

Article

Investigating Lifelong Learners' Continuing Learning Intention Moderated by Affective Support in Online Learning

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Abstract: During the pandemic crises, online learning has moved from the margin to the centre of education, thus making a change in the educational paradigm. The degrees of technology acceptance, therefore, pose a major challenge to administrators, educators, and students, including lifelong learners from all fields of work. This paper aims to investigate how technology acceptance facilitates lifelong learners' continuing learning intention. By constructing a structural equation model based on the Technology Acceptance Model (TAM) theory and verifying the mediating role of learning satisfaction and the moderating role of affective support empirically, this study addresses the online learning characteristics in terms of self-efficacy, satisfaction, and willingness to learn in the context of lifelong learners. Data were collected from the questionnaires embedded in the courses at a distance teaching university. A total of 513 questionnaires have been retrieved and 488 valid questionnaires have been processed and analysed via SPSS 26.0 and Amos 24.0. The findings indicate that positive relationships and positive correlations between learning satisfaction and continuing learning intention juxtapose, and satisfaction is positively correlated with continuing intention. Moreover, affective support moderates the three components significantly. The results of this research help expand the applicability of the TAM theory with more practical significance, conveying positive messages to the administrators, educators and lifelong learners in continuance of online learning, and thus maintaining retention, particularly in the post-pandemic new normal for the sustainability of higher education.

Keywords: online learning; lifelong learning; perceived usefulness; perceived ease of use; learning satisfaction; affective support; continuing learning intention; structural equation model; VLE



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1. Introduction

Online learning has progressed into the new normal in the COVID-19 pandemic era, with its characteristics of learning modes across time and space beyond the physical limitation [1–3]. In a certain sense, online learning is moving gradually onto the centre stage and making a strong impact on the perceived usefulness for the learners with the adoption of information and communication technology [4]. As such, high-quality perceived ease of use not only lowers the threshold for learners through a convenient operating experience, stable functional interface and scalable technical support, but also serves as a precise mapping of instructors' and learners' needs in product development [5]. In the case of lifelong learners, the continuing learning intention remains the powerhouse that sustains high levels of internal motivation and acts as a primary agent that continuously contributes to their learning behaviour.

In the realm of information technology, perceived usefulness refers to the extent to which an individual perceives a benefit in terms of job performance or future development by adopting certain information technology, and perceived ease of use relates to the ease with which an individual can use a given system [6,7]. In distance learning, online learners'

perceived ease of use exerts a considerable influence on their learning strategies and learning behavioural inputs, and directly reflects both learners' perceptions of the operational features of the online learning platform and their instrumental perceptions of the online learning model. It plays a pivotal function in the interaction between the virtual learning environment (VLE) and learners [8], and is also a crucial factor in upgrading VLE and boosting their learners' learning satisfaction (LS).

VLE was introduced into higher education in the middle of the 2000s. However, VLE was a system that was used in all subjects but mainly played a supplementary role to existing courses. As such, VLE has been viewed as more of a traditional design, copying classroom characteristics of storing, presenting and distributing course materials, rather than being an interactive learning environment [9,10]. As the physical carrier of online learning, VLE serves as the link between learners, instructors, online resources and learning support services. The challenges for online learning remain digital literacy, Internet connectivity, and the strategies and habits adopted in traditional learning, for these lifelong learners are called "digital migrants" or "digital refugees" [11]. Furthermore, perceived usefulness and perceived ease of use posit a significant factor in retaining these lifelong learners' continuing learning intentions [12].

Although a considerable body of previous studies has focused on the perceived ease of use and perceived usefulness, and satisfaction with online learning in the framework of the Technology Acceptance Model (TAM) and Expectation–Confirmation Model (ECM) [7,13–17], the authors find a lack of studies investigating the influencing mechanism of the interaction between these variables and the continuing learning intention moderated by affective support [18–20]. In addition, studies with online cohorts of lifelong learners in higher education via distance learning are scarce. Although blended learning has been advocated for the new normal post-COVID-19, the online learning mode provides a new pathway for learners to pursue further education and upgrade their qualifications, and the question of how to enhance the willingness of this cohort to continue learning is still an important issue that needs to be addressed in the context of distance learning. In particular, the impact of the COVID-19 pandemic has brought to the fore the psychological problems of adults in the learning process, and affective support may be an important measure to enhance their continuing learning intention, to retain the learners and reduce the risk of drop-out in online learning.

To examine the interrelationships between the constructs and variables, we intend to conduct research on the perceived usefulness and perceived ease of use from the perspectives of these lifelong learners within the TAM and ECM theoretical framework. In the study, we design a model and use affective support as a moderation variable to determine the extent to which affective support from instructors can enhance and improve the continuing learning intention. The present research constitutes a new domain with largely unstudied potential to provide educators, decision-makers, and stakeholders with some theoretical and practical insights regarding lifelong learners in terms of the development of more user-friendly VLE, learner support services, learner satisfaction and retention, and sustainable development in open and distance learning.

2. Relative Studies Based on the Theories of TAM and ECM

2.1. Concepts

As defined by Bates as "any type of learning conducted partially or fully through the Internet", online learning refers to the use of the Internet or other computer-facilitated technologies in providing education to learners [21]. The alternate terms for online learning are remote learning, e-learning/teaching, and online teaching/instruction. Educators from conventional colleges referred to online learning as emergency remote teaching and learning during the pandemic outbreak. It should be noted, however, that emergency remote teaching is merely a stopgap for course/instruction delivery, whereas online learning in this article is a form of distance learning with deliberately and specifically designed courses in a virtual learning environment, frequently a learning platform. Online education has

altered the manner in which people have access to distributed knowledge, and accommodated individuals of any colour, age, gender, or culture at any time and place. It is now one of the finest options for working people to gain access to higher education or professional development.

Davis defines perceived ease of use as “the degree to which a person believes that using a particular system would be free of effort” [6] (p. 320). Perceived ease of use is a crucial determinant of people’s adoption of learning strategies, learning engagement, and learning behaviours; thus, it reflects the perceived usefulness of online learning platforms and, indirectly, the acceptance of the online learning model as a tool [16]. It illustrates the technical link between online learning platforms and learning practices, which will affect the learning satisfaction of online students [22,23]. With the development of online learning platforms, the perceived ease of use is an important variable to be considered for boosting the distance and online learning experience.

Perceived usefulness refers to “the degree to which a person believes that using a particular system would enhance his or her job performance” [6] (p. 320). As a tool to measure the perception of the learner self in using the resources in terms of the actual effectiveness [24], perceived usefulness defines the values of the administration/stakeholders’ evaluations of the designs of the online learning platforms, an entity of the workflow and user satisfaction [25]. It functions as an additional crucial variable influencing the continuing learning intention, directly or indirectly affecting online learning, the continuing learning intention and learning satisfaction.

2.2. The Relationship between Perceived Usefulness and Perceived Ease of Use and Learning Satisfaction

Throughout the evolution of information technology, research on user satisfaction with the use of information technology has been the primary focus, with TAM serving as the linking theory. On the basis of the theory of rational behaviour and the theory of planned behaviour, Davis et al. investigated the subjective attitudes and behavioural intentions of users toward the use of information systems and found that perceived usefulness and perceived ease of use were significant factors influencing their attitudes [26]. Thong et al. developed an extended version of the Expectation–Confirmation Model in Information Technology (ECM-IT), and believed that perceived ease of use and perceived usefulness had a significant positive impact on user satisfaction [27]. Influenced by the theory of subject education, learning satisfaction has been progressively investigated during the evolution of online education, with researchers such as Joo et al. concluding that online university students’ perceived usefulness and perceived ease of use of online courses were major predictors of learning satisfaction [28]. The findings of a study conducted by Park et al. on the technological acceptance of mobile learning by students revealed that perceived usefulness was the most influential factor in learning attitude [29]. Cao et al. conducted a study on the application of social media by university instructors by constructing a structural equation model [30]. The empirical results demonstrated, once again, that perceived usefulness had a significant positive impact on social media use in teaching, and that such use decisions could positively contribute to students’ learning outcomes and satisfaction. Using a research model of satisfaction with university online self-directed learning platforms, Sun confirmed that both perceived usefulness and perceived ease of use were positively correlated with satisfaction and had a substantial effect on students’ learning satisfaction [7].

2.3. The Continuing Learning Intentions Relationship between Perceived Usefulness and Perceived Ease of Use

The continuing learning intention is the psychological propensity of learners toward the completion of learning activities after overcoming all types of uncertain interference, which is expressed in numerous areas including cognition, emotion, action, etc. [13]. The majority of this perspective’s study was founded on ECM proposed by Bhattacharjee [31]. The model has broadened ECM theory by emphasizing the variable for the continuous

intention of usefulness and has demonstrated that perceived usefulness and satisfaction are the most influential variables on users' actual behaviours of continuous use. Subsequently, the theory has been validated and expanded in other domains, such as mobile service terminals, social media, and online learning platforms, among others. Wu et al. investigated learners who followed MOOCs with the S-O-R paradigm and discovered that perceived ease of use generates the intention for continuous learning, acting as the largest source of dynamism for increasing learners' aspirations to study [14]. Jung and Lee also demonstrated through their research that perceived usefulness and perceived ease of use have direct or indirect effects on persistence in large-scale online learning, as well as the most important factors influencing the continuing learning intention [32].

2.4. Relationship between Learning Satisfaction and the Continuing Learning Intention

Individuals' satisfaction and sense of well-being can be attributed to their impression of the business's performance and evaluation of its products or services. Kotler viewed the difference between the actual perception and the expected effect of the consumers as satisfaction, which would affect the results of the competition to some degree and even result in the loss of customers [33].

ECM theory also posits that consumers' decisions to continue receiving a service or utilizing a product are contingent on their satisfaction with earlier interactions [34]. According to this approach, learning satisfaction can also be regarded as the difference between a person's prior learning expectations and the actual outcome. In the course of studying the continuous use of information systems, Bhattacharjee developed the ECM-ISC (Information System Continuance) model and demonstrated that user satisfaction is the most influential predictor of the continuous use of information systems, playing a more proactive and dominant role than other factors [35]. On the basis of the National Students Survey, Fernandes et al. developed a Program Experience Questionnaire in which satisfaction was defined as the subjective attitude generated by students' educational service experience and a factor influencing students' loyalty to their schools in terms of public reputation, retention, etc. [36]. Zhang et al. defined learning satisfaction as the learners' overall satisfaction with the learning experiences and the decision-making for learning engagement, following the completion of online courses. Their empirical findings indicated that learning satisfaction and perceived usefulness might implicitly or openly influence the continuing learning intention throughout their participation in MOOCs, and from the perspective of influence effects learning satisfaction had a greater effect on learning intention [37]. Tan et al. confirmed that in the course of online English learning, learning satisfaction demonstrated the strongest direct impact on the learning intention by creating a model that examined the impact factors on undergraduates' continuous intention of online English learning [38].

2.5. Moderating Function for Affective Support

Affective support in this context relates to the learners' experience of warmth, hope, and community through empathy [39]. Instructors serve as providers of affective support during online learning in terms of learning interests, motivation, willpower, etc., in order to facilitate/enhance the learners' subjective incentive to study [40]. This affective support requires instructors' ingenuity to create an active learning environment and focus on students' perspectives [41]. The application of information technology closes the gap between students and resources, while at the same time maintaining a semi-permanent barrier between instructors and students, so neglecting the two-way emotive contact attributed to "distance." Zhao et al. carried out a quasi-experimental study and discovered that efficient and effective support from instructors can help reduce boredom and anxiety in studying for online students [42]. Crosnoe et al. observed that when students feel a high level of affective support from instructors, their desire for independent learning is stimulated due to a stronger rapport between instructors and students, resulting in improved learning behaviour and academic outcomes [43]. Wu et al. investigated experimentally

how the affective support from the instructors influenced the continuing learning intention of the students in online learning. They discovered that, while cognitive support from the instructors could influence the learning intention via perceived ease of use, affective support also functioned to influence the learning intention via the mentality experience of the students [14]. Zhang confirmed that the impact mechanism did exist in the interactivity of MOOCs learning by creating a continuing learning intention model for MOOCs learners. He also noted that the positive emotional attitudes of the educational providers contributed to the improvement of the learners' perceived usefulness, hence enhancing the continuing learning intention [44].

As users of online learning platforms, their subjective perception will effectively and directly evaluate the online learning platforms and influence their own learning behaviours, learning satisfaction and the continuing learning intention. Marsh shares a similar position, arguing that students can cultivate an affective perception of learning results and conduct self-assessment and that this evaluation will not be influenced by hidden bias, making it more objective [45].

2.6. Hypothesis

The present study, conducted in 2021, uses learning satisfaction as a mediating variable and affective support as a moderating variable to construct a theoretical model of the influence of learning platform perceptions on the continuing learning intention, with adult distance learners as the core research object, to investigate how the mechanism influences the variables between the perceived usefulness, perceived ease of use, and the continuing learning intention of the distance learners, and will perform additional research on its statistical prominence zone. Moreover, the exploration of the boundary condition that the affective support by the instructors acts in moderation will be carried out. The theoretical model of the structural equation (see Figure 1) for the present research is created in accordance with the following hypothesis:

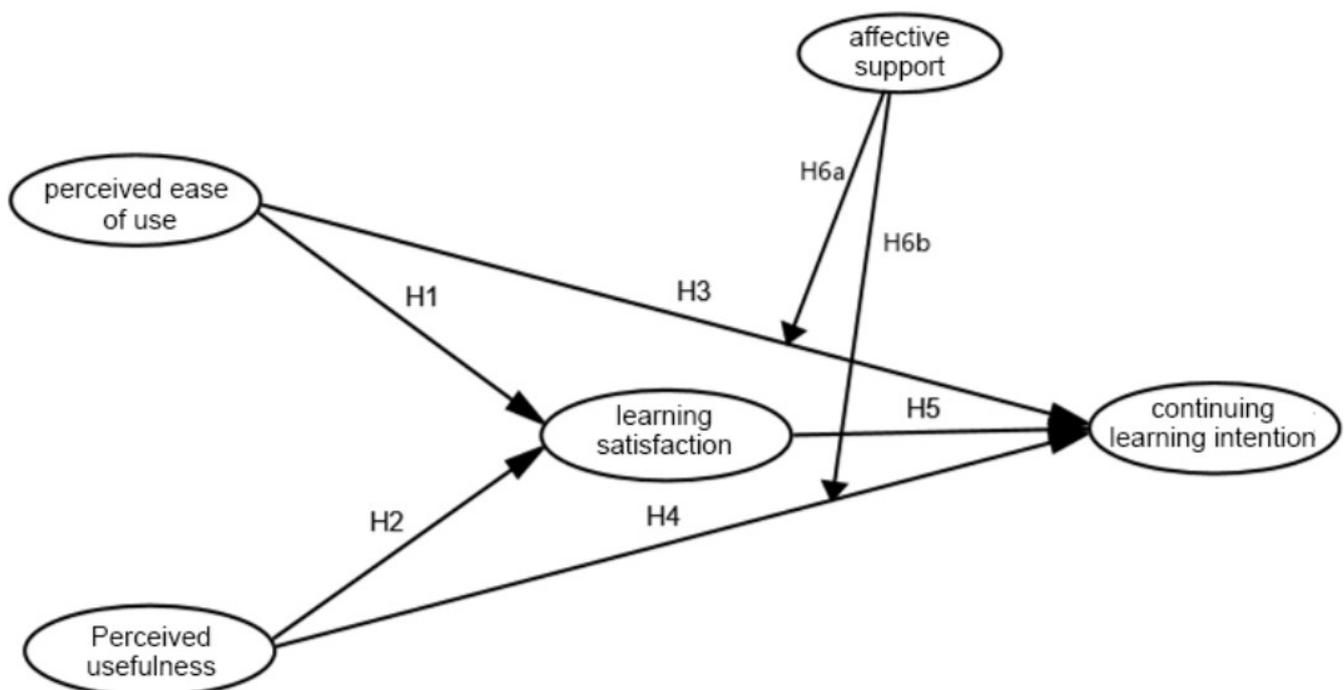


Figure 1. The theoretical model of the structural equation model (SEM).

- H1.** *There exists a positive relationship between perceived ease of use and learning satisfaction.*
- H2.** *There is a positive correlation between perceived usefulness and learning satisfaction.*
- H3.** *There exists a positive relationship between perceived ease of use with the continuing learning intention.*
- H4.** *There is a positive correlation between perceived usefulness and the continuing learning intention.*
- H5.** *Satisfaction is positively correlated with the continuing learning intention.*
- H6a.** *Affective support moderates the relationship between perceived ease of use and the continuing learning intention.*
- H6b.** *Affective support moderates the relationship between perceived usefulness and the continuing learning intention.*

3. Materials and Methods

3.1. Settings and Participants

This study's participants were lifelong learners at an online university. This online university, headquartered in the city of Nanjing, offers tertiary education programs to all province residents and is the province's leading university for distance and online learning. The School of Open Learning of this university provides working adults with over 30 BA/BSc and Associate Degrees programs via a virtual learning environment in terms of teaching and learning interaction, assignments, assessment, and evaluation. All lifelong learners have been grouped into typical classes in order to set up a learning community, virtually or physically. In the interim, individuals might seek assistance from the study centres distributed in the vicinity.

In the course of administering the survey, the questionnaires prepared for the current study were embedded in the courses of diverse subjects on VLE, with questions concentrating on the perceived ease of use, perceived usefulness, and learning satisfaction of the online learning platforms and choices of questions on the relevant continuing learning intention. All online learners registered at the university were invited, but not required, to respond to the embedded questions anonymously; nevertheless, only 513 questionnaires were ultimately submitted. After deleting the invalid surveys containing repeated answers or missing data, 488 questionnaires (n) have been approved as valid. All valid surveys were processed and analysed using the Statistical Package for Social Science Data Analysis (IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY, USA: IBM Corp.) and Amos 24.0. (Statistics for Windows, Version 24.0. Armonk, NY, USA: IBM Corp). Nearly half of the participants in Table 1 are working people 30 years old or over who are dispersed throughout the province's townships, rural areas, and counties. It also demonstrates that the learners have chosen subjects outside their areas of competence, preparing them for a career change. This phenomenon appears consistent with the fundamental characteristics of lifelong learners in this province, demonstrating the adequacy of the sampling of diversity.

3.2. Questionnaires and Measurement of Variables

The questionnaires in this study consist of two parts, the first of which consists of the demographic characteristics of the samples, the majors and the course categories of individual online learning, and the second of which is for the measurement questions of the main variables in the model, using the Likert 5.0 points rating scale, with 1 representing "strongly disagree" and 5 representing "strongly agree". The questionnaires focus primarily on five variables: perceived ease of use, perceived usefulness, learning satisfaction, the continuing learning intention, and affective support. The demographic characteristics consist mostly of learners' gender, age, location distribution, learning history, and the sorts of online courses they registered for.

Table 1. Demographics of participants.

Demographics	Groups	Frequency	Percentage (%)	Characteristics	Groups	Frequency	Percentage (%)
Gender	Male	218	44.67	Location of students sources	Village/Town	216	44.26
	Female	270	55.33		Town/City	175	35.86
Age	30 and under	284	58.20		Metropolitan/Major City	97	19.88
	31–40	153	31.40		Management Education	98	20.08
	41+	51	10.40	Online Learning programmes	143	29.30	
Prior learning background	Subjects The same subjects	124	25.41	Science and Technology	Science and Technology	147	30.12
	Similar subjects	139	28.49		Finance	39	8.00
	New subjects	225	46.10		Other Programs	61	12.50

In order to ensure the reliability and validity of this study, the measurement items were obtained from established scales in the relevant domestic and international literature and were partially revised and adapted by incorporating the fundamental characteristics of adult online learners and the suggestions made by the experts and scholars. The measurements of perceived ease of use and the usefulness of the online learning platform were primarily based on the findings of Davis et al. in 1989 and 1993, as well as Ouyang's scale of intention to adopt online learning [46,47], from which five and six items were selected with Cronbach's α of 0.956 and 0.972, respectively. Incorporating the research findings of Liaw and Yue et al. with the necessary revisions [48,49], the learning satisfaction measures resulted in four measurement questions with a Cronbach's α value of 0.98. The affective support scale was based on the secondary level indications of affective support from teachers in Jiang and his colleagues' study, as well as research findings by Ozkan and Koseler [41,50]. Three questions were chosen, and the Cronbach's α is 0.946. The scales for continuing learning intention were derived from the central components of Ajzen's study on the theory of planned behaviour: behavioural attitudes, subjective norms, and perceived behavioural control [51]. In addition, three items were selected from Venkatesh et al.'s extensive study on the technology acceptance model [52]. The scale's Cronbach's α was 0.957. Cronbach's alpha coefficients for all five variables in the model varied from 0.94 to 0.98, which exceeded the suggested value of 0.7, indicating that the questionnaire's reliability was adequate. In this study, the KMO coefficient was used to assess the structural validity of the scale; the KMO value was 0.958, which was larger than 0.7 and acceptable for factor analysis; and $p < 0.05$, which reached a level of statistical significance, indicating that the scale had good reliability and validity.

3.3. Common Methods Biases Test

Common method biases are artificial co-variations between predictors and calibration variables, which are caused by the same assessors or common data sources, item context, measurement environment, and item characteristics; these are systemic errors, and may therefore potentially mislead research conclusions [53]. Since both the independent and dependent variables are subjective variables, and the measurement of the respondents' perceived ease of use, perceived usefulness, learning satisfaction, and affective support is conducted simultaneously, co-response biases may exist. Consequently, the Harman single-factor test was utilized to examine the common approach biases of the variables in question. The results indicated that five common factors with eigenvalues greater than one were extracted, the cumulative explained variance was 82.76%, and the variance contribution rate of the first component was 31.37%, which was less than the industry standard of 40%. Therefore, this study contains no substantial common method biases.

4. Results

4.1. The Reliability and Validity Analysis

Using SPSS 26.0, the reliability and validity of the measurement model were initially estimated. The cumulative variation explained by the five common components exceeded the usual value of 60% at 82.76%. All factor loading coefficients were over 0.7, indicating that the five latent variables were highly representational of the measurement questions to which they belonged. Second, each dimension's internal consistency dependability fulfilled an acceptable criterion (Cronbach's $\alpha > 0.7$). The composite dependability (CR) ranged from 0.947 to 0.986, both of which were greater than the normal value of 0.7, indicating that the measurements utilized in this investigation were reliable. As shown in Table 2, the Average Variance Extracted (AVE) of the individual measurement models ranged from 0.81 to 0.94, which was greater than the standard value of 0.5, suggesting the measurement models' good convergent validity. In accordance with the Fornell–Larcker criterion, discriminant validity can be verified by comparing the open square root of the extracted mean-variance to the Pearson correlation coefficient [54]. In this investigation, the AVE open square values for each latent variable were bigger than their correlation coefficients with any other latent variable, and the constructs demonstrated a high degree of discriminant validity. Therefore, the measurement models utilized in this investigation were reliable.

Table 2. Analysis of validity and reliability.

Dimension	Item	Non-Standardized Coefficient	Standard Error	t-Value	p Value	Standardization Coefficient	Cronbach' α	CR	AVE
PEoU	EU1	1.000				0.934	0.956	0.955	0.811
	EU2	1.043	0.026	40.722	<0.001	0.945			
	EU3	1.039	0.032	32.738	<0.001	0.884			
	EU4	0.930	0.028	33.127	<0.001	0.887			
	EU5	0.919	0.031	29.419	<0.001	0.850			
	UF1	1.000				0.886			
PU	UF2	1.047	0.035	30.311	<0.001	0.898	0.972	0.972	0.853
	UF3	1.062	0.033	32.275	<0.001	0.921			
	UF4	1.096	0.033	33.256	<0.001	0.932			
	UF5	1.139	0.033	34.392	<0.001	0.943			
	UF6	1.107	0.031	35.914	<0.001	0.958			
	SAT1	1.000				0.967			
LS	SAT2	1.023	0.017	59.848	<0.001	0.970	0.986	0.986	0.947
	SAT3	1.023	0.016	64.874	<0.001	0.980			
	SAT4	1.008	0.016	63.092	<0.001	0.976			
	BH1	1.000				0.946			
CLI	BH2	1.015	0.025	40.836	<0.001	0.937	0.957	0.957	0.882
	BH3	1.055	0.026	40.292	<0.001	0.934			
	EM1	1.000				0.877			
AS	EM2	1.073	0.033	32.717	<0.001	0.949	0.946	0.947	0.857
	EM3	1.113	0.034	32.687	<0.001	0.949			

Note: PEoU is perceived ease of use, PU stands for perceived usefulness, LS represents learning satisfaction, CLI is continuing learning intention and AS stands for affective support.

4.2. Structural Equation Modelling and Path Coefficient Estimation

On the basis of the research hypotheses, maximum likelihood estimation was used to test a structural equation model constructed with perceived ease of use and perceived usefulness of the online learning platform as independent variables, the continuing learning intention as the dependent variable, learning satisfaction as the mediating variable, affective support as the moderating variable, and controlling for background variables such as gender, age, location, and online course attributes. As indicated by Hair et al., the model was first estimated for basic fit [55]. The results indicated that all error variances were positive, and the decisive values of the error variances varied from 9.661 to 14.170, all achieving a significant level of 0.001 or more, so satisfying the criteria of having no negative

values and reaching a significant level. The standard errors of the parameters ranged from 0.002 to 0.043, and none were statistically significant. The factor loadings between the potential variables and their respective measures were all greater than the suggested value of 0.6 [56]; thus, the test findings revealed that the measurement model’s basic fit was adequate.

Further analysis of the model’s overall fit revealed that $\chi^2/df = 4.558, p < 0.01$, RMSEA = 0.078, AGFI = 0.863, GFI = 0.900, IFI = 0.921, CFI = 0.921, and most of the indicators met the criteria, but the χ^2 was large and reached a significant level; however, χ^2 was susceptible to the influence of sample size [57]. CFI = 0.921 and TLI = 0.893, both within the acceptable range, and Anderson and Gerbing suggested that an AGFI ≥ 0.85 would satisfy the requirement [58]. The PGFI = 0.580 and the PNFI = 0.722 met the requirements of being greater than 0.50. As a result, the model was generally appropriate, the fit was satisfactory and the measurements were convincing to some extent.

According to Figure 2 and Table 3, the standardised path coefficients for hypotheses H1 through H5 were 0.101, 0.637, 0.288, 0.319, and 0.396, and the *p*-values were less than 0.05, indicating that the hypotheses were plausible. Hypotheses H1 and H3 were, therefore, confirmed. Hypotheses H2 and H4 were highly supported by the data. Learners’ PU of the online teaching platform positively predicted learners’ online learning satisfaction (=0.637, *p* < 0.001) and the continuing learning intention (=0.319, *p* < 0.001). Similarly, online learning satisfaction also strongly predicted learners’ continuing learning intention, thus confirming hypothesis H5.

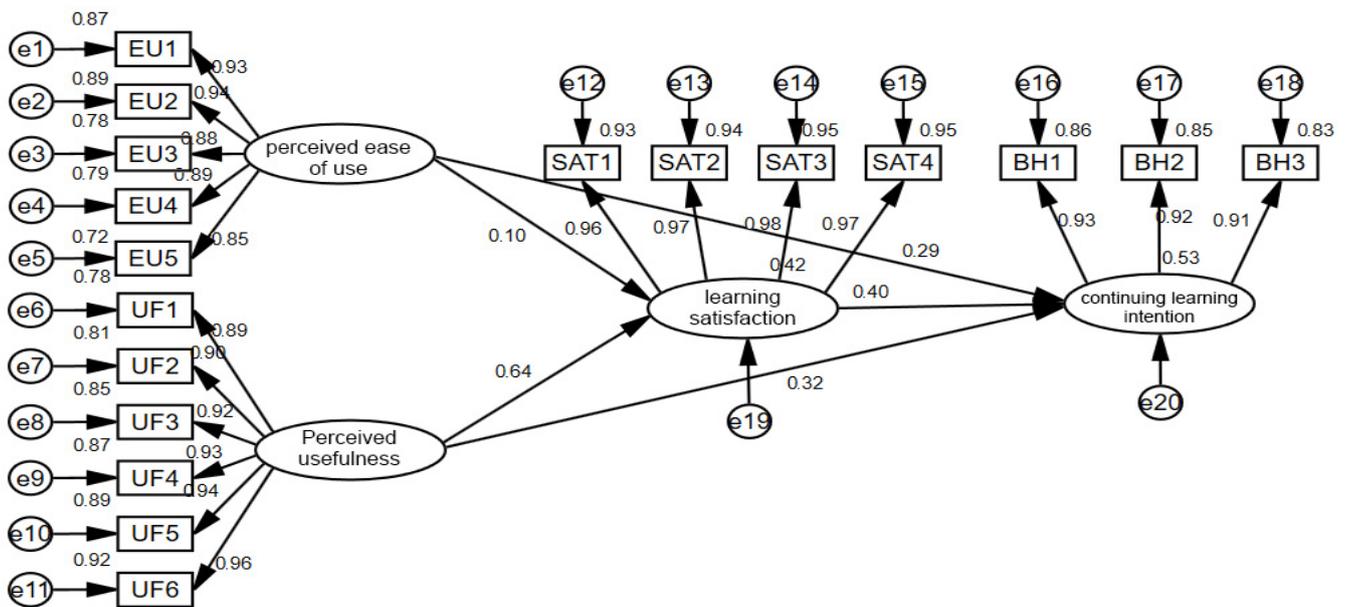


Figure 2. Model Roadmap and Normalized Estimates.

Table 3. Path relationship test results.

Hypothesis	Path Relationship	Unstd.	S.E.	Z-	Sig.	Std.	Support
H1	PeoU → LS	0.104	0.037	2.798	0.005	0.101	yes
H2	PU → LS	0.698	0.043	16.178	<0.001	0.637	yes
H3	PeoU → CLI	0.203	0.025	8.269	<0.001	0.288	yes
H4	PU → CLI	0.240	0.034	7.025	<0.001	0.319	yes
H5	LS → CLI	0.272	0.031	8.762	<0.001	0.396	yes

Note: Unstd. is the unstandardized coefficient; S.E. is the standard error; Z- is the Z value; Sig. is the significance; Std. is the standardized coefficient; PEoU stands for perceived ease of use, PU is perceived usefulness, LS stands for learning satisfaction and CLI represents continuing learning intention.

4.3. Moderation Effects Test

The two direct effect paths in the model (PEoU → CLI, PU → CLI) were both significant; hence, the mediation path of this study displayed a partial mediation impact. On the basis of the SEM model, the Bootstrapping technique was utilized 1000 times to extract samples, the relevant test results of the structural model were obtained, and the 95% confidence interval was established to calculate the perceived ease of use and perceived usefulness of the online teaching platform for learners and the continuing learning intention. The importance of the mediation effect of learning intention was evaluated. In accordance with Fritz et al., the non-parametric percentile Bootstrap technique with bias correction in increased mediation effect detection power was used for the test, and the confidence interval of the bias correction was utilized as the foundation for differentiation [59]. Table 4 reveals that the total effects between the learners' perceived ease of use and the perceived usefulness of the online teaching platform and their the continuing learning intention were 0.661, and that the mediation effect of learning satisfaction in platform use perception and the continuing learning intention was statistically significant (95% CI does not contain 0; $p < 0.05$). In terms of relative effect percentage, indirect effects comprised 32.98 per cent less of the total effect than direct effects. Specifically, the mediation effects of online teaching platforms on learners' perceived ease of use and perceived usefulness were 0.028 and 0.190, and the corresponding ratios to the overall effects were 4.24% and 28.74%, respectively. Comparing the mediation effects of the mediation paths revealed that, among the specific indirect effects, there was a substantial difference between the mediation paths "PEoU → LS → CLI" and "PU → LS → CLI".

Table 4. Bootstrapping mediation effect.

Effect Category	Effect Size	Coefficient Derived Value		Bootstrapping		Relative Effect Percentage
		SE	Z-Value	Bias-Corrected 95% CI		
				LLCI	ULCI	
Direct effectiveness	0.443	0.110	4.027	0.223	0.645	67.02%
Total indirect effectiveness	0.218	0.083	2.627	0.104	0.443	32.98%
Total effectiveness	0.661	0.071	9.310	0.516	0.793	100%
Specific indirect effects						
EU → SAT → BH	0.028	0.015	1.867	0.019	0.117	4.24%
UF → SAT → BH	0.190	0.085	2.235	0.076	0.417	28.74%
Comparison of mediation effects						
EU → SAT → BH vs. UF → SAT → BH	0.161	0.099	1.626	0.030	0.412	

Note: EU is PEoU; UF is PU; SAT is LS; BH is CLI; SE is Boot standard error; Z is Z value; LLCI is the lower limit of the 95% confidence interval; ULCI is 95% upper confidence interval limit; p is the p -value; where $n = 488$; 1000 draws.

4.4. Moderation Test

When assessing the moderation effect, the data were first processed to lessen the impact of the interaction term's multicollinearity and enhance the explanatory relevance of model parameters [60]. This study utilized Hayes's PROCESS 3.5 program module to examine the effect of moderated mediation [61]. Using teacher affective support for online learners as a moderator variable, sampling the samples 1000 times iteratively and assuming a 95% confidence interval, it was determined whether the moderated mediation effect moderated the connection between perceived ease of use and the continuing learning intention, and perceived usefulness and the continuing learning intention. Therefore, the perceived ease of use and perceived usefulness of the online learning platform were established as independent variables; the moderator variables, namely instructors' affective support, were subsequently included; the multiplication term of the two was established as the moderator effect variable; and the continuing learning intention was established as the dependent variable. Table 5 provides the results. The multiplier coefficient of affective

support and perceived ease of use was 0.083, which is positive at the 1% significance level, and the change in R^2 is significant (ΔR^2 value is 0.013, ΔF value is 14.016, $p < 0.001$), indicating that affective support positively modulated the relationship between PEOU and the continuing learning intention online, augmenting the positive effect of the perceived ease of use, assuming that H6a was valid. The multiplicative coefficient of affective support and perceived ease of use was 0.100, which is positive at the 1% significance level, and the change in R^2 is significant (ΔR^2 value is 0.019, ΔF value is 20.738, $p < 0.001$), indicating that affective support moderated the role of perceived usefulness and the continuing learning intention, and its existence would promote the further transformation of perceived usefulness. Additionally, H6b was also confirmed.

Table 5. Moderation effect test results.

Dependent Variable	Independent Variable	Unstd.	SE	t	p	LLCI	ULCI
BH	Constant	4.674	0.017	270.656	0.000	4.64	4.707
	EU	0.373	0.054	6.918	0.000	0.267	0.479
	EM	0.386	0.055	7.071	0.000	0.279	0.493
	EM * EU	0.083	0.022	3.744	0.000	0.039	0.127
$R^2 = 0.563, F = 207.573, p < 0.001; \Delta R^2 = 0.013, \Delta F = 14.016, p < 0.001$							
BH	Constant	4.665	0.018	266.452	0.000	4.631	4.699
	UF	0.455	0.073	6.27	0.000	0.313	0.598
	EM	0.320	0.074	4.309	0.000	0.174	0.466
	EM * UF	0.100	0.022	4.554	0.000	0.057	0.143
$R^2 = 0.562, F = 207.348, p < 0.001; \Delta R^2 = 0.019, \Delta F = 20.738, p < 0.001$							

Note: ΔR^2 is the amount of change in R^2 ; p is the p value; LLCI is the lower limit of the 95% confidence interval; ULCI is the upper limit of the 95% confidence interval. The sign * indicates the interaction between variants.

To further quantify the test results of the moderation effect, the Jonson–Neyman technique was used to investigate the boundary value of the moderation effect of affective support [62], thereby determining the level at which the moderator variable exerted a significant moderation effect. In this study, the influence of learners' perceived ease of use and perceived usefulness on the continuing learning intention was specifically assessed when teacher affective support exhibited various effect values during online learning, and the statistically significant interval of the associated moderating effect was determined. As depicted in Figure 3, when the standardised value of the teacher's affective support was greater than -2797 , the moderating variable had a significant positive moderation effect (the confidence interval did not contain 0); when the standardized value of affective support was less than -2797 , the moderator effect did not exist. It can be seen that the greater the instructors' affective support during the online learning process, the greater the learner's perceived ease of use of the learning platform, which can promote the continuing learning intention more effectively. Figure 4 demonstrates that when the standardised value of the teacher's affective support is greater than -2.841 , the positive moderation impact is substantial (the confidence interval does not contain 0), whereas when it is less than -2.841 , the moderation effect is not significant. The analysis demonstrates that when a teacher's affective support is at a medium or higher level, the increased perceived usefulness resulting from the support effect can greatly improve learners' continuing learning intention.

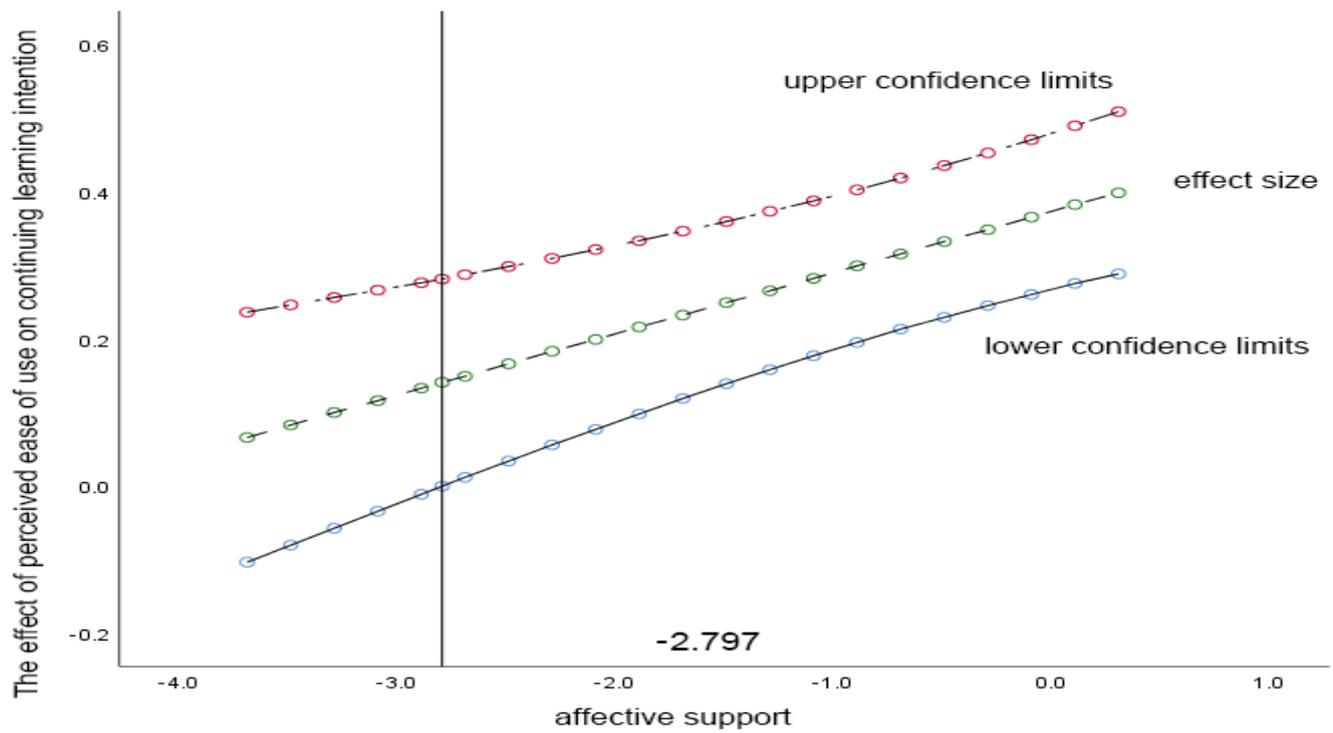


Figure 3. The effect of affective support on the relationship between perceived ease of use and the continuing learning intention.

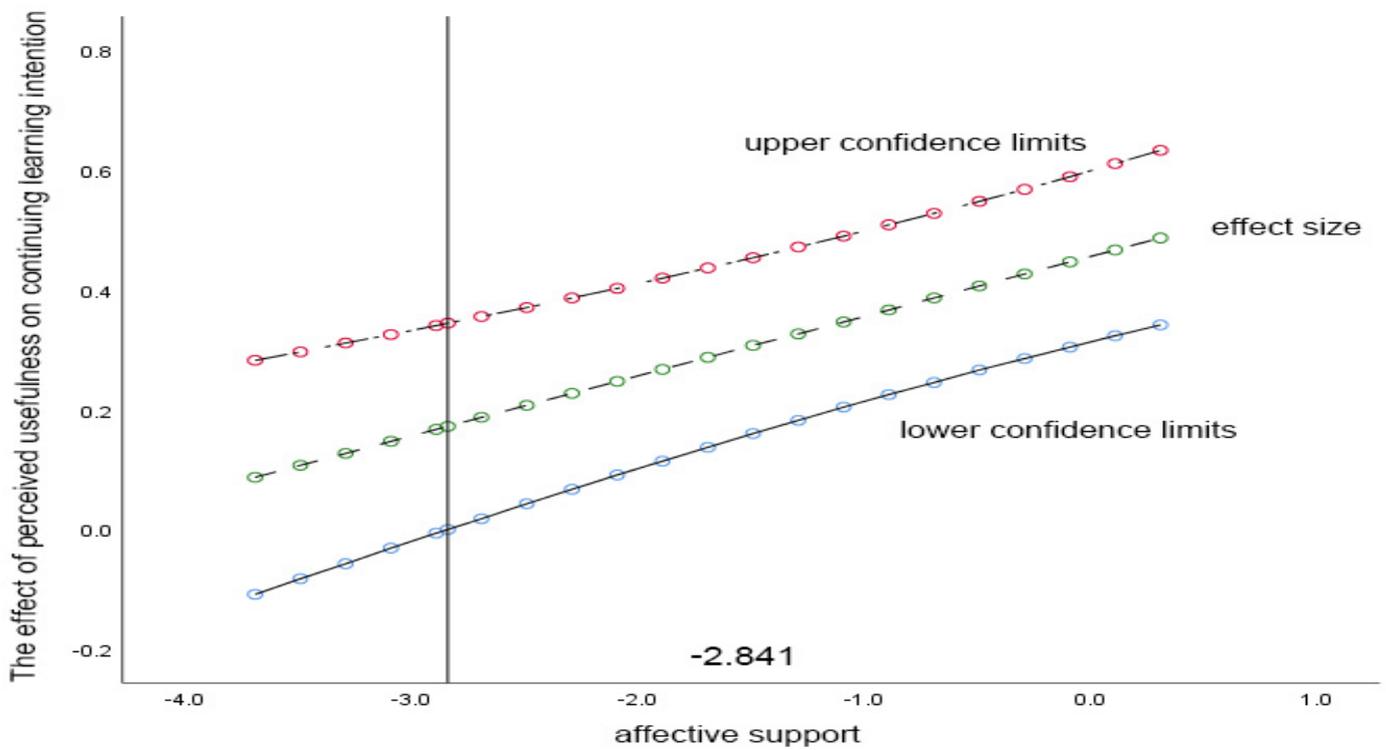


Figure 4. The effect of affective support on the relationship between perceived usefulness and the continuing learning intention.

5. Discussion

The present study employs a TAM-based structural equation model to investigate how perceived usefulness and perceived ease of use influence learning satisfaction and, as a result, the continuing learning intention via the moderating effect of affective support in the context of online learning in the school of open learning. The research findings supported the expected links between the TAM model's dimensions and important variables for mediation and moderation. The three influence mechanisms listed below should be discussed further.

5.1. *Perceived Usefulness and Perceived Ease of Use Interaction with Learning Satisfaction*

Our findings indicate that a substantial positive association exists between the perceived usefulness and perceived ease of use of online learning platforms among lifelong learners and their learning satisfaction. Perceived usefulness also has a substantial favourable influence on learning satisfaction. These results are consistent with prior research by Sun, Jung and Lee [7,32]. We discovered that, in terms of the influence on learning satisfaction, perceived usefulness appeared to be stronger than perceived ease of use, confirming prior studies that perceived usefulness determines learners' attitudes more than the perceived ease of use of online learning platforms [63]. It demonstrates that the stronger the learners' perceived usefulness of the online learning platform, the more positive their attitudes toward online learning and the better their learning satisfaction will be [64]. The perceived usefulness is not only directly related to learners' perceptions of the process of using the learning platform, but also influences comprehensive learning behaviours and attitudes, which are significant predictors of willingness to continue learning [14]. The results also confirmed Bhattacharjee's conclusion that learning satisfaction and perceived usefulness are the most influential elements in the learners' desire to continue using the platform [35]. This concludes that a user-friendly learning platform will retain online learners, and facilitate their positive attitudes to online and distance learning.

5.2. *Interaction between Perceived Usefulness, Perceived Ease of Use and the Continuing Learning Intention*

According to the validation results, it was evident that the perceived ease of use of the online learning platform had a significant direct effect on learners' continuing learning intention and directly affected learning satisfaction, resulting in learning satisfaction partially mediating the effect between perceived ease of use and the continuing learning intention, and partially mediating the effect between perceived usefulness and the continuing learning intention with platform access. Regarding the relative percentage effect of each variable on the pathway of the continuing learning intention, the direct effect of perceived usefulness accounted for the greatest proportion of the total effect, corroborating previous research findings that the effective occurrence of online learning behaviours was closely related to the extent that learners perceived the usefulness of the learning system. Our findings demonstrated that perceived usefulness was a significant factor influencing learners' participation in online learning [65] and that learners' perceived usefulness of online learning systems in terms of infrastructure configuration, information and system quality influenced learners' participation in online learning [66]. When learners think that online learning can strengthen their personal capacities or provide instrumental value, such as advancement prospects, they will intentionally promote successful learning behaviour which will result in continuing learning intention [67,68].

5.3. *Moderation Effect for Affective Support*

Our findings demonstrated that affective support influenced the link between PEOU and the continuing learning intention and perceived usefulness and the continuing learning intention in a significant and beneficial manner. Perceived ease of use and perceived usefulness of the learning platform encouraged lifelong learners to continue their online education when instructors exhibited more effective and encouraging behaviour. This study adds to

the findings of Malecki and Demaray, that affective support, as an affective social support model, incorporates a variety of characteristics including trust, love, and empathy [69]. When such affective support is perceived by learners, it can effectively help them overcome their fears and enhance the perception of ease of use [70], particularly positive affective support and emotional tone, which helps create a harmonious and supportive environment and enhances their deep perception of usefulness, thereby further stimulating positive behavioural responses from users and generating a good continuing intention to use the platform [71,72]. The findings may suggest that, for lifelong learners, online learning in the midst of ergonomic conflicts can be effective in using the fragmented time to enhance learning, but in this process the instructor and learner are in a quasi-permanent separation, which inevitably creates communicative 'barriers,' so the intervention of affective support will have a significant impact on learning outcomes [73], whereas the lack of interaction and feedback from instructors, i.e., the absence of affective support, remain obstacles in online learning. This shows that while educators, stakeholders, and designers focus on the functional design and instrumental support of the online platform itself, they should also consider the effect of affective support on the learning intention and learning outcomes of the learners [74].

It is common knowledge that today's online learning cohorts possess a specific "adaptive" skill for the mastery of information technology, including the operability of the learning platform [75]. However, there are also learners over the age of 40 who are still motivated to learn, referred to as "digital migrants" or "digital refugees." By integrating big data analysis technologies to gather learners' operating habits and cohorts' characteristics, an interface that corresponds to learners' behaviour patterns and online learning habits should be built in order to enhance the learning experience and learning satisfaction for the coming of the post COVID-19 era [76,77].

6. Conclusions

In this study, we investigated the association between perceived usefulness, perceived ease of use, learning satisfaction, and the continuing learning intention, as well as how affective support influenced the relationship between these constructs and key variables in our suggested theoretical framework based on David's TAM theory. The findings of the present study have revealed the existing mechanism of influence that we investigated based on the confirmed hypothesis: (1) significant positive associations were found between learners' perceived ease of use and perceived usefulness of online learning platforms, and learning satisfaction and the continuing learning intention, respectively. (2) Learning satisfaction was somewhat mediated between perceived ease of use and the continuing learning intention, and between perceived usefulness and the continuing learning intention, with the direct effect being greater than the indirect effect as a whole. (3) Moderate to high levels of affective support favourably modulate the link between perceived ease of use and the continuing learning intention, as well as between perceived usefulness and the continuing learning intention.

6.1. Limitations and Contributions

Obviously, the present study is not devoid of limitations. Cross-sectional research was undertaken, samples were not on a wide scale for the collection, and qualitative data were required to clarify more questions and information about lifelong learners in terms of learning satisfaction and the continuing learning intention via interviews or focus groups. The strict lockdown of pandemic crisis protocols prevented us from conducting face-to-face interviews on-site.

However, the research's strength is our contribution to the literature by extending the applicability of the theoretical model of TAM and ECM in the context of distance learning to investigate how the online lifelong learners' perceived usefulness and perceived ease of use affected their learning satisfaction and their continuing learning intention, with the moderation of the variable of affective support, which is considered a crucial

factor in learner support services. In terms of the sample population, previous studies have generally focused on full-time on-campus students, while relatively neglecting the continuing learning intention of lifelong learners who have both in-work commitments and continuing education needs. Our research has filled the gap with an exploration of the mechanism of affective support in regulating lifelong learners' continuing learning intention online, providing a new path to strengthen the willingness to learn, reduce the risk of drop-out and improve the user adhesiveness of the virtual learning environment.

6.2. Implications

We expect that the present research findings will showcase to educators, administrators, and practitioners more practical suggestions for enhancing the learning experience and learning platforms in terms of increased perceived usefulness and perceived ease of use for learning satisfaction and adult online learner retention.

First, it is proposed that consideration be given to the usability of VLE. The function of VLE must be continuously optimized to reflect the humanity and intelligence of the learning system. Focus, practicability, linkage, and networking of existing materials and repositories will, therefore, break down the barriers across disciplines, allowing learners to engage in fragmented learning and develop knowledge across various disciplines at their own pace.

Second, it is important to repeatedly upgrade VLE's hardware system configuration. Acquiring resources in real-time or downloading them offline may assure efficiency and effectiveness everywhere. In turn, learners can gain a satisfying and engaging platform experience and improve their continuing learning intention.

Third, the physical space between instructors and learners is cut off by the 'distance' of time and space, so there is a greater need to create a high-quality learning environment to compensate for the lack of emotional interaction and value generation between instructors and learners in pursuit of affective support's "empathy." When instructors provide active support for learners, their positive feedback will also invigorate instructors' enthusiasm for teaching. This reverse mechanism may then become another source for instructors to alleviate online teaching burnout and strengthen professional identity, resulting in the gradual development of affective empathy. This can also be applied to MOOCs.

Online learning is actually an invisible teaching and learning experience and emotional journey that assists learners in overcoming negative learning experiences such as isolation and lack of self-discipline, and enables instructors and learners to reach a consensus of ideas and experience a beautiful learning journey together.

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