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Research Article

Self-Perceived vs. Actual Online Engagement: Relationships with Academic Achievement Among Chinese Undergraduate English Learners in a Blended Learning Environment

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Abstract: This study, motivated by the growing integration of digital platforms in higher education, explores the relationships between Chinese undergraduate English learners' online engagement and academic achievement in a blended learning environment. Adopting a quantitative research design, the study involved 138 participants enrolled in an advanced English writing course, delivered through a blended learning approach. Data were collected using an adapted version of the Online Engagement Scale (OES) survey, assessing four constructs: Behavioral Engagement (BE), Cognitive Engagement (CE), Emotional Engagement (EE), and Social Engagement (SE). The study found that learners perceived higher levels of BE and CE compared to EE and SE. Analysis of actual behavioral online engagement revealed significant time spent on tasks, high task completion rates, and strong task performance. Significant correlations were found between BE and CE with total engagement time (TET) and task completion rates (TCR), while EE showed a correlation only with TET. SE did not correlate with any dimension of actual engagement. Despite these correlations, only task engagement scores (TES) significantly predicted academic achievement, with BE, CE, EE, and SE not predicting academic success. These findings contribute to the theoretical understanding of engagement in blended learning contexts, emphasizing that fostering task engagement, particularly task completion and performance, may enhance academic outcomes in such environments.

Keywords: online engagement, academic achievement, blended learning environment, behavioral engagement, English as a Foreign Language

1. Introduction

The integration of technology into education has significantly transformed the traditional learning environment, giving rise to blended learning approaches that combine face-to-face instruction with online components (Garrison & Kanuka, 2004; Bhadri & Patil, 2022; Zhang & Chen, 2022). In the context of English as a Foreign Language (EFL) learning, blended learning offers a flexible and interactive platform for students, enhancing both their engagement and academic outcomes (Kang & Kim, 2021; Cao, 2023; Xu, 2024). However, the complexity of online engagement within these environments has led to a need for a deeper understanding of how different forms of engagement influence academic success.

Online engagement is a multifaceted construct that includes various dimensions such as behavioral, cognitive, emotional, and social engagement (Fredricks et al., 2004; Appleton et al., 2008; Huang et al., 2022). In a blended learning context, engagement becomes even more critical as students must navigate both in-person and online learning tasks. While previous studies have highlighted the importance of engagement for academic success (Ferrer et al., 2022; Yang & Liu, 2023), there is limited research distinguishing between self-perceived engagement and actual behavioral engagement, particularly among EFL learners.

Research on online engagement within blended learning environments has evolved significantly over the past decade, with numerous studies demonstrating that heightened engagement levels correlate positively with improved academic performance (Henrie et al., 2015; Valverde-Berrocoso et al., 2020; Fazza & Mahgoub, 2021). Engagement in these environments typically encompasses behavioral, cognitive, emotional, and social dimensions, all of which contribute to students' overall success. Behavioral engagement, in particular, has been linked to better academic outcomes, as it often reflects the time and effort students invest in their learning activities (Reeve et al., 2020). However, while the importance of engagement is well-documented, there is an ongoing debate regarding the accuracy and reliability of self-reported engagement data. Self-perceived engagement is commonly assessed through surveys or self-assessment tools, where students rate their own participation and involvement. Although these measures provide valuable insights into students' perceptions, they may not always reflect their actual engagement. For instance, objective behavioral data, such as time spent on tasks or frequency of logins, often paints a different picture than students' self-reports (Zhang, 2022; Yang & Liu, 2023).

Despite the wealth of research on engagement, a critical gap persists in distinguishing between self-perceived engagement-students' subjective perceptions of their involvement-and actual behavioral engagement, which is based on objective data derived from online activity logs. This distinction is crucial, as self-perceptions of engagement may not always align with actual behaviors. Ferrer et al. (2022) have highlighted that students frequently overestimate their level of engagement, a phenomenon that can result in a misalignment between their self-assessment and their actual online activity. Such discrepancies are particularly problematic in blended learning environments, where students' engagement levels are pivotal to their success but are often self-regulated without immediate feedback from instructors.

Moreover, the literature has yet to fully explore the interplay between these two forms of engagement and their respective contributions to academic achievement. While some studies suggest that perceived engagement may have a motivational component that influences academic outcomes, others argue that only actual behavioral engagement, as captured through concrete metrics, can predict academic success reliably (Wong & Liem, 2022). The dynamic relationship between self-perceived and actual engagement, and their combined effect on academic performance, remains underexplored, particularly among EFL learners who may face additional challenges in navigating blended learning environments due to language barriers and varying levels of digital literacy.

Thus, this study seeks to fill these gaps by providing a comprehensive analysis of both self-perceived and actual behavioral online engagement in the context of Chinese undergraduate English learning. By investigating the relationships between these two dimensions of engagement and their impact on academic achievement, this research aims to contribute to a more nuanced understanding of how engagement functions in blended learning environments, ultimately offering insights that could inform more effective educational practices and interventions (Ferrer et al., 2022). Specifically, this research addresses the following questions:

RQ1: What are the levels of self-perceived and actual behavioral online engagement among Chinese undergraduate English learners in an English writing course within a blended learning context?

RQ2: What is the relationship between self-perceived and actual behavioral online engagement among Chinese undergraduate English learners, and how are these types of engagement connected to academic achievement in an English writing course within a blended learning context?

RQ3: To what extent can self-perceived and actual behavioral online engagement predict academic achievement among Chinese undergraduate English learners in an English writing course within a blended learning context?

This study makes several key contributions to the existing literature. First, it differentiates between self-perceived and actual online engagement, offering new insights into how these two forms of engagement relate to academic achievement. Second, it provides a deeper understanding of the dynamics of engagement in blended learning environments, emphasizing the importance of optimizing both perceived and actual engagement to improve student outcomes. Furthermore, this study introduces an innovative dual focus on self-perceived and actual behavioral online

engagement among Chinese undergraduate English learners, an area that has been underexplored in prior research. It also investigates the relationship between these two forms of engagement and their combined impact on academic achievement in an EFL context. By examining these dynamics, this study provides a more nuanced understanding of how engagement functions in blended learning environments and offers valuable insights for improving student performance in such settings.

2. Literature review

2.1 *Conceptualizing online engagement*

Online engagement is a critical factor in the success of students in digital learning environments, often conceptualized as a multidimensional construct encompassing behavioral, cognitive, emotional, and social aspects (Fredricks et al., 2004; Appleton et al., 2008; Huang et al., 2022). Behavioral engagement refers to the observable actions of students, such as participation in online discussions, completion of assignments, and interaction with course materials (Atik & Çelik, 2021). Emotional engagement involves students' affective reactions in the learning process, including interest, boredom, or anxiety (Huang et al., 2022). Cognitive engagement, on the other hand, relates to the investment in learning, including the use of deep learning strategies and the willingness to exert the necessary effort to comprehend complex ideas (Carter Jr et al., 2020; Derakhshan & Fathi, 2024). Social engagement refers to the interactive and interpersonal aspects of the learning experience within a social context, which involves the connections, collaborations, and relationships that learners establish with peers, instructors, and the broader learning community (Heilporn et al., 2021).

An important distinction in the literature is between self-perceived engagement, which reflects students' subjective assessments of their involvement, and actual behavioral engagement, which can be objectively measured through data analytics (Wong & Liem, 2022). Self-perceived engagement often captures students' awareness and self-reporting of their participation, while actual behavioral engagement is tracked through metrics such as logins, time spent on tasks, and frequency of interactions within the learning management system. Understanding the differences and correlations between these two types of engagement is essential for designing effective educational interventions, as discrepancies between perceived and actual engagement can significantly affect learning outcomes (Ferrer et al., 2022).

2.2 *Online engagement in blended learning environments*

Blended learning environments, which combine face-to-face instruction with online components, have become increasingly prevalent in higher education, particularly in the context of language learning (Bhadri & Patil, 2022). This instructional approach leverages the flexibility of online learning while maintaining the benefits of direct teacher-student interaction. In such environments, online engagement plays a crucial role, as it determines the extent to which students can effectively navigate between online and offline learning activities (Dziuban et al., 2018).

Research has shown that online engagement in blended learning environments is associated with higher levels of academic achievement, student satisfaction, and retention (Fisher et al., 2021). However, the nature of engagement in these settings is complex, as it requires students to be self-regulated learners who can manage their time and learning activities without constant supervision (Nkomo et al., 2021). This dual mode of learning challenges students to engage consistently across both platforms, making it imperative for educators to understand how engagement manifests in blended contexts and how it can be enhanced (Wong & Liem, 2022).

2.3 *Impact of online engagement on academic achievement*

The relationships between online engagement and academic achievement have been extensively studied, with a consensus that higher levels of engagement generally lead to better academic outcomes (Dabbagh & Kitsantas, 2012; Kang & Kim, 2021; Cao, 2023). Behavioral engagement, in particular, has been strongly linked to academic success, as students who actively participate in online activities are more likely to achieve higher grades (Kahu & Nelson, 2018). However, this relationship is not straightforward, as various factors, including the quality of engagement and the alignment between students' self-perceptions and their actual behaviors, can influence outcomes.

One of the challenges in this area of research is measuring engagement accurately. Self-perceived engagement, often assessed through surveys and self-reports, may not always reflect actual behaviors, leading to potential discrepancies in data (Ferrer et al., 2022). For example, students might report high levels of engagement but, in reality, engage only minimally with course materials. Conversely, students who may not perceive themselves as highly engaged could be consistently participating in discussions and completing assignments on time. This misalignment can lead to different conclusions about the impact of engagement on academic achievement (Wong & Liem, 2022).

2.4 *Engagement and academic achievement among EFL learners*

EFL learners, particularly those in non-English speaking countries, face unique challenges in online and blended learning environments. Language proficiency, cultural differences, and varying levels of digital literacy can all influence how these students engage with online content and, consequently, how they perform academically (Atik & Çelik, 2021). Studies have shown that EFL learners often require additional support to navigate these environments effectively, and their engagement levels are often closely tied to their comfort with the language and the digital platforms used (Cao, 2023).

Empirical studies focusing on EFL learners in blended learning contexts have highlighted the importance of both self-perceived and actual engagement in determining academic success. For instance, Ferrer et al. (2022) found that EFL learners who perceived themselves as more engaged tended to perform better academically, but this was only true when their actual behavioral engagement aligned with their self-perceptions. This finding underscores the importance of ensuring that EFL learners' self-assessments are accurate and that they receive the necessary support to translate their engagement into tangible academic outcomes.

In summary, the literature indicates a strong link between online engagement and academic achievement, with particular emphasis on the need to differentiate between self-perceived and actual engagement. However, significant gaps remain in understanding how these forms of engagement interact, especially among EFL learners in blended learning environments. The discrepancies between self-perceived and actual engagement, and their respective impacts on academic success, require further exploration to develop more effective educational strategies. This study aims to address these gaps by examining the relationships between self-perceived and actual behavioral engagement and their influence on academic achievement among Chinese EFL learners.

3. Methodology
3.1 *Participants*

The study involved 138 Chinese undergraduates enrolled in an advanced English writing course, which was delivered using a blended teaching approach. Participants were selected based on their enrollment in the course and their basic proficiency in English. These participants were selected through convenience sampling, a non-probability sampling method that involves choosing individuals who are readily accessible and willing to participate (Andrade, 2020). This approach was deemed appropriate given the researcher's direct access to the students. To assess potential variations in English writing ability before the course, a diagnostic writing test was administered at the start of the semester. This pre-course assessment was designed to evaluate students' baseline writing skills and ensure a more accurate interpretation of their final performance. The results of the diagnostic test revealed that there were no significant differences in the participants' writing abilities. Specifically, 80% of the students scored within a narrow range of 50-65% on the test (M = 58.2%, SD = 4.7), indicating a similar intermediate level of proficiency across the cohort. An analysis of variance (ANOVA) confirmed that there were no significant differences in the writing scores (F(2, 135) = 1.34, p = 0.26), allowing for the use of these participants in experimental teaching without introducing bias based on initial ability levels. The demographic characteristics of the participants are summarized in Table 1.

Table 1. Participants' demographics

Demographics	Categories	$N = 138$	%
Gender	Male	52	37.6
	Female	86	62.4
Age	21-22	119	86.2
	22-25	19	13.8
Faculty	New media communications	28	20.2
	Art & Design	17	12.3
	Social Sciences and Humanities	35	25.4
	Transportation	21	15.3
	Electronic Information Engineering	37	26.8

3.2 Instrument

The survey instrument used in this study was adapted from Hoi and Hang's (2021) Online Engagement Scale (OES) model, which was modified to align with the specific context of blended learning. Each item from the original model was rephrased to be positive statements in both English and Chinese. The final survey consisted of 16 items, each rated on a 5-point Likert scale, where 1 indicated complete disagreement and 5 indicated complete agreement. The instrument was designed to measure four key constructs of online engagement: Behavioral Engagement (BE), Cognitive Engagement (CE), Emotional Engagement (EE), and Social Engagement (SE).

For BE, the items assessed the extent to which students actively participate in online tasks. An example item for this construct was: "I complete all online learning tasks on the Superstar platform on time." This construct focused on observable actions, such as task completion and participation in online discussions.

CE construct examined students' efforts to engage with learning materials and reflect on their understanding. One example of an item measuring this construct was: "I try to connect what I am learning on the Superstar platform with what I learned previously." This construct aimed to capture the depth of students' engagement with the content beyond just completing tasks.

EE measured the students' emotional involvement and motivation during online learning activities. An example item was: "I look forward to engaging in online learning activities on the Superstar platform." This construct focused on the affective aspect of online learning, including enjoyment and anticipation of learning experiences.

Finally, SE assessed the students' interaction with peers and instructors. A sample item for this construct was: "I respond to other classmates' questions in online discussion boards on the Superstar platform." This construct aimed to evaluate the social dimension of online learning, including collaboration and communication with others in the learning environment.

The survey demonstrated strong reliability and validity, with a Cronbach's alpha of 0.869, a Kaiser-Meyer-Olkin (KMO) measure of 0.821, and a statistically significant Bartlett's sphericity test ($p < 0.001$). These results indicate that the instrument was both reliable and valid for measuring the various dimensions of online engagement in this blended learning context.

3.3 Ethical considerations

All ethical standards for research involving human participants were strictly adhered to in this study. Prior to the

commencement of the research, all participants were required to read and sign an informed consent form. They were assured that their privacy would be protected throughout the study, with all data securely stored and anonymized. Participants were also informed that they could withdraw from the study at any time without penalty, and that every effort would be made to minimize any potential negative impacts.

3.4 *Data collection*

The study was conducted from September to December 2023. During this period, the teacher-researcher utilized the Superstar platform to assign homework for both the pre-class and post-class online phases of the blended learning course. The blended learning context integrated structured online assignments with interactive face-to-face classroom activities. Online tasks were designed to prepare students for upcoming class discussions and to reinforce learning from in-person sessions. These tasks included timed essay submissions and interactive writing exercises.

Students' actual behavioral online engagement was assessed through three metrics: total engagement time (TET), task completion rates (TCR), and task evaluation scores (TES). To ensure reliable TET data, platform logs were cross-referenced with timestamped submissions. Students were required to label their submissions as either "draft" or "final" to distinguish between incomplete drafts and completed tasks. Additionally, to account for differences in writing processes, students were asked whether they typed up handwritten drafts or composed directly in a word processor. This information allowed for adjustments to TET calculations, ensuring that only the time spent on finalized online submissions was included in the analysis. Academic achievement was evaluated based on students' overall performance in the advanced English writing course, which comprised four components: class attendance (5%), class presentations (20%), online learning tasks (25%), and a final writing test (50%).

3.5 *Data analysis*

Data analysis was conducted using SPSS 22.0, following a systematic approach. Initially, descriptive statistics were generated to present the levels of self-perceived and actual behavioral online engagement, as well as academic achievement. Next, Pearson correlation analysis was performed to explore the relationships between self-perceived and actual behavioral online engagement, and their connections to academic achievement. Finally, multiple linear regression analyses were conducted to assess the extent to which self-perceived and actual behavioral online engagement predict academic achievement among Chinese undergraduate English learners in a blended learning context.

Prior to these analyses, data normality was assessed through histograms and the Shapiro-Wilk test. To approximate a normal distribution, the data were transformed using the Box-Cox method when necessary. Additionally, Z-score transformation was applied to standardize data across different measurement units, facilitating consistent comparisons among variables.

4. Results

4.1 *Overview of self-perceived and actual behavioral online engagement and academic achievement*

The first analysis involved the descriptive statistics of the survey data and academic achievement in the advanced English writing course, with the results presented in Table 2.

Table 2. Descriptive statistics of survey data and academic achievement

Variables	M (Item)	SD	M (Construct)
BE1	4.32	0.546	4.25
BE2	4.18	0.615	

Table 2. (cont.)

Variables	M (Item)	SD	M (Construct)
BE3	4.02	0.632	
BE4	4.49	0.741	
CE1	4.09	0.621	4.32
CE2	4.37	0.728	
CE3	4.26	0.667	
CE4	4.57	0.738	
EE1	3.76	0.691	3.95
EE2	4.08	0.734	
EE3	4.12	0.685	
EE4	3.82	0.695	
SE1	3.42	0.772	3.56
SE2	3.32	0.619	
SE3	4.05	0.654	
SE4	3.46	0.861	
TET (mins)	963.21	537.57	
TCR (%)	87.54	17.43	
TES (centesimal)	85.06	21.68	
AA (centesimal)	82.36	26.31	

$N = 138$

Table 2 presents descriptive statistics on Chinese undergraduate English learners' self-perceived and actual behavioral online engagement, as well as their academic achievement in a blended learning environment. For self-perceived online engagement, learners reported higher levels of BE ($M = 4.25$) and CE ($M = 4.32$), while EE ($M = 3.95$) and SE ($M = 3.56$) were comparatively lower. Regarding actual behavioral online engagement, learners demonstrated high engagement on the Superstar platform, averaging 963.21 minutes to complete online tasks, with a task completion rate of 87.54% and an average task score of 85.06. Additionally, the average academic achievement score was 82.36, surpassing the typical benchmark of 80, indicating an improvement in writing proficiency to an advanced level following this intervention.

4.2 *Correlations between self-perceived and actual behavioral online engagement, and academic achievement*

The second analysis conducted a correlational study of self-perceived and actual behavioral online engagement, as well as the relationships between these engagement forms and academic achievement. The results are detailed in Table 3.

Table 3. Correlational analysis

Variables	BE	CE	EE	SE	TET	TCR	TES
BE	1	0.240	0.184	0.063	0.278*	0.315*	0.143
CE			0.076	0.349	0.293*	0.329*	0.086
EE				0.034	0.259*	0.117	0.144
SE					0.026	0.013	0.016
TET						0.270	0.057
TCR							0.069
TES							1
AA	0.038*	0.163	0.016	0.005	0.043	0.294*	0.336*

$N = 138$, $*p < 0.05$

Table 3 presents the correlation results for self-perceived and actual behavioral online engagement and their relationships with academic achievement in a blended learning context. Notably, self-perceived BE and CE were significantly correlated with TET ($r = 0.278$, $r = 0.293$, $p < 0.05$) and TCR ($r = 0.315$, $r = 0.329$, $p < 0.05$) in actual behavioral online engagement. Additionally, EE in self-perceived online engagement showed a significant correlation with TET ($r = 0.259$, $p < 0.05$), while SE did not correlate significantly with any variable of actual behavioral engagement. Moreover, none of the self-perceived engagement variables were significantly correlated with TES in actual behavioral engagement.

Further analysis revealed statistically significant correlations between BE and academic achievement ($r = 0.038$, $p < 0.05$), as well as TCR, TES, and academic achievement ($r = 0.294$, $r = 0.336$, $p < 0.05$). Conversely, no other dimensions of self-perceived or actual behavioral engagement showed significant correlations with academic achievement.

4.3 *Predictive analysis of online engagement on academic achievement*

The third analysis conducted a multiple linear regression to determine the predictive roles of self-perceived and actual behavioral online engagement in academic achievement. The results are detailed in Table 4.

Table 4. Multiple regression analysis

Variables	R	R^2	Adjusted R^2	$F(7, 130)$	Beta	$t(130)$	Tolerance	VIF	Predictor
AA	0.185	0.034	-0.120	5.223					
BE					0.193	5.189	0.872	1.146	No
CE					0.095	-0.442	0.790	1.266	No
EE					0.038	-0.883	0.941	1.063	No
SE					0.021	0.190	0.846	1.181	No
AA	0.225	0.354	0.024	26.242*					
TET					0.088	0.462	0.926	1.080	No
TCR					0.295	0.497*	0.924	1.082	Yes
TES					0.335	1.820*	0.994	1.006	Yes

$N = 138$, $*p < 0.05$

Table 4 presents the results of a multiple linear regression to determine the predictive roles of self-perceived and actual behavioral online engagement in academic achievement. As indicated in Table 4, the Tolerance values for the four variables of self-perceived online engagement and the three variables of actual behavioral online engagement are all greater than 0.2, and all the VIF values are less than 10. This indicates that there is no collinearity among these variables.

Table 4 indicates that the four variables of BE, CE, EE and SE in self-perceived online engagement did not significantly forecast academic achievement ($R^2 = 0.034$, $F = 5.233$, $p > 0.05$). Contrastingly, the three variables of TET, TCR and TES in actual behavioral online engagement exhibited a significant predictive impact on academic achievement ($R^2 = 0.354$, $F = 26.242$, $p < 0.05$). This implies that the combination of the three variables of actual behavioral online engagement explains 35.4% of the variance in academic achievement. Furthermore, the standardized regression coefficients for TES (task evaluation scores) were identified as the highest (Beta = 0.335), followed by TCR (task evaluation rate) (Beta = 0.295). This suggests that learners achieving higher task evaluation scores tended to attain better academic achievement.

5. Discussion

This study explored the relationships between Chinese undergraduate English learners' online engagement and academic achievement. Specifically, it examined the levels of self-perceived and actual behavioral online engagement, their correlations with academic achievement, and the predictive roles of these engagement forms within a blended learning context.

5.1 *Levels of self-perceived and actual behavioral online engagement*

Regarding the levels of self-perceived online engagement, this study found that learners reported higher levels of BE ($M = 4.25$) and CE ($M = 4.32$), but lower levels of EE ($M = 3.95$) and SE ($M = 3.56$). In addition, the results of actual behavioral online engagement revealed an average of 963.21 minutes spent on online learning tasks, coupled with an impressive 87.54% online task completion rate and an average online task score of 85.06. These findings indicate learners' active involvement and commitment in the online learning process. The outcomes of actual behavioral online engagement align with learners' higher levels of self-perceived cognitive and behavioral online engagement. This consistency indicates that learners' perceptions of their engagement are closely reflected in their actual behaviors during the online learning process. Specifically, the high levels of cognitive and behavioral engagement suggest that learners not only believe they are actively participating but are also demonstrating this through significant time investment and task completion in the blended learning environment.

These findings highlight the strong alignment between self-perceived engagement and actual behaviors, underscoring the effectiveness of the blended learning approach in fostering both subjective and objective forms of engagement among Chinese undergraduate English learners. This alignment further suggests that enhancing cognitive and behavioral aspects of online engagement could be key to improving academic outcomes in similar educational settings. These findings are consistent with research conducted by Park and Yun (2018), which revealed that students tend to exhibit higher levels of actual engagement when they perceive themselves as being cognitively and behaviorally involved in their learning. This suggests that self-perception can play a significant role in driving actual learning behaviors, reinforcing the importance of fostering both cognitive and behavioral engagement in online learning environments. However, the distinctly lower levels of self-perceived emotional and social engagement found in this study highlight the need for more effective strategies to enhance interpersonal connections and emotional involvement in the blended learning context.

5.2 *The relationship between self-Perceived and actual behavioral online engagement and their connection to academic achievement*

Regarding the relationship between self-perceived and actual behavioral online engagement, the study found significant correlations between BE and CE with both TET ($r = 0.278$, $r = 0.315$, $p < 0.05$) and TCR ($r = 0.293$, $r = 0.329$,

$p < 0.05$) in actual behavioral engagement. EE ($r = 0.259$, $p < 0.05$) was significantly correlated with TET. However, SE showed no significant correlation with any aspect of actual behavioral engagement, and none of the self-perceived engagement variables was correlated with TES.

These findings resonate with Zhang's (2022) research, identifying BE, CE, and EE as prominent facets in the dynamics of L2 learning. However, the absence of a significant correlation between SE and actual behavioral online engagement does not necessarily imply a diminished significance of the social dimension in learners' online engagement. As highlighted by Sulis (2022), engagement is an ongoing and fluctuating process, and the impact of social engagement should be scrutinized in real-world contexts rather than controlled laboratory settings. The lack of substantial online community support could be a contributing factor to the observed non-significant correlation between SE and actual behavioral online engagement in the blended learning context.

Regarding the connection between online engagement and academic achievement, this study revealed that significant correlations were found between BE and academic achievement ($r = 0.038$, $p < 0.05$), as well as TCR, TES, and academic achievement ($r = 0.294$, $r = 0.336$, $p < 0.05$). Other dimensions of self-perceived and actual behavioral engagement did not significantly correlate with academic achievement. These findings align with Cole et al.'s (2021) studies, suggesting that higher levels of actual online engagement improve student academic success. Moreover, Wang and Baker (2015) found that learners with more active participation tend to have better learning outcomes in online learning contexts.

5.3 *Predictive roles of engagement in academic achievement*

In terms of the predictive roles of self-perceived and actual behavioral online engagement in academic achievement, the study found that BE, CE, EE, and SE did not significantly predict academic achievement ($R^2 = 0.034$, $F = 5.233$, $p > 0.05$). However, TET, TCR, and TES significantly predicted academic achievement ($R^2 = 0.354$, $F = 26.242$, $p < 0.05$), accounting for 35.4% of the variance. TES had the strongest predictive impact (Beta = 0.335), followed by TCR (Beta = 0.295), indicating that higher task scores were linked to better academic outcomes. These findings corroborate those of Ryan and Poole (2019), confirming that tangible behavioral engagement within a virtual learning environment significantly influences students' academic achievement and knowledge retention. Additionally, these results partially align with the findings of Jiang and Peng (2023), indicating that actual behavioral online engagement generally has stronger predictive power for academic outcomes than self-perceived online engagement.

6. Conclusions
6.1 *Summary of the study's findings*

This study explored the intricate dynamics between various forms of online engagement and their relationship to academic achievement in a blended learning context. The findings revealed that learners perceived higher levels of behavioral and cognitive engagement, while emotional and social engagement were comparatively lower. These differences may stem from the limited emotional and social interaction opportunities in online environments. Actual behavioral engagement, including total engagement time and task completion rate, significantly correlated with both behavioral and cognitive engagement, while emotional engagement correlated only with total engagement time. Social engagement, however, had no significant correlations with any dimensions of actual engagement, likely due to the individualistic nature of online tasks. Behavioral engagement, task completion rate, and task engagement scores significantly predicted academic achievement, with task engagement having the strongest impact. These results suggest that fostering specific aspects of online engagement, particularly task engagement, could enhance academic performance in blended learning environments.

6.2 *Implications for blended learning course design*

Based on these findings, this study offers several practical insights for improving online engagement among Chinese undergraduate English learners in blended learning settings. First, in light of the lower levels of emotional and social engagement, educators should implement targeted interventions to foster a sense of community and emotional

connection. Collaborative activities, discussion forums, and virtual social interactions could enrich the online learning experience. Additionally, given the higher levels of cognitive and behavioral engagement reported, instructors can leverage these strengths by incorporating challenging and intellectually stimulating activities. Using varied instructional strategies that cater to diverse learning styles can further enhance cognitive engagement. The positive results associated with the Superstar platform suggest that integrating similar features-such as proactive engagement tasks-can enhance participation and task completion. Institutions should consider optimizing online platforms to include interactive elements that encourage active involvement. Second, the study underscores the importance of aligning learners' self-perceptions with their actual engagement behaviors. Educators should provide feedback to help learners develop a more accurate understanding of their engagement, potentially improving their overall learning experience. Finally, recognizing the strong predictive power of task engagement, institutions can use this information to identify students who may be at risk of underachievement and implement timely interventions.

6.3 *Limitations and directions for future research*

Despite its valuable insights, this study has limitations. First, the relatively small sample of 138 Chinese undergraduate English learners restricts the generalizability of the findings. The specific academic context and limited sample size may impact the external validity of the conclusions. Second, data were collected over a single semester, offering only a snapshot of engagement and academic performance. A longer data collection period could provide a more comprehensive understanding of engagement dynamics across multiple semesters. Lastly, while the study acknowledged potential gender differences in engagement, it did not explore these differences in depth. Future research should further investigate gender-related engagement patterns to inform more targeted interventions for diverse learner groups in blended learning environments.

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Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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