that students with an appreciable level of curiosity are more hard-working, well organized, and have the tendency to perform better academically. According to Cankaya et al. (2018), Gallagher & Lopez (2007), and Kashdan et al. (2009), curious students are likely to engage in unique and perplexing conditions in their daily routine and will meet and involve themselves more in prospects for progress and anticipated consequences.

Curiosity has an indirect impact on the willingness of online learners to continue learning. Just as curiosity is the driving force of learning, curiosity is also the driving force of online learners. With the support of a strong desire for knowledge, learners can maintain a positive attitude, which will generate a willingness to continue learning and enhance learning stickiness. Therefore, in terms of stimulating the curiosity of online learners to seek knowledge, it can be achieved through the setting of learning challenges. Learning challenges are reflected in the difficulty and novelty of online learning content and resources, the design of problem situations, the challenge of online learning tasks, and the establishment of an online interpersonal atmosphere.

Through learning challenges, online learners' desire to explore and the excitement of seeking knowledge about unknown things are stimulated, and learners are allowed to establish a positive coping attitude, thereby promoting their willingness to continue learning and the occurrence of continuous learning behaviors. It should be noted that excessive difficulty of learning challenges can easily lead to cognitive overload of online learners, thereby undermining learners' confidence and causing them to lose interest and curiosity in seeking knowledge. Therefore, the design of learning challenges should be based on the existing knowledge base and cognitive level of online learners, and should be suitable for the learners' "zone of proximal development" to stimulate learners' curiosity and enhance the continuity of learners' online learning.

Contrary to the results obtained by Nuryakin et al. (2023), the influence relationship between perceived

usefulness and attitude is not significant. The relationship between Perceived Usefulness, and attitude towards use is complex and may vary depending on the technology and the context in which it is used. Contrary to the results obtained by Deng (2021) who indicated that the study validates the role of curiosity as a multifaceted individual difference that serves as an antecedent to satisfaction with online education courses, the relationship between curiosity and willingness to continue learning is not significant. The relationship between perceived usefulness and willingness to continue learning is not significant. However, Huang (2021) obtained that PU positively affects students' continuous usage intention of online learning platforms. Roca & Gagné (2008) found that PU has the most significant effect on continuous intention and that some demographic variables existed.

Conclusion

Attention and research on online learners' willingness to continue learning are of great significance to the learning effects of online learners and even the sustainable development of online education. Although this study explores the influencing factors of online learners' willingness to continue learning from the perspective of ECM and draws corresponding conclusions, there are still limitations and room for further research: First, the number of effective samples available for research is not extensive enough. According to statistics, most of the effective samples are college students. The coverage of the sample is small and not representative of the general population. Future research will expand the categories of survey objects on the basis of ensuring a sufficient number of samples, and collect data on various types of online learners to increase the coverage and representativeness of the research sample. Second, willingness is an important predictor and explanation indicator of behavior. Research on online learners' willingness to continue learning is not the ultimate goal. To predict and explain online learning's continuous learning behavior based on online learners' willingness to continue learning is to test online learners continued learning behavior. The relationship between learning intention and continuous learning behavior will be an important direction for subsequent research.

Theoretical/practical implications and future research

The study analyzed the influencing factors and influencing mechanisms of online learners' willingness to continue learning and found that attitude is an important factor affecting online learners' willingness to continue learning, and supports learners to maintain positive attitude throughout the entire online learning process. It is an important help online learners to generate continuous learning intention and maintain learning behavior. The attitude of online learners is a direct factor affecting their willingness to continue learning. Starting from the factor of attitude, discussing how to keep online learners active and maintain a positive attitude is the key to their willingness to continue learning. Therefore, first, a good online teacher-student relationship is an important guarantee for learners to maintain positive academic emotions and form a positive learning attitude. Social interaction is an important means to effectively reduce social isolation in online learning communities, stabilize learners' emotions and moods, and maintain positive attitudes. Therefore, through the social interactive learning method of multi-person discussion and mutual assistance and collaboration in online learning communities, learners' loneliness in online learning can be reduced, and their sense of belonging in online learning can be enhanced so that they can maintain and maintain an attitude of active participation, thereby promoting learners' active learning, improving the continuity of learners' online learning, and enhancing their willingness to continue learning.

Curiosity, learning satisfaction, and expectation confirmation have an indirect impact on online learners' continuous learning intention, and attitude is the mediating factor for this indirect effect. Therefore, improving the degree of consistency between individual expectations and reality, maintaining individual desire for knowledge and exploration, and improving online learning satisfaction can have a certain impact on online learners' willingness to continue learning. Perceived usefulness has a certain impact on online learners' continuous learning. There is no significant impact on willingness, which means that although online courses can promote learners' progress in certain aspects, these advantages and characteristics cannot be sufficient conditions for online learners to generate continuous learning intention and maintain learning behavior.

Data availability statement Data will be made: available on request.

Declaration of competing interest

The author declares that she has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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