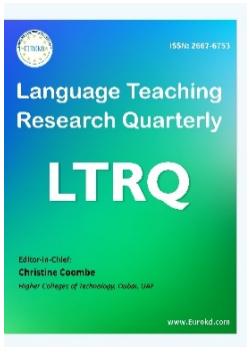

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Chinese EFL Learners' Task Control-Value Appraisals, Emotions and Behavioral Engagement During After-Class App-Assisted Vocabulary Learning

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Abstract

Mobile apps have surged in popularity, enhancing the effectiveness of more traditional second or foreign language (L2) teaching and enabling independent L2 learning. Drawing on control-value theory, the present research examined the role of students' control-value appraisals in enhancing behavioral engagement via enjoyment and boredom in specific app-assisted vocabulary learning tasks. Analyzing questionnaire responses from 98 college students, the results showed that learners' task control-value appraisals impacted their behavioral engagement in multiple ways, both directly and indirectly, with task-related enjoyment and boredom serving as key mediators in these relationships. Specifically, intrinsic task value positively affected learners' behavioral engagement directly and indirectly through enjoyment and boredom; extrinsic task value promoted behavioral engagement directly, but undermined it indirectly through boredom; task control appraisal did not significantly affect behavioral engagement directly but had a positive impact through task enjoyment. The findings offer important theoretical insights and practical applications for L2 education.

Keywords: *Task Control-Value Appraisals, Task Enjoyment, Task Boredom, Behavioral Engagement, App-Assisted Vocabulary Learning*

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[1]Introduction

The rapid evolution and advancement of wireless technology have sparked a surge of interest in Mobile-Assisted Language Learning (MALL) in the field of Second Language Acquisition (SLA) in recent years. MALL is characterized by features such as mobility, portability, and instant accessibility, as well as individuality, social engagement, and adaptability (Kukulska-Hulme, 2009). Within MALL, mobile applications (apps) are becoming increasingly popular, acting as supplementary tools in formal second or foreign language (L2) instruction while also providing a platform for self-regulated L2 learning (Rosell-Aguilar, 2018). Given the essential role of vocabulary learning in L2 acquisition (Nation, 2013), App-assisted Vocabulary Learning (AVL) has emerged as an extremely promising line of inquiry in current MALL research (Burston, 2015).

Previous studies indicate that learners' engagement in AVL positively influences word retention (Lin & Lin, 2019). Furthermore, positive emotions such as L2 enjoyment have been recognized for their ability to broaden language learner cognition, motivation and engagement (Khajavy, 2021; MacIntyre, 2016), whereas negative emotions are considered to constrict attention and limit the variety of possible language input throughout L2 learning (MacIntyre & Gregersen, 2012). However, the impact of learners' cognitive appraisal and emotional experiences on their AVL engagement remains inadequately explored. In addition, achievement emotions, along with their antecedents like cognitive appraisals and outcomes such as engagement, are organized in ways that are specific to each domain (Goetz, Frenzel, et al., 2006; Pekrun, 2006). Therefore, grounded in control-value theory (CVT; Pekrun, 2006) alongside the findings of relevant empirical studies (e.g. Li & Li, 2024; Frenzel et al., 2007; Pekrun et al., 2009), this research examines how two primary emotions, that is, enjoyment and boredom, mediate relationships between learners' control-value appraisals and their behavioral engagement in contexts involving AVL in China.

Literature Review

Theoretical Background

This research draws on Pekrun's (2006) control-value theory of achievement emotions. According to this theory, the emotions learners experience during the learning process are directly influenced by their appraisals of control and value. These emotions, in turn, significantly affect learners' involvement in the learning process. Accordingly, when individuals feel that they have control over tasks or outcomes they value, they experience certain emotions related to achievement. Conversely, when they feel they lack control or the tasks are not valued highly, different emotions may arise.

In this study, it is essential to highlight that enjoyment generally arises when learners regard the activity as manageable and maintain a positive attitude toward the task. Conversely, boredom is likely to set in when the activity lacks meaningful value or challenge, or when learners feel they lack control due to the tasks surpassing their capabilities (Pekrun & Stephens, 2010). CVT also stipulates that achievement emotions directly influence levels of

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engagement. Additionally, it suggests that appraisals of control-value impact student engagement indirectly through their effect on achievement emotions (Pekrun & Perry, 2014).

Taking a situated perspective of achievement emotions, the current investigation attempts to verify the assumption that achievement emotions mediate the relationships between control-value appraisals and engagement within an AVL context among university EFL learners in China.

Behavioral Engagement, Achievement Emotions, Control-Value Appraisals

Behavioral engagement

Engagement, a crucial factor for student success in educational settings (Fredricks et al., 2004), has been linked to several positive outcomes, including improved grades, enhanced learning, and greater achievement (Garn et al., 2017). Engagement also plays a crucial role in SLA, encompassing both the quantity and quality of students' active participation in language learning tasks, as highlighted by Hiver et al. (2020) and Mercer and Dörnyei (2020). As defined in Philp and Duchesne's (2016, p. 15) framework for task engagement, this construct refers to "a state of heightened attention and involvement." Scholars agree that this concept is multidimensional, encompassing behavioral, emotional, and agentic dimensions, as well as cognitive aspects (Philp & Duchesne, 2016; Zhou et al., 2023). However, the core construct of engagement is behavioral engagement, serving as its most prototypical form, while cognitive and agentic dimensions are considered subcomponents of it (Skinner et al., 2009). Behavioral engagement can be operationalized through students' efforts on academic tasks, the quality of their participation, and the degree of their involvement in learning activities (Sang & Hiver, 2021). Behavioral engagement is also domain-specific (Wang et al., 2016). Thus, this study operationalizes it as the efforts made by students and their level of active involvement in AVL.

Achievement emotions

According to control-value theory, achievement emotions are understood as multidimensional constructs that include factors such as object focus (differentiating between activity and outcome), emotional valence (pleasant versus unpleasant), and levels of activation (activating compared to deactivating) (Pekrun & Perry, 2014). Thus, enjoyment is classified as a pleasant and energizing emotion related to learning activities, while boredom is identified as a negative and deactivating emotion associated with such activities. In the L2 context, according to Dewaele and Li (2021), enjoyment is viewed as a positive learning state that is closely linked to increased motivation and engagement, contributing to improved L2 performance (Botes et al., 2021). Enjoyment occurs when an individual feels satisfied or pleased with their participation in an activity (Ainley & Hidi, 2014). In contrast, Kruk and Zawodniak (2018, p. 177) define L2 boredom as "a combination of dissatisfaction, disappointment, annoyance, inattention, lack of motivation to pursue previously set goals and impaired vitality". In this study, task enjoyment specifically refers to learners' positive state when they feel satisfied or pleased with their participation in app-assisted vocabulary learning process. Conversely, task boredom refers to a combined negative state when students feel unsatisfied, unpleasant, or demotivated during their participation in this learning activity.

Control-value appraisals

Control-value appraisals consist of three elements: control appraisal, intrinsic value appraisal, and extrinsic value appraisal. *Control appraisal* pertains to an individual's assessment of their ability or competence to execute a given task, as well as their perceived control over the outcomes they wish to achieve (Pekrun & Perry, 2014). *Intrinsic value* appraisal involves the perceived significance of the activities and outcomes related to achievement, which leads to considering them interesting and meaningful (Eccles, 2005). In contrast, *extrinsic value* appraisal concerns the perceived practical usefulness of the activity and the benefits derived from successfully completing it (Pekrun, 2006). Within the specific context of the present study, task control appraisal refers to learners' perceived control over the effectiveness of AVL. Intrinsic task value appraisal refers to learners' perceived interest and meaningfulness in the activity of AVL, whereas extrinsic value appraisal refers to the perceived instrumental utility of AVL.

L2 enjoyment, boredom and engagement

In the field of SLA, aligned with the control-value theory (Pekrun, 2006), findings from multiple empirical studies have revealed that elevated levels of enjoyment positively affect learners' engagement in academic activities and their success in language acquisition (Dewaele & Li, 2021; Li et al., 2025; Wang et al., 2022; Wang & MacIntyre, 2021). Conversely, increased levels of boredom often lead to feelings of discontent, lack of focus, and a decrease in motivation (Kruk & Zawodniak, 2018), which can adversely affect L2 learning (Derakhshan et al., 2022). For example, the study by Feng and Hong (2022) involving 633 senior high school students in China revealed a positive correlation between L2 enjoyment and behavioral engagement. Similarly, in another study, Derakhshan et al. (2022) investigated how boredom mediates the relationships among social climate of the classroom, growth mindset, and engagement in a sample of 287 university students majoring in English. The results demonstrated that boredom negatively predicted EFL students' English learning engagement. These studies in general EFL learning contexts lay the groundwork for further exploration of how achievement emotions predict engagement in more specific L2 learning situations.

Research indicates that student engagement tends to be higher when using online vocabulary learning platforms compared to reliance on conventional methods, such as textbooks (Stroud, 2014). Employing technology can boost learner's motivation, self-confidence, positive emotions, and involvement, ultimately facilitating the mastery of fundamental skills (Hashemifardnia et al., 2018). Nonetheless, there is a scarcity of studies that have investigated the relationship between achievement emotions and engagement specifically within the context of AVL. For instance, Harley et al. (2019) in a study involving 57 undergraduates using a mobile app revealed that technology-related enjoyment positively predicted perceived success in learning, while boredom had a negative effect. In a general online learning context, the findings of the study undertaken by Ding and Zhao (2020) indicated significant influences of enjoyment and boredom on learning engagement, with enjoyment exerting a positive effect and boredom having a negative impact. In a study particularly pertinent to the current research, Ebrahimzadeh and Alavi (2016) explored how enjoyment derived from e-learning influences vocabulary acquisition through a digital video game, involving 136 EFL high school students. Their findings indicated that enjoyment

derived from e-learning significantly predicted game-enhanced vocabulary learning. However, how learners' emotions during the performance of an app-assisted vocabulary learning task related to their behavioral engagement in the task remains to be explored.

Control-value appraisals and engagement

CVT proposes that achievement emotions arise from various forms of appraisals, including subjective control and value appraisals. These emotions affect students' cognition, motivation, and engagement, ultimately impacting academic performance (Pekrun & Stephens, 2010). Studies from both general education and SLA have generally supported these assumptions.

Numerous studies have explored the connections between intrinsic and extrinsic value and engagement or achievement, revealing a positive association among these factors. For instance, Chen and Kraklow (2014) discovered that both intrinsic motivation and extrinsic motivation were significant predictors of English learning engagement among 276 international and domestic college students in Taiwan. In the Iranian EFL context, Salehpour and Roohani (2020) found that both types of motivation positively affected language achievement in speaking tasks among 249 L2 learners.

There has been little empirical inquiry into direct relationships between intrinsic and extrinsic value, along with engagement, specifically within the domain of AVL. For example, among 169 EFL undergraduates using mobile devices, Sun and Gao (2020) found that intrinsic motivation positively influences students' behavioral intention in MALL, mediated by perceived usefulness and task technology fit (i.e., the effectiveness of technology in helping individuals achieve their tasks). An et al. (2024) revealed that intrinsic motivation mediates the connection between technology acceptance and self-directed learning in a sample of 495 students in Chinese middle schools. Thus, how intrinsic and extrinsic value affect engagement in app-assisted learning context remains largely unexplored.

As for control appraisals and learning engagement, some researchers have used self-efficacy as an indicator of learners' perception of controllability, revealing that higher self-efficacy is associated with better engagement. For example, Tomás et al. (2019) conducted a study involving 614 middle school students in the Dominican Republic to investigate how self-efficacy, hope, and engagement influenced academic achievement. Their findings revealed that hope and self-efficacy significantly and positively impacted engagement. Among 165 students in an undergraduate course, Galyon et al. (2011) also noted that high, medium, and low levels of academic self-efficacy were strong predictors of learners' participation in classroom activities and their exam results.

In specific task domains or online learning contexts, a positive association has also been found between self-efficacy and engagement. For instance, Tsao (2021) found that among 227 senior high school students in Taiwan, EFL learners' self-efficacy in L2 writing had a positive effect on their interaction with written corrective feedback. In the online learning context, Jung and Lee (2018) also discovered that participants' academic self-efficacy was positively associated with their level of engagement in massive open online courses (MOOC).

Research has also investigated how control and value appraisals affect students' engagement, demonstrating a positive influence of all three appraisal types, although the effect sizes for intrinsic and extrinsic value differed. For example, Walker et al. (2006) reported that self-efficacy, along with both extrinsic and intrinsic motivation, positively affected cognitive

engagement among 191 college students. A study involving 1,036 Chinese EFL eighth graders conducted by Ma et al. (2018) explored how self-efficacy beliefs mediate the relationship between students' intrinsic and extrinsic value and their foreign language proficiency. Findings revealed that intrinsic value associated with foreign language learning influences proficiency both directly and indirectly through partial mediation of self-efficacy. Conversely, extrinsic value has been shown to have a relatively minor direct effect on proficiency and no significant effect through self-efficacy. In China, drawing on the CVT, Xu et al. (2023) found that control appraisal, along with both intrinsic and extrinsic value, positively predicted cognitive, emotional, and behavioral engagement among university EFL learners. These studies have consistently highlighted the significant impact that control-value appraisals have on language learning and achievement, both directly and indirectly. However, empirical evidence concerning the links between control-value appraisals and learners' engagement during AVL tasks is lacking, which motivates the present study.

Control-value appraisals, achievement emotions and engagement

CVT also posits that control-value appraisals play an indirect role in shaping student engagement by affecting achievement emotions like enjoyment and boredom (Pekrun & Stephens, 2010). This assumption has found widespread support within the field of general education. Nevertheless, there has been limited investigation into the relationship involving control-value appraisal, achievement emotions, and engagement within SLA, particularly within online settings or in the context of AVL.

Drawing on Pekrun's (2006) CVT, a longitudinal study was conducted by Garn et al. (2017) over one semester in university physical education classes. Path analysis revealed that extrinsic value beliefs positively affected behavioral engagement and emotional engagement through enjoyment. Similarly, King and Gaerlan (2013) showed that trait self-control, which involves managing one's impulses, feelings, thoughts, and behaviors (Tangney et al., 2004), had a positive effect on emotional and behavioral engagement through positive emotions like enjoyment, hope, and pride. Conversely, self-control was found to significantly predict emotional and behavioral disaffection (the opposite of engagement) through negative emotions, including anger, anxiety, shame, hopelessness, and boredom. Within the Chinese EFL context, the empirical investigation by Shao et al. (2020) focused on the relationship between students' control-value appraisals and their academic emotions as well as foreign language performance. Their findings revealed that perceived control and value were associated with positive emotions and enhanced performance. More relevant for the current study, Xu et al. (2023) discovered that academic emotions mediated the relationship involving control-value appraisals and student engagement among 323 foreign language undergraduates in China. Specifically, positive emotions positively mediated the connection between control-value appraisals and involvement, while negative emotions negatively mediating this relationship.

In summary, the preceding literature review provides empirical support for the proposed links among control-value appraisals, achievement emotions, and engagement within CVT, as delineated by Pekrun (2006). This relationship has been substantiated in general education and foreign language learning contexts. Nonetheless, studies examining these dynamics in online settings or AVL environments remain scarce. Given the context-specific nature of achievement

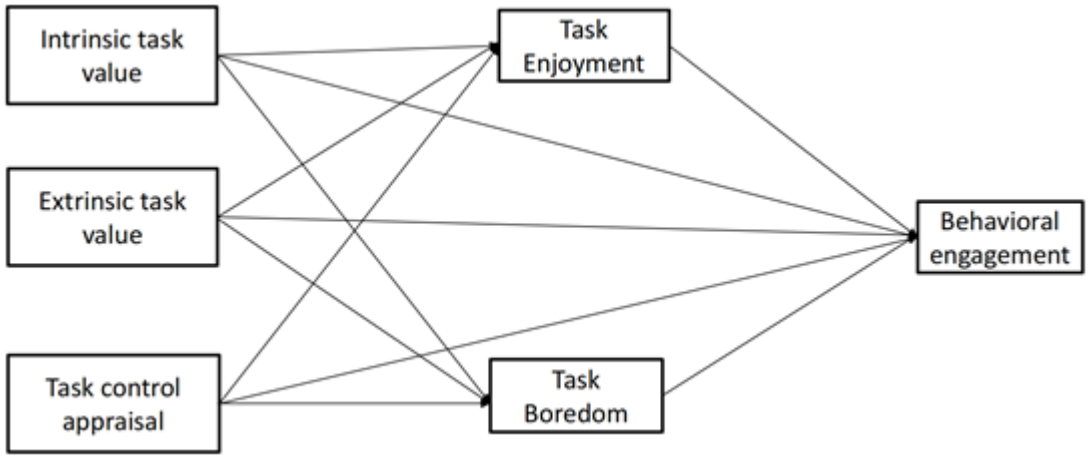
emotions and their antecedents and outcomes (Goetz, Frenzel, et al., 2006), a substantial gap remains in understanding how L2 learners perceive the task of vocabulary learning via mobile applications concerning controllability and task value. Furthermore, it is unclear how these perceptions engender distinct emotional experiences and, subsequently, variations in engagement within the context of AVL. The study reported below was undertaken in order to address these gaps.

The Present Study

In light of the gaps in existing literature, the present study seeks to explore how control-value appraisals relate to enjoyment, boredom, and behavioral engagement specifically within the context of AVL. Inspired by CVT and relevant literature, this research presents the mediating model shown in Figure 1 and details the specific hypotheses (Hs) that will be examined within the AVL framework.

Figure 1

Conceptual Model



H_1: Achievement emotions will significantly predict behavioral engagement.
H_{1a}: Enjoyment will positively predict behavioral engagement.
H_{1b}: Boredom will negatively predict behavioral engagement.
H_2: Control-value appraisals will significantly predict behavioral engagement.
H_{2a}: Intrinsic task value will positively predict behavioral engagement.
H_{2b}: Extrinsic task value will positively predict behavioral engagement.
H_{2c}: Task control appraisal will positively predict behavioral engagement.
H_3: Enjoyment and boredom will co-mediate the relationships between control value appraisals and behavioral engagement.
H_{3a}: Enjoyment and boredom will co-mediate the relationship between intrinsic task value and behavioral engagement.
H_{3b}: Enjoyment and boredom will co-mediate the relationship between extrinsic task value and behavioral engagement.
H_{3c}: Enjoyment and boredom will co-mediate the relationship between task control appraisal and behavioral engagement.

Methodology

Participants and Context

This research utilized convenience sampling to recruit first-year students who are non-English majors from a key university in Beijing, China. A group of 106 undergraduate students took part in the survey. The valid sample size was determined to be 98 students after removing data from eight students with invalid responses. Among the participants, 22 (21.4%) were female and 79 (78.6%) were male, and the average age was 18.58 (*SD* = .687). The average duration of their English learning was 10 years (*SD* = 2.352). Admission to this distinguished university was granted to all participants through *Gaokao*, and they were obligated to take a College English course delivered in a blended format, consisting of 4 hours per week (2 hours online and 2 hours face-to-face) for an academic year. Each semester concludes with a final exam that evaluates learners' language learning achievement, including vocabulary, listening, reading, translation and writing. All undergraduate students must undertake the College English Test Band 4, conducted twice annually in June and December.

Instruments

A composite questionnaire was utilized to gather quantitative data on participants' background information, such as gender and age, alongside the target variables of interest, including behavioral engagement, control-value appraisals, enjoyment, and boredom. Participants responded to all scales using a 6-point Likert scale, ranging from "1" (strongly disagree) to "6" (strongly agree). Original items were adapted by the first author to fit the current EFL context, with all scales translated into Chinese. To ensure content and face validity, the translated scales were back translated and further evaluated by two applied linguists and five university students.

Control-value appraisals measure

The Chinese versions of the scales measuring control appraisal and value appraisals, as used in the study by Li et al. (2021), were employed in this research. Three items measure an individual's self-perceived controllability, extrinsic value and intrinsic value of AVL, respectively. Example items are: "I have control over the effect of memorizing words with the app" (control-appraisal); "I simply like memorizing words with apps" (intrinsic value); and "It is very important for me to complete the word clock every week" (extrinsic value). CFA results indicated a satisfactory validity for the entire scale in the current study (χ^2/df = 26.337/15, p < .05; CFI = .971; TLI = .946; RMSEA = .088; SRMR = .061).

Measures of behavioral engagement

Students' behavioral engagement in AVL task was evaluated using the scale developed by Zhou et al. (2023). Item wording was modified to align with the context of AVL. Four items were used to assess students' behavioral engagement in this process. An example item is "I pay attention in memorizing words with apps." CFA results demonstrated good validity for the entire scale in the current study (χ^2/df = 1.529/2, p < .05; CFI = 1.000; TLI = 1.007; RMSEA = .000; SRMR = .013).

Measures of task enjoyment and boredom

The short form of the Achievement Emotions Questionnaire (AEQ-S; Bieleke et al., 2021) served to evaluate enjoyment and boredom in the context of AVL. Originally designed for broader educational psychology contexts, the AEQ targets emotions related to class, learning, and testing. This study specifically employed the learning-related enjoyment and boredom subscales, adjusting item wording to fit the AVL context. Example items are: "I enjoy using apps to memorize words" (learning-related enjoyment) and "I would rather put off this boring work till tomorrow" (learning-related boredom). CFA results indicated satisfactory validity for the entire scale in the current study ($\chi^2/df = 31.448/18$, $p < .05$; CFI = .961; TLI = .939; RMSEA = .087; SRMR = .072).

Procedure

At the beginning of the fall semester, students were encouraged to use their preferred apps for vocabulary memorization outside of class to better prepare for the upcoming College English Test Band 4. Students are encouraged to set their own goals (e.g., quantity) and choose their preferred apps to memorize vocabulary every week outside of class. They can choose the target vocabulary from any vocabulary bank provided by the app they choose. They also have the flexibility to choose when, where, and how to complete the task. The commonly used apps by the undergraduate students are BaiCiZhan, Bubei, Momo. To motivate their participation in this after-class activity, students who consistently completed this task each week throughout the semester were eligible to receive two bonus points towards their final course grade. The student monitor was responsible for collecting screenshots of task completion from students on a weekly basis. The questionnaire survey took place in the fifth week of the semester, after students had adjusted to the out-of-class tasks. Data collection received approval from the institution associated with the first author, and informed consent was obtained from participants before they completed the survey.

Data Analysis

First, descriptive and correlation analyses were conducted, with data normality evaluated through calculating skewness and kurtosis. Path analysis using maximum likelihood estimation in Mplus 8.3 examined both direct and indirect relationships among the variables. Bootstrapping was applied to evaluate the significance of mediating effects. In evaluating our model, we considered a range of fit indices and criteria. These included a Chi-square value with a significance level of $p > .05$, a comparative fit index (CFI) that exceeds .95, and the Tucker-Lewis index (TLI) greater than .95, as outlined by Hu and Bentler (1999). Additionally, we considered the root mean square error of approximation (RMSEA) with a threshold of less than .06 and a standardized root mean square residual (SRMR) of less than .08, following Kline' s (2016) guidelines. For interpreting the standardized regression coefficients, we followed Keith's (2006) framework, categorizing coefficients under .10 as small, those between .10 and .25 as moderate, and coefficients exceeding .25 as indicative of strong effects.

Results

Preliminary Results

Table 1 presents the descriptive results, normality check outcomes, and reliability indicators. The findings on skewness and kurtosis indicate that the data represented a normal distribution, enabling the implementation of intended statistical procedures.

Table 1

Descriptive Analyses of All Variables (N = 98)

Variables	Observed Range	Mean	*SD*	Skewness	*SE*	Kurtosis	*SE*	α
Intrinsic Task Value	1-6	3.62	0.89	-.293	.244	.729	.483	.852
Extrinsic Task Value	1-6	3.46	0.78	-.029		1.160		.612
Task Control Appraisal	1-6	3.64	0.88	-.245		.535		.734
Enjoyment	1-6	3.80	0.81	-.292		1.759		.792
Boredom	1-5.75	3.27	0.95	-.160		-.152		.863
Behavioral Engagement	1-6	3.88	0.81	-.214		1.548		.879

Table 2 reports the bivariate correlations among the variables. The matrix indicates a significant negative correlation between enjoyment and boredom (r = -.377, p < .01). Enjoyment was found to have a significant positive correlation with behavioral engagement (r = .604, p < .01). In contrast, boredom exhibited a significant negative correlation with behavioral engagement (r = -.285, p < .01). Additionally, intrinsic task value (r = .665, p < .01), task control appraisal (r = .545, p < .01), and extrinsic task value (r = .391, p < .01) all showed significant positive correlations with behavioral engagement.

Concerning control-value appraisals and the two emotions, intrinsic task value (r = .738, p < .01) and task control appraisal (r = .706, p < .01) showed strong positive correlations with enjoyment, while extrinsic value had a moderate positive correlation with enjoyment (r = .276, p < .01). For boredom, intrinsic task value (r = -.227, p > .01) and task control appraisal (r = -.136, p > .01) were negatively correlated but not significantly, whereas extrinsic task value had a significant positive correlation with boredom (r = .304, p < .01). Additionally, intrinsic task value, extrinsic task value, and task control appraisal were all positively and significantly correlated with one another.

Table 2

Correlation Coefficients Among all the Variables

Variables	1	2	3	4	5	6
Intrinsic Task Value	1					
Extrinsic Task Value	.366**	1				
Task Control Appraisal	.780**	.405**	1			
Enjoyment	.738**	.276**	.706**	1		
Boredom	-.227	.304**	-.136	-.377**	1	
Behavioral Engagement	.665**	.391**	.545**	.604**	-.285**	1

Note. *p < .05; **p < .01

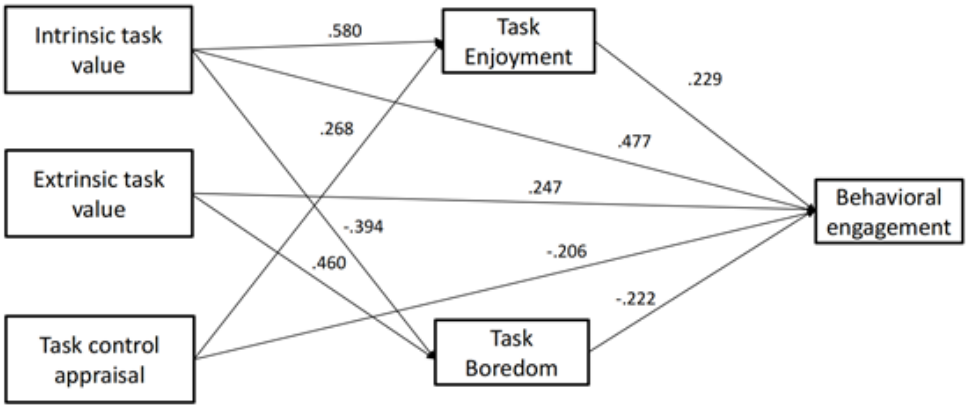
Path Analysis

A three-step method was utilized for path model testing. First, the initial theoretical model was assessed (see Figure 1), revealing it was a saturated model with excellent fit (CFI = 1.00,

RMSEA = .000). However, the analysis identified two non-significant paths: 1) from extrinsic task value to enjoyment and 2) from control value appraisal to boredom. To streamline the model, these two paths were removed. Subsequent analysis demonstrated that the revised model fit the data well (χ^2 = 2.224, df = 2, p = .329, CFI = .999, TLI = .993, RMSEA = .034, SRMR = .023). A chi-square difference test was carried out to assess the two nested models, which indicated no significant differences ($\Delta\chi^2$ = 2.224, df = 2, p > .1). Therefore, the final selected model was the more concise version, depicted in Figure 2.

Figure 2

Final Path Model with Standard Estimated Coefficients



Note. All coefficients were significant ($p \leq .05$), and are consistently put at the top of the corresponding path.

Direct Effects of Enjoyment and Anxiety on Behavioral Engagement

The findings largely support H_1 regarding the relationships between achievement emotions and behavioral engagement (see Table 3). Specifically, H_{1a} and H_{1b} were well supported, as enjoyment positively predicted behavioral engagement moderately (β = .229, t = 2.040), and boredom negatively predicted behavioral engagement moderately (β = -.222 t = -2.699). H_2, concerning the relations between control-value appraisals and behavioral engagement, received partial support in the current study. Specifically, H_{2a} and H_{2b} were supported, as intrinsic task value positively predicted behavioral engagement strongly (β = .477, t = 4.614), and extrinsic task value positively predicted behavioral engagement moderately (β =.247, t = 3.018). However, H_{2c} was not supported, as the path analysis revealed that task control appraisal negatively predicted behavioral engagement moderately (β = -.206, t = -2.257). It should be noted that this path became insignificant in the bootstrapping procedure (95%CI = [-.650, .069]).

Table 3

Estimates for Direct Effects

Predictor	Outcome	R^2	β	*SE*	*t*	*p* (Two-tailed)
Enjoyment	Behavioral	.553	.229	.112	2.040	.041
Boredom	Engagement		-.222	.082	-2.699	.007
Intrinsic Task Value			.477	.103	4.614	***
Extrinsic Task Value			.247	.082	3.018	.003
Task Control Appraisal			-.206	.091	-2.257	.024

*** p < .001

Mediating Effect of Achievement Emotions on the Link between Control-Value Appraisals and Behavioral Engagement

Bootstrapping was employed to evaluate the indirect effects of control-value appraisals on behavioral engagement via enjoyment and boredom. H_3, concerning the mediating effects, received substantial support (see Table 4). Figure 2 illustrates that four of the six paths from control-value appraisals to achievement emotions were significant, except the paths from extrinsic task value to enjoyment and from task control appraisal to boredom. Both paths from task enjoyment and boredom to behavioral engagement were significant, indicating that control-value appraisals exerted indirect effects on behavioral engagement through the two task emotions.

Table 4

Estimates and Confidence Intervals (CI) for Indirect Effects

Predictor	Mediator	Outcome	*β*	S.E.	*t*	95% CI
Intrinsic Task Value	Total Effect	Behavioral	.698	.096	7.294	[.425, .850]
	Enjoyment	Engagement	.133	.078	1.704	[-.020, .273]
	Boredom		.088	.047	1.856	[.015, .186]
Extrinsic Task Value	Total Effect	Behavioral	.145	.082	1.771	[-.012, .336]
	Boredom	Engagement	-.102	.048	-2.132	[-.242, -.027]
Task Control Appraisal	Total Effect	Behavioral Engagement	-.145	.127	-1.142	[-.557, .131]
	Enjoyment		.061	.035	1.734	[.002, .201]

Note. Confidence intervals at 95% (with 2000 bootstrap samples) that do not include zero indicate significant mediating effects.

Specifically, H_{3a} was well supported: intrinsic task value demonstrated a small to moderate positive indirect effect on behavioral engagement via enjoyment (β = .133, t = 1.704) and boredom (β = .088, t = 1.856). Partial support was found for H_{3b}. Specifically, extrinsic task value exhibited a small negative indirect effect on behavioral engagement through boredom (β = -.102, t = -2.132). However, no mediation effect was identified through enjoyment, due to the insignificant relationship between extrinsic task value and enjoyment. Lastly, H_{3c} was partially supported, showing that task control appraisal contributed a small positive indirect effect on behavioral engagement through enjoyment (β = .061, t = 1.734), while the connection from task control appraisal to boredom was insignificant.

Discussion

Predictive Effects of Enjoyment and Boredom on Behavioral Engagement

The findings demonstrate that enjoyment positively predicted behavioral engagement, thereby supporting H_{1a}. This correlation is consistent with assumptions in CVT (Pekrun, 2006) and previous research (Ding & Zhao, 2020; Feng & Hong, 2022; Shakki, 2023; Fredricks et al., 2004). The relationship between enjoyment and behavioral engagement can be accounted for in terms of the fact that experiencing enjoyment promotes students' motivation, innovative thinking, and persistence (Sadoughi & Hejazi, 2021), thereby enhancing behavioral engagement characterized by effort and persistence (Pekrun & Linnenbrink-Garcia, 2012). It

appears that the association between enjoyment and behavioral engagement is stable across mobile-assisted language learning environments and traditional learning approaches.

Supporting H_{1b}, the results show that boredom negatively predicted behavioral engagement, aligning with previous research (Derakhshan et al., 2022; Ding & Zhao, 2020; Shakki, 2023; Xie, 2021). As a negative and deactivating emotion, boredom can exert significant and harmful effects on students' behavior in learning (Pekrun et al., 2002), diminishing their motivation and negatively impacting academic performance (Li, 2021; Kruk & Zawodniak, 2018; Dewaele & Li, 2021). Consequently, it discourages students from putting additional effort into AVL.

Predictive Effects of Control-Value Appraisals on Behavioral Engagement

Firstly, it was observed that intrinsic task value positively influenced behavioral engagement, thereby supporting H_{2a}. This relationship is consistent with the findings of earlier studies (Camanru & Noels, 2009; Chen & Kraklow, 2014; Kanellopoulou & Giannakoulopoulos, 2020). In the L2 learning context, research indicates that learners driven by intrinsic motivation often find language acquisition enjoyable due to their inherent interest and the enjoyment they derive from the process (Chen & Kraklow, 2014). When students perceive language learning as meaningful and interesting, their engagement in the learning process tends to increase (Camanru & Noels, 2009).

Secondly, in support of H_{2b}, the findings revealed that extrinsic task value was a positive predictor of behavioral engagement. This result aligns with previous studies (e.g., Xiao & Hew, 2023). Extrinsic motivation arises from external factors, such as the desire to satisfy others, avoid undesirable outcomes, or receive rewards (Kanellopoulou & Giannakoulopoulos, 2020). This type of motivation does not lead to enjoyment, as demonstrated by both the current study and previous research (Li & Li, 2024), and can lead to higher levels of boredom. However, extrinsic value did encourage learners to engage in the vocabulary learning task. These findings provide evidence that both intrinsic and external motivation significantly predict engagement in English learning within the AVL context (Chen & Kraklow, 2014).

Contrary to H_{2c}, the findings revealed that task control appraisal has a negative rather than a positive impact on behavioral engagement, although the association was not significant in the bootstrapping procedure. This finding conflicts with earlier studies showing that students with higher self-efficacy generally demonstrate greater engagement in class (Galyon et al, 2011) and better L2 speaking performance (Derakhshan & Fathi, 2024). This negative, though insignificant, association between learners' control appraisal and behavior engagement might be explained by the distinctive context of AVL and learners' motivation for engaging in this out-of-class task. Given the convenience, immediacy, and amount of individual choice associated with mobile devices, most mobile language apps are designed and used in informal, outside-of-class contexts (Kynäslahti, 2003; Lopezet al., 2009; Cheonet al., 2012). In this study, students set their own goals to memorize vocabulary every week outside of class, which accorded them high autonomy and control over when and how to complete the task. However, due to certain restrictions in a mobile-assisted learning setting, such as the lack of peer scaffolding (Guo et al., 2022) and the absence of an instructor or authoritative figure (Eshach, 2007; Gerber et al., 2001) that could provide feedback, students might have a low task control appraisal concerning the effectiveness of using the app to memorize vocabulary. Nevertheless,

students may still devote a considerable amount of time to vocabulary memorization to obtain a score bonus or to manifest their belief that vocabulary memorization will enhance their language proficiency or assist them in passing the College English Test band 4 or band 6. Further research with in-depth qualitative data might help explain the specific relationship between learners' task-control appraisal, task motivation, and their task engagement.

Mediating Role of Enjoyment and Boredom

The results indicated that enjoyment and boredom mediated the relationship between control-value appraisals and behavioral engagement, providing partial support for H_3. The results highlight nuanced variations in the roles of enjoyment and boredom as mediators in the context of AVL.

Specifically, the results support H_{3a}, indicating that intrinsic task value exerts an indirect positive influence on behavioral engagement via enjoyment and boredom. The finding provides evidence that intrinsic task value has both a direct effect on behavioral engagement and an indirect impact by influencing achievement emotions. A task or learning material that is highly valued for its intrinsic worth enhances enjoyment (Li & Li, 2024; Li et al., 2023), which subsequently promotes positive outcomes like increased engagement (Yu et al., 2024; Feng & Hong, 2022). Simultaneously, intrinsic value sustains low levels of boredom (Putwain et al., 2018), and boredom can divert attention from the task and cause superficial information processing (Pekrun et al., 2002).

Partially supporting H_{3b}, extrinsic task value was shown to negatively influence behavioral engagement through boredom indirectly, not through enjoyment. Due to this negative indirect effect through boredom, the total effect of extrinsic value on learners' behavioral engagement in the task became insignificant. This is closely tied to the unique characteristics of extrinsic task value as well as the distinct AVL context. Extrinsic value appraisal involves the perceived instrumental utility of the activity along with the outcomes that result from its accomplishment (Pekrun, 2006). The characteristic of MALL, such as the absence of an instructor or an authoritative figure (Eshach, 2007; Gerber et al., 2001), combined with high extrinsic task value, may lead to high levels of boredom, which subsequently negatively impacts learners' willingness to communicate, interests, and engagement (Derakhshan et al., 2022; Kruk, 2016; Kruk & Zawodniak, 2018). Previous studies indicate that, despite the increasing popularity of app-assisted second language learning, it still faces persistent challenges related to low learner engagement (Botero et al., 2018).

Lastly, the results offer partial support for H_{3c}, as enjoyment mediated the relationship between task control appraisal and behavioral engagement, while boredom did not. Despite task control appraisal having a negative insignificant direct effect on behavioral engagement, it positively impacts task enjoyment, which in turn increases learners' behavioral engagement. The mediating role of task enjoyment is understandable. In accordance with CVT (Pekrun, 2006), when learners have high self-perceptions of their capability or competence to perform a task or high perceived control over desired outcomes, enjoyment is stimulated (Li & Li, 2024; Pekrun & Perry, 2014). This highlights the significance of positive emotions in fostering student engagement during the L2 learning process (MacIntyre, 2016).

Implications, Limitations, and Suggestions for Future Research

This research focused on the direct and indirect relationships among task control-value appraisals, task enjoyment, boredom, and behavioral engagement, highlighting the mechanisms that affect behavioral engagement in AVL outside the classroom for Chinese EFL learners. The findings support control-value theory while also expanding its relevance to the specific field of AVL.

The findings provide a basis for pedagogical implications regarding how EFL learners can be assisted to effectively regulate and manage their behavioral engagement in AVL through interventions targeting control-value appraisals. Considering the findings of this study related to the direct and indirect influences of intrinsic task value, extrinsic task value, and task control appraisal on behavioral engagement through achievement emotions, it is essential to implement interventions that simultaneously target control-value appraisals and achievement emotions in EFL learning. For one thing, encouraging students' intrinsic task value in vocabulary learning is crucial. For example, vocabulary software designers can incorporate creative activities in vocabulary learning based on promoting real life experiences fostering curiosity and interest, thereby helping students cultivate sustained intrinsic value over time (Rotgans & Schmidt, 2011). Given that control appraisal predicts enjoyment but not behavioral engagement, learners' perceived control over the effectiveness of AVL needs improvement. In order to achieve this goal, software designers can harness the motivational power of clear feedback and progress tracking by allowing students to monitor their progress and witness their improvement over time. Teachers can also design vocabulary activities in class to encourage learners to use the words and phrases they learned from apps in meaningful contexts, thus enabling them to recognize the effectiveness of their AVL and cultivate more intrinsic motivation. Additionally, teachers can provide feedback on goal attainment through direct measures (e.g., completing assignments) as well as comparative evaluations (e.g., outperforming peers), enabling learners to identify gaps between their learning goals and current progress, thus enhancing their sense of control over effectiveness. This approach could alleviate boredom while encouraging the motivation and involvement needed to actively bridge the gaps. By integrating these strategies seamlessly into vocabulary learning, teachers can cultivate an environment that strengthens students' autonomy, nurtures intrinsic motivation, and enhances positive emotional engagement, ultimately supporting the emotional well-being of Chinese EFL learners.

This study is subject to certain limitations that should be acknowledged. First, the study utilized a cross-sectional research design, which inherently limits its capacity to clarify causation between control-value appraisals, achievement emotions, and engagement on the specific AVL tasks. Future research could adopt a longitudinal approach to illuminate the intricate and evolving interactions among these factors. Second, learners' behavioral engagement in AVL may be largely impacted by the characteristics of the apps, which should be considered in future studies. Different app designs, functionalities, and user interfaces can influence student engagement and should be examined to understand their effects better. Third, the data for this study were gathered through self-reports from the participants. Self-report measurements may be affected by social desirability bias, which could skew the results towards the more positive end of the scales. While self-reports offer practicality and convenience,

future research should incorporate additional methods, including peer evaluations, teacher assessments, and interviews, to thoroughly validate the relationships among these variables.

Conclusion

Previous studies have recognized control-value appraisals as immediate determinants of enjoyment and boredom (Li et al., 2023) and have shown how achievement emotions influence learning engagement in classroom contexts (e.g., Li et al., 2025; Xu et al., 2023). This study broadens the application of CVT to out-of-class AVL, enhancing the growing body of research by demonstrating that control and value appraisals, along with their direct effects, indirectly influence behavioral engagement by initially shaping Chinese EFL learners' enjoyment and boredom in AVL tasks. To the best of our knowledge, this study is among the first empirical investigations into the complex relationships between control-value appraisals, achievement emotions, and behavioral engagement within the specific context of AVL among Chinese EFL learners. Future research in this area is warranted, including longitudinal investigations that would consider app characteristics to provide further insights into the complex interplay among control-value appraisals, achievement emotions, and behavioral engagement in technology-enhanced learning contexts.

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Ethics Declarations

Competing Interests

No, there are no conflicting interests.

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