




Article

Sustainable Development of University EFL Learners' Engagement, Satisfaction, and Self-Efficacy in Online Learning Environments: Chinese Experiences

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Abstract: This study investigated the sustainable development of university EFL learners regarding their engagement, satisfaction, and self-efficacy in online learning environments during the outbreak of COVID-19. In a questionnaire survey with a sample of 428 Chinese undergraduate EFL learners, the students reported a favorable view of online learning environments and subjective learning outcomes. Behavioral engagement was positively related to involvement. Emotional engagement was positively related to student cohesiveness and negatively related to teacher support. Satisfaction was not related to any of the learning environment factors. Self-efficacy mediated the effect of student cohesiveness and student involvement on behavioral engagement, emotional engagement, and satisfaction. These results of the study have implications for creating a sustainable online learning environment and promoting EFL learners' sustainable development.

Keywords: English as a foreign language; sustainable learning; online learning



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1. Introduction

The COVID-19 outbreak has caused a transformation of learning environments from conventional face-to-face instruction into forced online learning [1–3], which has greatly challenged the teaching and learning practices in higher education [4]. In the field of English-as-a-Foreign-Language (EFL) learning, which requires learners' active participation and interaction [5], although EFL learners were provided with more flexible access to learning resources and self-paced learning opportunities in online learning environments, they were found to have fewer opportunities to contact their teachers and interact in the target language than they did in conventional face-to-face instruction, leading to problematic language learning performance [6].

Online learning has become the new normal [7], especially with the popularity of eLearning 4.0, which aims at making full use of modern technologies [8]. As a result, the sustainable development of university students who generally report an authoritative view of internet use in their study (usually referred to as Generation Z) [8], particularly in online learning environments, has attracted increasing attention [1,8]. Considering the various challenges that online learning has presented to language learners, sustainable and effective online language learning requires language teachers to promote a favorable language learning environment that is interactive, supportive, and attractive in order to motivate and engage language learners [1,9,10].

Learning environments have been regarded as a significant determinant of students' learning outcomes. Research has explored the relationships between learning environments, such as traditional face-to-face learning environments [11] and blended learning environments [12], and students' affective and behavioral outcomes. Recently, the exploration of the relationships between online learning environments and university students' subjective learning outcomes (e.g., perceived engagement, satisfaction, and motivation) has drawn

increasing attention from researchers, particularly since the COVID-19 outbreak [13,14]. University students' perceived online learning environments were identified as a predictor of their self-efficacy (an often-researched indicator of student motivation), learning engagement, and satisfaction, which were found to be key indicators of online learning quality [15,16]. These studies have highlighted the significance of sustainable online learning environments. However, as existing studies have been mainly conducted in non-English-language learning contexts [17], such as mathematics [18] and science [19], more evidence is expected from EFL learners' perspective. In addition, previous studies have shown the significant mediating role of self-efficacy between learning environments and learning outcomes, whereas few studies have tested its mediating role in online learning environments. Therefore, this study aims to explore the relationships between Chinese university EFL learners' perceived online learning environments and their learning outcomes, stressing the mediating role of self-efficacy to promote their sustainable development.

2. Literature

2.1. Students' Perceived Online Learning Environments

'Learning environment' refers to the psychological conditions or climate of the classroom [20], and it is a significant determinant of students' affective and behavioral outcomes in higher education [21]. Recently, with the increased attention paid to online learning environments, students' perceptions regarding the role of teachers and students have changed dramatically [22], leading to an unexplored research area that may impact students' online learning outcomes [5].

Research has generally demonstrated that students' perceived online learning environments are related to their academic performance [6], the quality of online learning [16], and satisfaction [15]. Empirical studies have indicated that students involved in online learning received less prompt feedback from their instructors than those in traditional face-to-face learning environments [13,23]. Such students were also found to be less engaged in collaborative learning, participation in group discussions, and interactions with peers [23]. These challenges may affect language learners' learning outcomes, as language learning requires learners' active interaction and involvement [5].

Among the numerous instruments that examine learning environments, the Technology-Rich Outcomes-Focused Learning Environment Inventory (TROFLEI) was specifically developed to evaluate students' perceived online learning environments [24]. This scale has demonstrated good psychometric features in empirical studies conducted in several contexts [18,25]. Of the constructs of the TROFLEI, student cohesiveness, teacher support, and student involvement were agreed to be key factors in shaping students' affective and behavioral outcomes [18,26]. Student cohesiveness indicates the extent to which students relate to the group as a unit and are supportive of one another [25]. Teacher support concerns to what extent students perceive instructors' help, trust, and interest in them [24]. Student involvement concerns students' participation, interest, and enjoyment in class [20]. In this study, these three factors were used as indicators to assess Chinese EFL learners' perceptions of their online learning environments.

2.2. Student Engagement and Satisfaction and Their Relationships with the Learning Environment

Student engagement and satisfaction are key factors in evaluating the effectiveness of online learning [16]. Student engagement focuses on the active participation of students by investing time and energy during their learning process [5,27]. Student engagement concerns two dimensions: behavioral and emotional engagement [27]. The former focuses on students' effort, attention, and persistence in the learning process, and the latter concerns students' enthusiasm, interest, and enjoyment in the learning process [27]. Many studies have demonstrated that student engagement keeps students connected to their learning [5,28] and acts as an observable indicator of the online learning quality [29].

Student satisfaction reflects the outcome of students' learning practice [15], and it is a significant indicator of the quality and effectiveness of online learning [30]. Learning

environment factors, such as faculty performance and peer relationships, have been demonstrated to influence student satisfaction [16]. Studies revealed that student motivation [13], perceived support [31], and interaction among students [15] were significant determinants of their online learning satisfaction. Therefore, the significance of evaluating EFL learners' perceptions of their overall learning practice should be highlighted to improve the online learning quality and promote the sustainable development of EFL learners [16].

The student-perceived learning environment was found to be predictive of student engagement and satisfaction [4,26]. In traditional learning environments, student cohesiveness, teacher support, and student involvement were found to be related to student engagement and satisfaction [32,33]. Recently, an increasing amount of research has been conducted to look into the relationships between online learning environments and student engagement and satisfaction [14,15]. The results have shown that student-perceived support, such as timely and meaningful instructor feedback and peer facilitation, was positively related to students' online learning engagement and satisfaction [5,34]. However, existing studies have mainly focused on primary and secondary mathematics and science classes [18,19]. Although English language learning environments in higher education have received researchers' attention [5,12], they remain underexplored.

2.3. Self-Efficacy as a Mediator

Self-efficacy, one of the most influential motivational theories [35], is defined as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" [36] (p. 3). In educational settings, self-efficacy is commonly described in terms of "academic self-efficacy" [37] (p. 3), indicating students' judgments about their capabilities to perform learning tasks [35], and it is usually considered to be an essential psychological construct in students' learning process [11]. In online learning environments, student self-efficacy is perceived as students' general expectations and confidence during their online learning process [38].

The past two decades have witnessed a considerable amount of research indicating that self-efficacy is both a significant outcome influenced by the learning context and an essential determinant influencing students' academic success [11,31]. Empirical studies have recognized several environment factors shaping students' self-efficacy, such as student cohesiveness, teacher support, and student involvement [11,26]. Meanwhile, self-efficacy has also proven to be significant in explaining students' learning performance and outcomes, such as engagement and satisfaction [15,29]. Specifically, students with higher self-efficacy were found to be more engaged in and more satisfied with their learning [26].

Considering its relationship with learning environment factors and learning outcomes, self-efficacy has been consistently identified as a significant mediator between learning environment and learning outcomes [31,32]. Research indicated that students' perceived environment factors, such as teacher support [32] and student involvement [20], were indirectly related to their learning outcomes through the mediation effect of self-efficacy. However, the mediation effect of self-efficacy, especially in online learning environments, has rarely been tested.

3. Research Model and Hypotheses

Based on the literature, a hypothesized research model (see Figure 1) was proposed to illustrate the relationships between Chinese EFL learners' perceived online learning environments and their affective and behavioral outcomes. The following hypotheses were proposed:

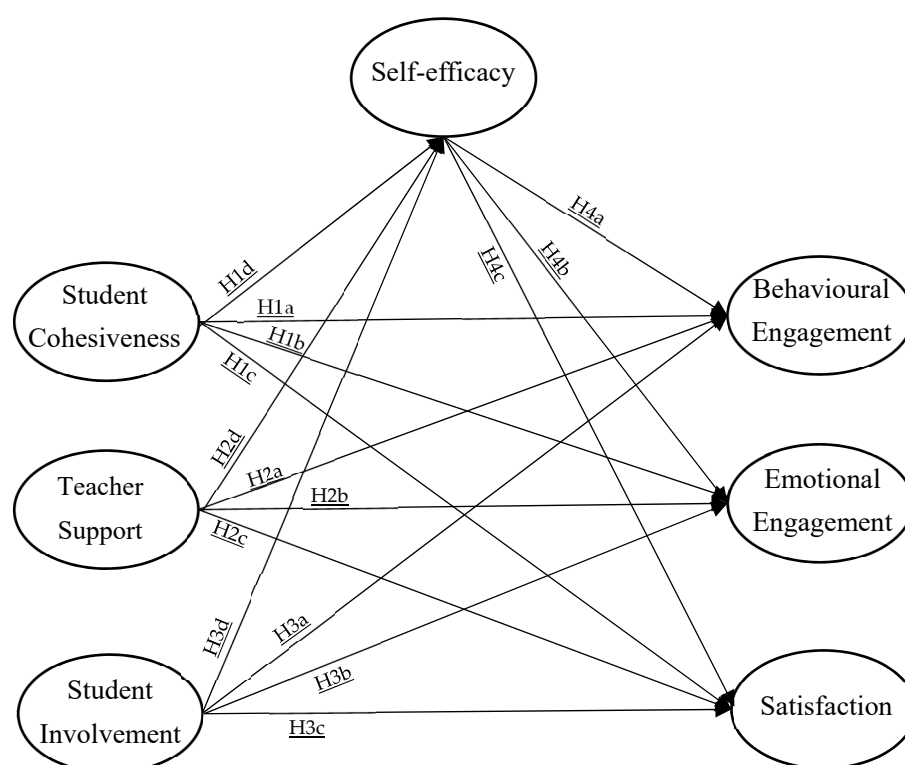


Figure 1. The hypothesized research model.

Hypothesis 1a (H1a). *Student cohesiveness is positively related to behavioral engagement.*

Hypothesis 1b (H1b). *Student cohesiveness is positively related to emotional engagement.*

Hypothesis 1c (H1c). *Student cohesiveness is positively related to satisfaction.*

Hypothesis 1d (H1d). *Student cohesiveness is positively related to self-efficacy.*

Hypothesis 2a (H2a). *Teacher support is positively related to behavioral engagement.*

Hypothesis 2b (H2b). *Teacher support is positively related to emotional engagement.*

Hypothesis 2c (H2c). *Teacher support is positively related to satisfaction.*

Hypothesis 2d (H2d). *Teacher support is positively related to self-efficacy.*

Hypothesis 3a (H3a). *Student involvement is positively related to behavioral engagement.*

Hypothesis 3b (H3b). *Student involvement is positively related to emotional engagement.*

Hypothesis 3c (H3c). *Student involvement is positively related to satisfaction.*

Hypothesis 3d (H3d). *Student involvement is positively related to self-efficacy.*

Hypothesis 4a (H4a). *Self-efficacy is positively related to behavioral engagement.*

Hypothesis 4b (H4b). *Self-efficacy is positively related to emotional engagement.*

Hypothesis 4c (H4c). *Self-efficacy is positively related to satisfaction.*

Hypothesis 5a (H5a). *Self-efficacy significantly mediates the relationship between student cohesiveness and behavioral engagement.*

Hypothesis 5b (H5b). *Self-efficacy significantly mediates the relationship between student cohesiveness and emotional engagement.*

Hypothesis 5c (H5c). *Self-efficacy significantly mediates the relationship between student cohesiveness and satisfaction.*

Hypothesis 6a (H6a). *Self-efficacy significantly mediates the relationship between teacher support and behavioral engagement.*

Hypothesis 6b (H6b). *Self-efficacy significantly mediates the relationship between teacher support and emotional engagement.*

Hypothesis 6c (H6c). *Self-efficacy significantly mediates the relationship between teacher support and satisfaction.*

Hypothesis 7a (H7a). *Self-efficacy significantly mediates the relationship between student involvement and behavioral engagement.*

Hypothesis 7b (H7b). *Self-efficacy significantly mediates the relationship between student involvement and emotional engagement.*

Hypothesis 7c (H7c). *Self-efficacy significantly mediates the relationship between student involvement and satisfaction.*

4. Method

4.1. Participants

This study was reviewed and approved by Shandong University with written informed consent from all participants. An anonymous questionnaire survey was conducted online in June 2020. The study sample consisted of a total of 428 English majors at a comprehensive, research-oriented university directly under the Ministry of Education in East China. The students were asked to voluntarily evaluate their stay-at-home online learning. The sample consisted of 77 (18%) freshmen, 196 (45.8%) sophomores, 143 (33.4%) juniors, and 12 (2.8%) seniors. The female sub-sample constituted 84.1% of the full sample.

4.2. Instruments

The questionnaire was composed of four sets of scales to measure EFL learners' perceptions of online learning environments, student engagement, satisfaction, and self-efficacy (see Appendix A). All of the items were scored on a 5-point Likert scale (1 = totally disagree, 5 = totally agree).

The online learning environment was measured with 24 items in three sub-scales selected from the TROFLEI [24]. The three sub-scales were student cohesiveness (eight items), teacher support (eight items), and student involvement (eight items).

The students' online learning engagement was measured using 10 items selected from Skinner et al.'s [27] Engagement Versus Disaffection with Learning Scale. These items reflected the students' participation in the classroom and were used to assess their behavioral and emotional engagement in online learning activities.

The measurement of the students' online learning satisfaction was adapted from the five-item course satisfaction scale [34].

Five items reflecting students' general efficacy were selected from the web-based learning self-efficacy instrument [38].

4.3. Data Analyses

SPSS 22 was used to manage the data. First, the construct validity and reliability of the four scales and their inter-correlations were examined. Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were performed to examine the factor structure. Pearson's correlations were calculated between all of the factors. Second, a full structural equation model (SEM) was constructed using Amos 24 to explore the relationships among the variables. Bootstrapping was adopted to test the mediation effect of self-efficacy. The following suggested guidelines were used to interpret the effect size: small = 0.10–0.20, medium = 0.20–0.30, and large = ≥ 0.30 [39].

5. Results

5.1. Validity and Reliability

The factor analysis of the 24 items measuring the online learning environment was first conducted using EFA with the maximum likelihood method and direct oblimin rotation. The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy (KMO = 0.971) and the Bartlett's test of sphericity ($\chi^2(253) = 11,094.93$, $p < 0.001$) verified the appropriateness of the factor analysis, and all items had a factor loading higher than 0.40 on their own scales. Item 9 was removed from further analysis because it failed to verify the hypothesis. The construct validity of the remaining 23 items was then examined using CFA. The fit indices were acceptable ($\chi^2 = 1036.08$, $df = 226$, $p < 0.001$, CFI = 0.93, TLI = 0.92, RMSEA = 0.072) with factor loadings ranging from 0.77 to 0.90.

The construct validity of the other three scales was tested using CFA. After removing one item with a low factor loading from the engagement scale and one from the satisfaction scale, the model fit indices of the engagement scale ($\chi^2 = 242.62$, $df = 25$, $p < 0.001$, CFI = 0.95, TLI = 0.93, RMSEA = 0.073), the satisfaction scale ($\chi^2 = 3.32$, $df = 2$, $p < 0.001$, CFI = 0.99, TLI = 0.99, RMSEA = 0.039), and the self-efficacy scale ($\chi^2 = 10.20$, $df = 5$, $p < 0.001$, CFI = 0.99, TLI = 0.99, RMSEA = 0.049) were all acceptable. Factor loadings of the three scales ranged from 0.79 to 0.93 (engagement), 0.66 to 0.92 (satisfaction), and 0.82 to 0.95 (self-efficacy). The Cronbach's α coefficients for all measures were acceptable (see Table 1)

Table 1. Descriptive statistics, correlations, and reliability ($N = 428$).

	1	2	3	4	5	6	7
1. Student Cohesiveness	0.95						
2. Teacher Support	0.84 **	0.96					
3. Student Involvement	0.85 **	0.93 **	0.95				
4. Behavioral Engagement	0.77 **	0.78 **	0.82 **	0.93			
5. Emotional Engagement	0.71 **	0.67 **	0.73 **	0.89 **	0.95		
6. Satisfaction	0.58 **	0.53 **	0.57 **	0.70 **	0.85 **	0.90	
7. Self-efficacy	0.79 **	0.80 **	0.84 **	0.84 **	0.83 **	0.71 **	0.95
Mean	3.91	4.02	4.01	3.89	3.76	3.50	3.87
Standard Deviation	0.67	0.63	0.62	0.68	0.83	0.88	0.73

Note: ** $p < 0.01$. The Cronbach's α coefficients are in bold on diagonals.

5.2. Descriptive Statistics and Correlations

Table 1 displays the descriptive results and correlations. The mean scores of the seven variables were higher than the median value (3), indicating a relatively higher level of evaluation, among which teacher support and student involvement won the highest evaluation. Table 1 also shows the Pearson's correlations between the factors of learning environment, engagement, satisfaction, and self-efficacy. Large ($r > 0.50$) and positive correlations were found between all factors.

5.3. Structural Model

The relationships between EFL learners' perceived online learning environment, engagement, satisfaction, and self-efficacy were examined using an SEM framework. The

independent variables were student cohesiveness, teacher support, and student involvement. The dependent variables were engagement and satisfaction. Students' self-efficacy was treated as a mediating variable between the learning environment factors and engagement and satisfaction. The SEM results indicate that the model fits the data well ($\chi^2 = 2647.56$, $df = 756$, $p < 0.001$, CFI = 0.91, TLI = 0.90, RMSEA = 0.077). As is shown in Figure 2, student cohesiveness was positively related to emotional engagement with a small effect size ($\beta = 0.14$, $p < 0.05$), thus H1b was accepted; teacher support was negatively related to emotional engagement with a medium effect size ($\beta = 0.23$, $p < 0.05$), thus H2b was rejected; and student involvement was positively related to behavioral engagement with a large effect size ($\beta = 0.31$, $p < 0.01$), thus H3a was accepted. Meanwhile, student cohesiveness and involvement showed positive relations to self-efficacy with medium and large effect sizes, thus H1d and H3d were accepted. Self-efficacy was positively related to behavioral engagement ($\beta = 0.46$, $p < 0.001$), emotional engagement ($\beta = 0.72$, $p < 0.001$), and satisfaction ($\beta = 0.76$, $p < 0.001$) with strong associations, supporting H4.

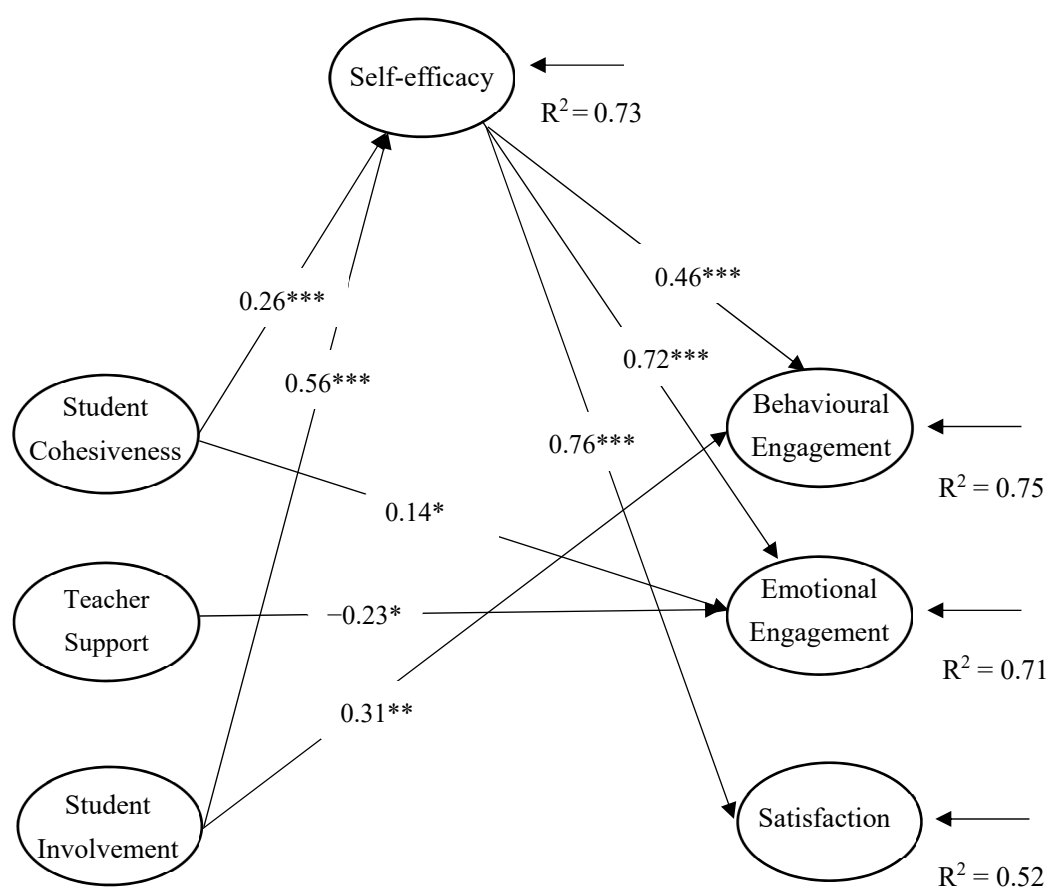


Figure 2. The SEM results ($N = 428$). Note: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$; Goodness-of-fit indices: $\chi^2 = 2647.56$, $df = 756$, $p < 0.001$, CFI = 0.91, TLI = 0.90, RMSEA = 0.077; Non-statistically significant paths ($p \geq 0.05$) are not reported.

5.4. Mediation Analyses

To test the mediation effects of self-efficacy, the bootstrapping technique based on 5000 samples was used, and the results are summarized in Table 2. According to Hayes [40], the indirect effect is significant if the 95% confidence intervals do not include zero. According to the results, self-efficacy significantly mediated the effects of student cohesiveness and involvement on behavioral engagement, emotional engagement, and satisfaction, supporting H5a, H5b, H5c, H7a, H7b, and H7c. Specifically, self-efficacy mediated the effects of student cohesiveness on behavioral and emotional engagement with a small effect size ($< |0.20|$), and on satisfaction with a medium effect size. Self-efficacy mediated the

effects of student involvement on behavioral engagement with a medium effect size, and on emotional engagement and satisfaction with a large effect size.

Table 2. The estimates of direct effects and indirect effects of the 95% confidence intervals.

Dependent Variable	Independent Variable	Direct Effect	Indirect Effect	95% CIs		R ²
				Lower 2.5%	Upper 2.5%	
Behavioral Engagement	Student Cohesiveness	0.12	0.12 *	0.04	0.23	0.75
	Teacher Support	0.02	0.03	−0.07	0.16	
	Student Involvement	0.31	0.26 *	0.13	0.42	
Emotional Engagement	Student Cohesiveness	0.14	0.19 *	0.07	0.31	0.71
	Teacher Support	−0.23	0.05	−0.11	0.24	
	Student Involvement	0.22	0.41 *	0.22	0.61	
Satisfaction	Student Cohesiveness	0.17	0.20 *	0.08	0.33	0.52
	Teacher Support	−0.16	0.05	−0.12	0.25	
	Student Involvement	−0.07	0.43 *	0.22	0.66	

Note: * items in bold showing a significant mediation effect.

6. Discussion

This study adds literature to EFL learners' sustainable development research by revealing some characteristics of Chinese university EFL learners' perceived online learning environments and verifying the relationships between online learning environments and learning outcomes. In addition to highlighting the significance of university EFL learners' perceptions of online learning environments, the findings of this study also contribute to our knowledge of the sustainable online learning development of other language learners in the course of eLearning 4.0.

6.1. Characteristics of EFL Learners' Perceived Learning Environments, Satisfaction, Engagement, and Self-Efficacy

The mean scores of the learning environment factors, ranging from 3.91 to 4.02, indicate that the Chinese EFL learners appreciated their online learning environments during the COVID-19 outbreak. Specifically, the students appreciated teachers' academic support for their online learning experience, and they had favorable views about being involved in group work and the whole online learning process. However, it should be noted that of the three online learning environment factors, the mean scores of teacher support and student involvement were higher than that of student cohesiveness, indicating that the Chinese EFL learners enjoyed their online learning participation and perceived more support from their teachers than from their peers. These results are in line with the findings in a recent study by Luan et al. [5] with Chinese EFL learners but are inconsistent with the findings of Bi's [21] study, which revealed lower levels of teacher support and student involvement than student cohesiveness in face-to-face instruction. This discrepancy indicated that the Chinese EFL learners were more involved and felt more support from their teachers in the online learning environment. Unlike traditional face-to-face instruction, online learning modalities separate students through physical distance, whereas teachers who are available to provide instructional support and technological support ensure that students feel connected [1]. Meanwhile, students were found to be highly involved in online learning environments [22] where they were provided opportunities to self-record a course and repeatedly access lesson recordings wherever available [10,41].

The Chinese EFL learners also reported high levels of engagement, satisfaction, and self-efficacy, indicating that they appreciated their online learning outcomes during the pandemic. The students agreed that they had a strong inner drive in and positive attitudes towards their online learning, and they actively participated in and were highly engaged in online learning. This result is consistent with the findings of a recent study

by Wang et al. [12], in which Chinese EFL learners found the online learning environment to be effective in motivating them to learn and were satisfied with and engaged in the online learning process. Although previous studies have reported many challenges faced by online learners, such as the lack of effective counseling from teachers and reduced post-class face-to-face group discussion with friends as well as adaptability with online learning environments [23,31], our findings show that those challenges may not significantly discourage Chinese EFL learners' online learning outcomes. A possible explanation may be related to the fact that online learning environments encourage student-centeredness [42], providing students with opportunities to control their own learning and develop learner autonomy [16]. Considering the fact that our participants were from a relatively developed area in China, they might have already been equipped with advanced technology and the requisite skills and knowledge [12], thereby facilitating their adaptation to the new learning environment.

6.2. Relationships between Learning Environments and Learning Outcomes

Emotional engagement exhibited a positive relationship with student cohesiveness and a negative relationship with teacher support. This indicates that the Chinese EFL learners who were supportive of one another in online learning tended to display more interest and enthusiasm in the learning process, and those who perceived more help and interest from their teachers were less likely to enjoy online learning. The results are consistent with the claim that language learning values social interaction [5]. In a previous study, it was suggested that positive peer relationships promoted a positive sense of emotional well-being, because the students felt that they had friends to provide help and share experiences with [43]. This may have contributed to the positive relationship between student cohesiveness and emotional engagement. Meanwhile, empirical studies have indicated that online learning environments encourage EFL learners' learning autonomy [6], which were found to predict emotional engagement [27,44]. However, in online learning environments, teachers have been found to constantly monitor students' online learning activities and to be readily available to offer support [28], leading students to perceive teachers as providing more than adequate support [16] and exerting strict control in monitoring their studies [44]. These may have led the EFL learners to be less emotionally engaged in online learning.

Of the three environmental variables, only student involvement was positively associated with behavioral engagement, indicating that the Chinese EFL learners who were more active and interested in online learning tended to expend more effort, attention, and persistence in the learning process. This is consistent with the finding of Webber et al.'s [33] study, in which college students' frequency of involvement was found to be positively related to their quality of effort in learning. Khalil and Aldridge [19] also suggested that students who showed attentive interest in and enjoyed the class were found to be more engaged in activities and tasks. Meanwhile, no significant relationship existed between the EFL learners' perceived learning environment factors and their learning satisfaction. This is inconsistent with the findings of a recent study, in which positive relationships were reported between student satisfaction and online learning environment perceptions, such as interaction with teachers and peers and involvement in online learning [31]. However, it should be noted that, unlike our study, which was conducted in the synchronous online learning environment, Wei and Chou's study was conducted in an asynchronous online learning environment without considering the subject area of the participants. Research has indicated that prompt and helpful feedback and output interaction through intrapersonal communication are likely to increase EFL learners' satisfaction [30]. However, in online learning environments, students have been found to be isolated from the campus and peer learners, and their online communication with teachers and classmates was less effective than in traditional face-to-face communication [13]. Such factors may be linked to the finding of a non-significant relationship between EFL learners' perceived online learning environments and online learning satisfaction.

6.3. Mediation of Self-Efficacy in the Relationships between Learning Environments and Learning Outcomes

Our results confirm the significant mediating role of self-efficacy in the influence of student cohesiveness and involvement on students' online learning engagement and satisfaction. In general, the inclusion of self-efficacy as a mediator increased the explanatory power of online learning environments. According to the mediation analysis results, the effect size of self-efficacy as a mediator was higher on the effect of student involvement than on student cohesiveness. This indicates that for the Chinese EFL learners who actively took part in online learning, the effect of online learning environments on the favorable changes in the students' affective and behavioral outcomes was actualized through their increased self-efficacy. Although very few studies have addressed the relationships between student involvement and self-efficacy in online learning environments, research on face-to-face instruction has provided supporting evidence for the positive relationship between the variables [35]. Therefore, student involvement has the strongest power to predict Chinese EFL learners' self-efficacy in online learning towards enhanced engagement and satisfaction.

Although no direct relations were found between Chinese EFL learners' perceived online learning environments and satisfaction, self-efficacy was found to be a significant mediator for the effect of student cohesiveness and involvement on satisfaction. This indicated that with increased self-efficacy, the students who perceived a more positive online learning environment tended to be more satisfied with their online learning process. Empirical studies have suggested that self-efficacy is predictive of students' online learning satisfaction [15]. Theoretically, students who are assured of their capabilities participate more readily, work harder, and perceive challenges as motivators for further accomplishment, and this personal attainment brings satisfaction [36]. Therefore, without a direct effect on satisfaction, the effect of Chinese EFL learners' perceived online learning environment was mainly actualized through the mediation of self-efficacy.

Although this study yields several preliminary findings, the following two limitations should be noted; these limitations also indicate directions for future studies. First, the participants involved in this study were EFL learners from a key university located in a province that is economically developed in East China. This may limit the generalizability of the findings, as regional differences exist among higher institutions in China due to imbalanced development. In addition, considering the fact that females account for the majority of Chinese university EFL learners, the large percentage of female participants in this study may be another factor that may limit our understanding of the findings. Therefore, future studies should consider a more representative sample to gain more insight into the research questions. Second, all of the data used in this study were self-reported by the participants, making it likely that some of the participants under- or overestimated their perceptions of their experiences. Although privacy was upheld in this study by using an anonymous questionnaire to reduce social desirability bias, future studies may consider using multiple methods, such as applying social desirability scales to detect and measure social desirability, to better interpret the results.

7. Implications

The results of this study extend our understanding of the nature of university EFL learners' perceived online learning environments and outcomes. They also help in formulating practical strategies to create a sustainable online learning environment and enhance students' online learning engagement, satisfaction, and self-efficacy for their sustainable development.

First, the positive relationship between student involvement and behavioral engagement suggests that EFL learners' behavioral engagement could be enhanced by heightening their feelings of online learning involvement. EFL learners could be encouraged to express their opinions and share their ideas during online course discussions, and online learning activities could be carefully designed to increase their feelings of involvement. Meanwhile, to reinforce the physical involvement in sustainable online learning, visual

functionality through video conferencing could be enabled to create a virtual face-to-face learning environment to enhance students' behavioral engagement [1].

Second, given the positive relationship between student cohesiveness and emotional engagement, EFL learners could improve their emotional engagement through increased cooperation with peers. Online learning activities for cultivating student cohesiveness could be carefully designed to increase their enthusiasm and interest in the online learning process. For example, EFL learners could be encouraged to work together through peer facilitation to promote students' cooperation and help establish a rapport between students. Meanwhile, the negative relationship between teacher support and emotional engagement implies that EFL learners may be emotionally disengaged in online learning if they receive an abundance of support from their teachers. This may inspire EFL teachers to be more cautious in providing support, to avoid the exertion of strict control in monitoring students' online learning, and to empower students to express their views about the online course design so as to reduce their negative attitudes and increase their enjoyment of online learning. For example, instead of teacher assessment, alternative ways such as peer assessment could be adopted to help EFL learners reflect on their own learning.

Third, the mediating role of self-efficacy in the relationship between EFL learners' perceived online learning environments and their behavioral and affective outcomes reminds us that EFL learners' engagement and satisfaction can be increased by reinforcing their confidence in their online learning capabilities. On the premise of enhancing student cohesiveness and involvement in online learning, attention could be paid to strategies for increasing EFL learners' expectations of and confidence in online learning, such as providing instructions to help them better understand online course content, selecting appropriate learning materials that match students' language levels, and encouraging students' mutual help in solving problems to create a sustainable online learning environment, all of which may increase their satisfaction with the overall online learning experience.

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Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Human Participants Ethics Committee of Shandong University, China.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data are available on request.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

The questionnaires used in this study
Technology-Rich Outcomes-Focused Learning Environment Inventory
Student cohesiveness

1. I make friends among students in this class.
2. I know other students in this class.
3. I am friendly to members of this class.
4. Members of the class are my friends.
5. I work well with other class members.
6. I help other class members who are having trouble with their work.
7. Students in this class like me.
8. In this class, I get help from other students.

Teacher support

9. The teacher takes a personal interest in me.
10. The teacher goes out of his/her way to help me.
11. The teacher considers my feelings.
12. The teacher helps me when I have trouble with the work.
13. The teacher talks with me.
14. The teacher is interested in my problems.
15. The teacher moves about the class to talk with me.
16. The teacher's questions help me to understand.

Student involvement

17. I discuss ideas in class.
18. I give my opinions during class discussions.
19. The teacher asks me questions.
20. My ideas and suggestions are used during classroom discussions.
21. I ask the teacher questions.
22. I explain my ideas to other students.
23. Students discuss with me how to go about solving problems.
24. I am asked to explain how I solve problems.

Engagement Versus Disaffection with Learning Scale

Behavioral engagement

1. I try hard to do well in school.
2. In class, I work as hard as I can.
3. When I am in class, I participate in class discussions.
4. I pay attention in class.
5. When I am in class, I listen very carefully.

Emotional engagement

6. When I am in class, I feel good.
7. When we work on something in class, I feel interested.
8. Class is fun.
9. I enjoy learning new things in class.
10. When we work on something in class, I get involved.

Couse Satisfaction Scale

1. This course increased my interests in the subject.
2. I felt I achieved the objectives in this course.
3. I liked the course format (online).
4. I felt comfortable in this course.
5. I would recommend this course to others.

General Web-based Learning Self-efficacy

1. I believe that I can get excellent grades on web-based courses.
2. I believe that I can capture the basic concepts taught in web-based courses.
3. I believe that I can understand the most difficult part of web-based learning materials.
4. I believe that I can do a good job of learning tasks involved in web-based courses.
5. I believe that I can master the learning materials in web-based courses.

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