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Examining the Effect of Online Learning Environments on Learning Behavioral Engagement: The Mediating Role of Academic Self-efficacy

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Abstract: *With the rapid development of information technology, online learning environments are becoming increasingly prevalent. Therefore, it is meaningful to study how online learning environments affect students' learning engagement. This study explored the effect of online learning environments on students' English learning behavioral engagement and investigated whether academic self-efficacy could mediate the relationship between online learning environments and students' English learning behavioral engagement in a sample of Chinese undergraduate students. Data were analyzed on the basis of a total of 390 second-year undergraduates of college English course in a comprehensive university in Eastern China who participated in the questionnaires concerning online learning environments, academic self-efficacy and learning behavioral engagement. The study found that: (1) online learning environments predicted learning behavioral engagement; (2) online learning environments predicted academic self-efficacy; (3) academic self-efficacy predicted learning behavioral engagement; and (4) academic self-efficacy mediated the relationship between online learning environments and learning behavioral engagement. This study indicated the significance of online learning environments in enhancing students' English learning behavioral engagement and highlighted the function of academic self-efficacy on mediating the relationship between online learning environments and students' English learning behavioral engagement, thereby informing educators of optimizing the design of online learning environments and strengthening students' academic self-efficacy.*

Keywords— online learning environments; academic self-efficacy; learning behavioral engagement; English language learning

1. INTRODUCTION

In today's digital age, online learning has become an important way of learning. As online learning environments are characterized by rich learning resources, flexible learning time and space, high interactivity and diversified learning modes, they can provide students with more flexible and convenient learning opportunities, breaking the limitations of time and space (Lai & Gu, 2011; Teo et al., 2010). However, online learning environments are very different from traditional classroom learning environments, and their impact on students' learning behavioral engagement has attracted much attention. Learning behavioral engagement refers to the degree of students' active participation and effort in the learning process, including cognitive, emotional and behavioral engagement (Nguyen et al., 2018). Understanding the impact of online learning environments on students' learning behavioral engagement is of great significance for improving the effectiveness and quality of online learning. An increasing number of scholars are arguing for the need to promote students' learning behavioral engagement under online learning environments. For instance, research found that students' interactions with teachers and peers were also regarded as a critical factor to increase students' learning behavioral engagement (Cooper, 2014; Davis & McPartland, 2012; Valeski & Stipek, 2001). Apart from the external factors, some previous studies have found that students with more academic self-efficacy intrinsically devoted more efforts and persistence when they engaged in learning activities (Hardre & Reeve, 2003; Suárez et al., 2019; Wigfield & Eccles, 2006). However, in spite of some research being

conducted from either external or internal perspectives, the exploration of the influence from both the external and internal factors on students' learning behavioral engagement is still scant. Thus, this study aimed to investigate how the external variable (online learning environments) influenced students' learning behavioral engagement, and examine whether students' academic self-efficacy would mediate the relationship between online learning environments and students' learning behavioral engagement.

2. LITERATURE REVIEW

2.1 Online Learning Environments

The online learning environment is a virtual space constructed on the basis of computer network technology to support learners' distance learning activities, which integrates learning resources, teaching tools, interactive platforms and learning management systems, creating a digital atmosphere of teacher-student and student-student communication and collaboration, into which learners can access at any time and at any place to carry out personalized learning processes according to their own needs (Pan, 2023; Velayutham & Aldridge, 2013). The components of online learning environments include: learning resources, learning platform, teacher support and learning community, which are mainly characterized by openness, interactivity, personalization and autonomy (Heo et al., 2021). As the carrier of online learning, the online learning environment is directly related to whether learners can acquire knowledge efficiently and pleasantly, and its quality has attracted much attention, and many scholars have conducted in-depth research from different perspectives. For instance, Lewin (1936) recognized that environment and interaction was powerful determinant of individuals' behavior. Similarly, Moos (1974) delineated three dimensions characterizing any human environment: personal relationships involving strengths of relationships, personal growth concerning the availability of opportunities for personal development, and system management. As such, Bećirović et al. (2022) held that students' cooperation played a significant role in the EFL context in the current learning environment because it was highly beneficial to learners' positive attitude and learning achievements. Students' interaction with peers and the teacher by using the technology tools in the online learning environment was considered as a weapon to solve the learning problems. Therefore, in the current study, online learning environments mainly refer to classroom cooperation, classroom interaction and resource acquisition, which constructs a synthetical learning context.

2.2 Academic Self-efficacy

Academic self-efficacy has become a hot topic in the field of educational psychology. It reflects students' beliefs about their ability to succeed in academic tasks, which profoundly affects their motivation, effort, persistence, and ultimate academic achievement, and an in-depth investigation of academic self-efficacy is of great significance in understanding students' learning behaviors and optimizing educational strategies.

Bandura (2001) systematically described self-efficacy as an individual's subjective judgement of whether he or she can successfully perform a particular behavior in a given situation. This theory laid the foundation for academic self-efficacy, emphasizing the critical role of individual cognitive appraisal in the initiation and maintenance of behavior. In academic contexts, students form their perceptions of their own learning abilities based on information such as past academic experiences, other people's evaluations, and physiological and psychological states, which in turn affects their choices, efforts, and perseverance when facing academic tasks.

The triadic reciprocal determinism theory (Bandura, 1965) highlighted the meaning of self-efficacy, stressing that individuals, behaviors and environments influence and determine each other. In the academic domain, students' own sense of academic efficacy influences their learning behaviors, such as active participation in class and active completion of homework after class; learning behaviors in turn affect academic performance, and good performance strengthens the sense of efficacy, thus forming a virtuous circle; at the same time, factors in the school environment not only shape the sense of academic efficacy of the students but also are affected by the feedback of students' learning performance, such as encouraging classroom atmosphere, which can help to enhance the sense of academic efficacy.

2.3 Learning Behavioral Engagement

Learning behavioral engagement is a concrete manifestation of students' externalization of psychological energy into learning practices, distinct from pure cognitive and affective engagement, and places more emphasis on the behavioral level of putting into practice, which is a direct impetus for knowledge acquisition and skill development. Existing literature measures learning behavioral engagement mainly in terms of time investment in learning, efforts in learning, participation in learning activities, and concentration in learning (Hamane, 2014; Nguyen et al., 2018). Factors that influence commitment to learning behavior are internal to the individual and external environmental factors. Among the internal factors, academic self-efficacy is one of the important determinants, as students' beliefs about their ability to succeed in learning tasks affect their behavioral choices. Students who believe that they have the capacity to learn are more confident in confronting challenges and actively engage in learning; on the contrary, students with low academic self-efficacy often avoid learning tasks for fear of failure, and their engagement behaviors are greatly reduced. For example, in English language learning, students with high academic self-efficacy are more likely to take the initiative to conduct independent learning, build up a language base through learning, and further enhance their self-confidence, thus forming a virtuous circle.

Numerous researchers expanded and supplemented the concept of learning behavioral engagement by putting forward categories and measuring indexes about it. Thus, learning behavioral engagement can be concluded into six categories based on these findings, respectively, participation, interaction, persistence, concentration, academic challenge, and self-directed learning. Participation which was the basic factor in learners' learning behavioral engagement mainly refers to the effort and time learners devoted, reflecting whether learners agreed with the school rules and teachers' requirements (Fredricks et al., 2004; Miles & Stipek, 2006; Schaufeli et al., 2002). In addition to the definition and categories of learning behavioral engagement, previous research found that the degree of learners' behavioral engagement was deeply influenced by external factors (Murray, 2009) as well as internal factors such as inner interest in certain subject (Rose-Krasnor, 2010).

2.4 Current Study

Informed by recent new visions in the study of students' learning behavioral engagement above, two research questions were specified below.

(1) What are the relationships among online learning environments, academic self-efficacy, and students' English learning behavioral engagement?

(2) Will academic self-efficacy mediate the relationships between online learning environments and students' English learning behavioral engagement?

In line with these two research questions, this research put forward 4 hypotheses.

H1: Online learning environments directly predict learning behavioral engagement.

H2: Online learning environments directly predict academic self-efficacy.

H3: Academic self-efficacy directly predicts learning behavioral engagement.

H4: Academic self-efficacy mediates the relationship between online learning environments and learning behavioral engagement.

The following research hypothesis models (see **Figure 1**) was constructed to correspond to the above two research questions and 4 hypotheses.

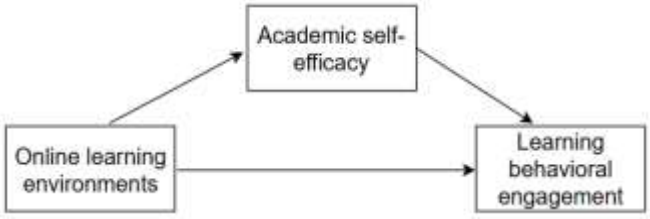

Figure 1. The research hypothesis model.

3. METHODOLOGY

3.1 Participants and Procedure

Currently, in Chinese universities, the advanced network technology has been applied in college English teaching and learning in accordance with the innovation of college English course. Thus, in college English course, online platform constitutes an important avenue for students' online language learning.

In this study, participants were second-year undergraduates from a comprehensive university in Eastern China. All the participants voluntarily and anonymously completed the face-to-face questionnaire survey within ten minutes on the spot at the class interval of college English course and were informed of the purpose of this study and their rights to withdraw from the study at any time during or after the completion of the questionnaire. A total of 390 valid questionnaires were retained after discarding 12 incomplete questionnaires. Among the 390 questionnaires, there were 132 (33.8%) male participants while 258 (66.2%) female ones.

3.2 Instruments

The research instruments involved three questionnaire scales measuring different variables, i.e., online learning environments, academic self-efficacy, and learning behavioral engagement. Each questionnaire item was measured on a 6-point Likert Scale, ranging from 1 (strongly disagree) to 6 (strongly agree). Higher scores indicated students' higher perceptions of online learning environments, academic self-efficacy and learning behavioral engagement.

Online Learning Environments Based on the previous research (Liaw, 2008; Liaw & Huang, 2013; Vighnarajah et al., 2009), online learning environments questionnaire was developed into three subscales with a total of 12 items: classroom interaction (4 items), classroom cooperation (4 items), and resources acquisition (4 items). The total Cronbach alpha value was 0.946, and Kaiser-Meyer-Olkin (KMO) value for validity was 0.932, indicating a good reliability.

Academic Self-efficacy In this study, academic self-efficacy questionnaire was adapted from the research of Won et al. (2023) and Jinks and Morgan (1999) Children's Perceived Academic Self-Efficacy Scale. This scale consisted of 9 items. The Cronbach alpha value was 0.916, and Kaiser-Meyer-Olkin (KMO) value was 0.883, demonstrating good reliability.

Learning Behavioral Engagement In this study, learning behavioral engagement questionnaire was developed from previous studies (Dixson, 2015; Fredricks et al., 2004; Skinner et al., 2008; Hamane, 2014). The questionnaire including 10 items, involving students' self-directed language learning engagement (5 items) and students' cooperative language learning engagement (5 items). The total Cronbach alpha value was 0.953, and the Kaiser-Meyer-Olkin (KMO) value was 0.947, which suggested that the questionnaire had good reliability.

3.3 Data Analysis

In this study, the test of the reliability and validity of the questionnaire and the analysis of the descriptive statistics and correlations among each variable were conducted by using SPSS 21.0. The establishment of the structural equation modeling (SEM) and the path analysis adopted AMOS 21.0.

4. RESULTS

4.1 Descriptive Statistics and Correlations

Table 1 presented the descriptive statistics of the main study variables. The mean values of the three variables varied from 4.385 to 4.416, indicating participants' positive response to the questionnaire. The standard deviations varied from 0.943 to 1.104, indicating an acceptable spread of participants' responses.

Table 1. Descriptive statistics (N=390).

Variables	Minimum	Maximum	Mean	SD
OLE	1	6	4.416	0.943
AS	1	6	4.385	1.104
LBE	1	6	4.387	0.986

Note: OLE=Online learning environments; AS=Academic self-efficacy; LBE=Learning behavioral engagement.

Pearson correlation matrices for the relations between variables were displayed in **Table 2**, indicating that there were noticeable correlations among the variables. The values in diagonal in parentheses were square root of average variance extracted from observed variables, which were greater than correlations between variables.

Table 2. Correlations between variables.

Variables	OLE	AS	LBE
OLE	(0.804)		
AS	0.662	(0.847)	
LBE	0.725	0.697	(0.841)

*Note: **p<0.01. Diagonal in parentheses: square root of average variance extracted from observed variables (items); and off-diagonal: correlations between variables.*

4.2 Test of Measurement Model

The fitness of the measurement model was examined via confirmatory factor analysis (CFA). The convergent validity was established by testing standardized factor loading of each item, average variance extracted (AVE), t-value (C.R. > 2) and S.E. value (>0) of parameter estimation while the discriminant validity was assessed by examining the square root of AVE for each construct. In terms of the convergent validity, the standardized factor loading of each item should exceed 0.7, average variance extracted (AVE) by each construct exceeding 0.5 (Teo & van Schaik, 2012). Besides, according to Teo (2011), the presence of discriminant validity was suggested when a construct was more strongly associated with its indicators than with the other constructs on the condition that the square root of the average variance extracted (AVE) was greater than the off-diagonal elements in the corresponding rows and columns. According to these criteria, **Table 2** and **Table 3** indicated the good convergent and discriminant validity of the measurement model.

Table 3. The test results of the measurement model.

Variables	Items	SFL	CR (>0.7)	AVE (>0.5)	Cronbach's alpha
OLE	OLE1	0.890	0.956	0.647	0.946
	OLE2	0.850			
	OLE3	0.849			
	OLE4	0.823			
	OLE5	0.782			
	OLE6	0.762			
	OLE7	0.741			
	OLE8	0.715			
	OLE9	0.729			
	OLE10	0.880			
	OLE11	0.810			
	OLE12	0.797			
AS	AS1	0.916	0.958	0.717	0.916
	AS2	0.902			
	AS3	0.865			
	AS4	0.817			
	AS5	0.801			

	AS6	0.901			
	AS7	0.852			
	AS8	0.805			
	AS9	0.749			
	LBE1	0.882			
	LBE2	0.869			
	LBE3	0.862			
	LBE4	0.852			
LBE	LBE5	0.848	0.960	0.708	0.953
	LBE6	0.838			
	LBE7	0.828			
	LBE8	0.827			
	LBE9	0.807			
	LBE10	0.796			

4.3 Test of the Hypothesized Model

A few values, i.e., comparative fit index (CFI), the Tucker-Lewis index (TLI), the root mean square error of approximation (RMSEA), and the standardized root mean the standardized root mean square residual (SRMR) were employed to test the model fitness. The final structural model (see **Figure 2**) achieved a good fit (X2/df=2.776<3, TLI=0.941>0.9, CFI=0.948>0.9, RMSEA=0.069<0.08, SRMR=0.067).

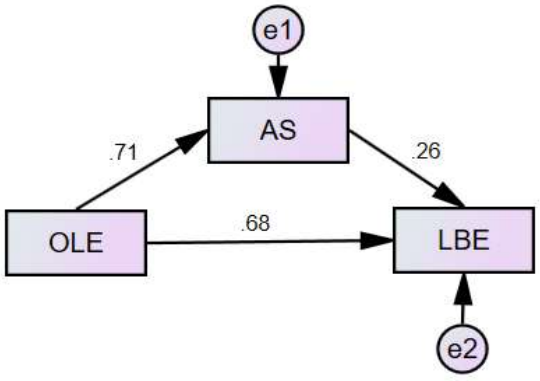

Figure 2. The final structural model.

4.4 Path Analysis Testing the Hypothesized Model

Path analysis was employed to explore the relationship between online learning environments and learning behavioral engagement, thus clarifying whether online learning environments could influence the facilitation of learning behavioral engagement. It can be seen in **Table 4**, online learning environments strongly predicted learning behavioral engagement (β=0.678, P<0.001), supporting hypothesis 1; online learning environments strongly predicted academic self-efficacy (β=0.714, P<0.001), supporting hypothesis 2; and academic self-efficacy predicted learning behavioral engagement (β=0.261, P<0.001), supporting hypothesis 3.

Table 4. The path analysis.

Path	Estimate	S.E.	C.R	*P*	Results
OLE→ LBE	0.678	0.037	17.407	***	supported
AS→L BE	0.261	0.035	7.526	***	supported
OLE→ AS	0.714	0.041	18.146	***	supported

**** P<0.001*

4.5 The Assessment of Mediating Path

The mediating effect of academic self-efficacy was tested using bootstrapping approach. **Table 5** presented summary of the assessment of mediating path of academic self-efficacy. As can be seen, OLE→AS→LBE had mediating effect, with a medium mediating effect (β=0.178, P<0.001). 95% confidence interval did not include 0, thereby verifying the mediating effect of academic self-efficacy. Hypothesis 4 was supported.

Table 5. Results of the mediational analysis.

From	β	Medi-ator	β	To	Indirect effect	95% CI
OLE	0.71 4	AS	0.26 1	LBE	0.178 ***	[0.118, 0.247]

**** P<0.001*

5. DISCUSSION

While students' learning behavioral engagement is regarded as a significant component in students' learning English and has been the focus of numerous research in recent years, little has been reported about how external factors and

internal factors acting on it. This study gained sights into the influencing mechanism of online learning environments and academic self-efficacy on learning behavioral engagement, and attempted to find the associations between them and explore some good ways to promote students' learning behavioral engagement.

5.1 The Relationships among Online Learning Environments, Academic Self-efficacy and Learning Behavioral Engagement

This study found that online learning environments strongly predicted learning behavioral engagement, demonstrating that students' high recognition and approval of online learning environments practically promoted students' participation and efforts to learn language (Hao et al., 2017), thus providing some evidence of the significance of establish constructive learning contexts. An engaging and interactive online learning environment can foster learning behavioral engagement. Features such as gamification elements (e.g., awarding points for participation), live-streaming lectures with real-time sessions, and collaborative project spaces can encourage students to participate more actively.

The result of the direct influence of academic self-efficacy to students' learning behavioral engagement was in accordance with the research which displayed that academic self-efficacy would consciously or unconsciously influence learners' autonomous learning behavior inside and outside the classroom (Lamb, 2008; Lai, 2015). High academic self-efficacy often leads to greater learning behavioral engagement. Students who believe in their abilities are more likely to take risks and actively participate in learning. For example, a student with high academic self-efficacy in English writing might volunteer to share their work in a peer-review session, seeking feedback to improve further.

In addition, the finding that online learning environments could positively influence students' academic self-efficacy was in line with the research that online learning environments were related to various aspects of students' learning behavioral engagement like higher participation in learning cooperative tasks (Battistich et al., 1997; Fredricks et al., 2004). A well-designed online learning environment can boost academic self-efficacy. For instance, if an online course provides immediate feedback on assignments, students can better understand their strengths and weaknesses. This timely feedback can increase their confidence in their academic capacities.

5.2 The Mediating Role of Academic Self-efficacy in the Relationship between Online Learning Environments and Learning Behavioral Engagement

The online learning environment can influence academic self-efficacy. For example, an online learning environment that provides ample support resources and clear instructions may boost students' confidence in their ability to learn (Heo et al., 2021; Pan, 2023). In turn, this enhanced self-efficacy can lead to increased learning behavioral engagement. In the context of online education, it is of paramount importance to comprehensively understand the mediating function of academic self-efficacy within the relationship between online learning environments and learning behavioral engagement. Through the emphasis on augmenting students' academic self-efficacy by means of efficacious instructional design and support services, educators are enabled to foster enhanced learning behavioral engagement and, in the long run, achieve more favorable learning outcomes in online learning settings. Educators possess the capacity to architect online learning environments in a manner that bolsters students' academic self-efficacy. This may entail the provision of lucid learning objectives, sequential instructions, as well as avenues for students to engage in practice and obtain feedback. For instance, the instructor could dissect a convoluted online assignment into more diminutive and tractable subtasks and dispense formative feedback throughout the process.

5.3 Implications and Limitations

This research demonstrated that a favorable online learning environment serves to augment academic self-efficacy and bolster engagement in learning behavior, thereby drawing the attention of educators to the necessity of optimizing the design of online learning settings. Academic self-efficacy pertains to students' belief in their capacity to accomplish academic tasks and exerts a crucial influence on academic achievement and motivation. The findings of this study indicated that academic self-efficacy functions as a mediating factor between online learning environments and learning behavioral engagement. Consequently, instructors can implement targeted strategies to reinforce students' academic self-efficacy. For instance, educators can devise online learning tasks with an appropriate level of challenge, enabling students to experience a sense of accomplishment during task completion and subsequently enhancing their confidence in their own learning capabilities.

Despite this study added to knowledge concerning students' learning behavioral engagement and adopted rigorous testing procedure, some limitations existed. First of all, the results of this study were grounded on a relatively small sample, which may not represent all students in Chinese higher education. The future study may entail involving a larger sample to include more students from different universities or majors. Secondly, the simplex cross-sectional design being applied in this study may result in a common method bias. Hence, it is suggested that future study adopt multi-layered, multidimensional methods (e.g., the combination of cross-sectional design with longitudinal research) to enhance our understanding of the causality as far as possible.

6. CONCLUSION

The present study was purposefully constructed to meticulously investigate the impacts of online learning environments upon students' learning behavioral engagement and to scrutinize whether academic self-efficacy serves as a mediator in this relationship. The interconnections among online learning environments, academic self-efficacy, and learning behavioral engagement are intricate and interwoven.

A favorable online learning environment has the capacity to augment academic self-efficacy and stimulate learning behavioral engagement. Concurrently, elevated academic self-efficacy can precipitate enhanced engagement, and an engaged student is more prone to possess a positive appraisal of the online learning environment. Comprehending these associations is of paramount importance for educators aiming to optimize online learning experiences and foster student academic accomplishments.

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