

A Response Surface Analysis of the Interplay between Foreign Language Hope, Hopelessness, and Learner Engagement

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Abstract

Previous research has consistently revealed significant associations between foreign language (FL) hope (FL-H) and adaptive educational outcomes, primarily through correlational and linear approaches. However, less is known about how it functions along FL hopelessness (FL-HL) in shaping FL engagement, particularly when their interactive and nonlinear effects are considered. Addressing this important gap, the present study probed the intricate nexus between FLH, FL-HL and the three dimensions of FL engagement, including behavioral (BE), emotional (EE) and cognitive (CE) engagement among 457 university FL learners, using polynomial regression with response surface analysis (RSA). We examined the congruent and discrepancy effects between these two future-oriented emotions and each dimension of FL engagement. RSA results revealed that the congruence between FL-H and FL-HL was associated with progressively higher FL engagement as both emotions increased together and lower when low level of both was reported, suggesting that the absence of FL-HL alone is insufficient to enhance FL engagement when learners simultaneously lack hope. In fact, FL-H compensated for the detrimental effects of FL-HL, enabling FL learners to remain behaviorally, emotionally, and cognitively involved even when both emotions co-occurred. Nevertheless, the line of incongruence showed that congruence itself was not an optimal emotional state. Rather, FL engagement was highest when FL-H substantially predominated FL-HL and lowest when FL-HL outweighed FL-H, indicating that the discrepancy magnitude is less consequential than its direction. Pedagogical and methodological implications were also discussed.

Keywords: FL hope; FL hopelessness; learner engagement; polynomial regression; Response Surface Analysis

1. Introduction

Over the last two decades, emotions have emerged as one of the prominent topics in foreign language (FL) research (Prior, 2019). Once regarded by-products of cognition (Sharwood Smith, 2017), emotions are now recognized as key drivers of learners' wellbeing, performance, motivation, engagement and achievement (see Dewaele et al., 2019). Such growing scholarly attention reflects a broader recognition that FL learning is not merely cognitive experience but also inherently emotional. As such, understanding learners' emotional experiences and their potential effects on learning outcomes has become one of the crucial research agendas in educational psychology and applied linguistic research (Dewaele et al., 2019).

The advent of positive psychology (PP) has substantially reinforced this emotional turn by shifting scholarly attention from an exclusive focus on learners' deficits to emotional strengths that help them flourish (Seligman, 2011). Hence, a great flurry of research has probed the role of FL positive emotions such as enjoyment, hope, love, pride and grit (e.g., Derakhshan & Yin, 2025; Ibrahim, 2016; Khajavy & Lüftenegger, 2024; Pavelescu & Petrić, 2018; Seligman, 2018; Shao et al., 2020; Shao et al., 2026). Collectively, this body of research suggests that positive emotions play a vital role in fostering learners' performance, motivation, self-regulation strategies, engagement, and academic success.

Among these FL positive emotions, FL hope (FL-H) sparked increasing interest given its distinctive motivational functions. Hope reflects perceived determination and ability to attain future desired success (Snyder, 2002). Hopeful learners were found to maintain motivation in difficult moments, navigate setbacks and continue to invest sustained effort to achieve desired learning goals (MacIntyre & Gregersen, 2012). In addition, growing empirical evidence shows that FL-H is positively related to language learning outcomes. Previous studies have consistently yielded moderate to strong positive associations between FL-H and FL engagement, and achievement, willingness to invest energy, persistence and time in language learning tasks and activities (Derakhshan & Yin, 2025; Idan & Margalit, 2014; Jiang & Liu, 2024; Shao et al., 2020).

However, such extensive focus on positive experiences attracted criticism. Drawing on the second wave of PP (Lomas & Ivztan, 2015), scholars argue that the lack of balance between positive and negative emotions fails to understand the complex human emotional experiences (Held, 2004). Within academic settings, research suggests that positive and negative emotions are not two sides

of a single continuum (e.g., Dewaele & MacIntyre, 2014; Pekrun, 2024); instead, they are distinct psychological experiences that coexist and interact in shaping learners' outcomes.

This perspective is especially relevant for understanding FL hopelessness (FL-HL), a relatively understudied FL emotion. According to Control Value Theory (CVT; Pekrun, 2006, 2024), FL-H and FL-HL are two prospective emotions that arise from learners' perceptions of control and value appraisals. FL-H is an activating positive emotion that develops when learners highly value success and perceived as controllable and achievable, whereas FL-HL is a deactivating negative emotion, which emerges when a high value is assigned to success but perceived as largely unattainable or uncontrollable. Moreover, amid the scarcity of studies examining this unpleasant emotion, FL-HL was related to maladaptive roles. It was negatively associated with academic engagement and motivation (Pekrun & Linnenbrink-Garcia, 2022; Shao et al., 2020). CVT also advocates the relationship between these FL future-oriented emotions and FL engagement.

Furthermore, FL engagement has become one of the most studied cornerstones of successful language learning because it reflects the extent to which learners invest behavioral, emotional, and cognitive resources in classroom activities (Fredricks, 2004; Hiver et al., 2024; Mercer, 2019). In the past research, FL engagement has consistently been linked to emotions (e.g., Derakhshan & Yin, 2025; Pekrun & Linnenbrink-Garcia, 2022), motivation, achievement (e.g., Shao et al., 2026), teacher emotional support (e.g., Shen et al., 2024), Classroom environment (e.g., Derakhshan et al., 2022), and L2 self and growth mindset (e.g., Derakhshan et al., 2022). Given its pivotal role in language learning success, understanding the complex emotional experiences that shape FL engagement is a central objective of contemporary research.

The relationship between FL-H, FL-HL and FL engagement can be understood from the complementary perspectives of Broaden-and-Build Theory (Fredrickson, 2006) and CVT. That is, CVT explains the distal (e.g., autonomy support, feedback, and cultural context) and proximal (i.e., control-value appraisals) antecedents of FL-H and FL-HL, and how they are related to FL engagement. Broaden-and-Build Theory on the other hand explains how hope broadens learners' thoughts and builds cognitive, emotional and behavioral resources. As such, the two theoretical frameworks suggest that FL-H should facilitate FL cognitive, emotional and behavioral engagement, whereas, FL-HL should undermine them. Despite these theoretical advances, past research has largely examined FL-H and FL-H as independent predictors of learners' academic

outcomes, implicitly assuming that the impact of these emotions can be captured and understood independently. As such, little is known about how FL-HL is linked to learners' engagement or how it interacts with other positive emotions (e.g., FL-H). This provides a partial understanding of how learners' emotions shape their FL learning outcomes.

Addressing this gap in literature requires advanced analytical approaches and methods that can capture the joint predictive effects of multiple emotions. Polynomial regression combined with response surface analysis (RSA) are considered powerful tools to explore such configurations. They are useful and helpful in probing the effects of both congruence (similar levels of two constructs) and incongruence (different levels of two constructs) on another outcome variable (Edwards, 2002; Humberg et al., 2019). In this study, we adopted this configurational perspective by exploring the congruence and incongruence of FL-H and FL-HL in predicting FL learners' behavioral (BE), emotional (EE), and cognitive (CE) engagement. Drawing upon PP, BBT, and CVT, the study probes the joint predictive effects of these two prospective emotions on FL engagement rather than treating them as independent variables. Methodologically, this study advances the use and application of polynomial with RSA in applied linguistics and educational psychology, providing a more nuanced understanding of FL complex emotional experiences.

2. Literature Review

2.1 FL hope and hopelessness

FL-H and FL-HL are two influential future oriented emotions that shape learners' experiences in FL learning (Pekrun, 2024). Within CVT, FL-H is a positive activating emotion that reflects learners' perceptions and expectations to attain language learning outcomes and future success. Hopeful learners tend to exhibit greater engagement and achieve better academic outcomes (Derakhshan & Yin, 2025; Gao, 2025; Shao et al., 2020). Consistent with BBT, hope has also been identified as a positive construct that broadens individuals' cognitive repertoire, helping them achieve their goals (Fredrickson, 2006). Nevertheless, the important role of FL-H may be contingent partly on the broader emotional environment in which it functions, including the role of negative emotions that may attenuate or counterbalance its effects.

One of such emotions is FL-HL. CVT (Pekrun, 2006, 2014) posits that FL-HL is a negative deactivating emotion induced when learners highly value success but perceive that achieving it is

far beyond their control. It reflects a personal belief that invested effort is unlikely to influence achieving success. Consequently, hopeless learners are less likely to invest efforts, easily withdraw from academic activities and thus show lower levels of engagement (Pekrun & Linnenbrink-Garcia, 2022). This multiplicative mechanism has been empirically shown in the context of FL learning. Using latent interaction analysis, Shao et al. (2020) found a negative relationship between control-value appraisals and FL-HL, while the interaction between these antecedents strengthened this relationship. Their study revealed a positive link between positive emotions such as FL-H and learners' performance and appraisals. Pekrun et al. (2011, 2017) found a negative link between FL-HL and self-regulated learning, cognitive resource allocation, motivation, and academic achievement.

These findings supported CVT's assumption that FL-H and FL-HL are not two ends of a single continuum as they are distinct emotions arising from different combinations of control-value appraisals. Hence, learners may simultaneously experience FL-H and FL-HL toward different aspects of the same learning outcome. For instance, a FL learner may remain hopeful about achieving language related success while feeling hopeless about achieving success on a particular language test. Such emotional complexity indicates that positive and negative emotions (e.g., FL-H and FL-HL) should not be treated as opposing sides of a single continuum but rather as related yet distinct emotional constructs that may interact in meaningful ways. This conceptualization highlights the importance of using advanced methodological approaches (e.g., polynomial regression with RSA) to examine how positive and negative emotional experiences jointly shape learning outcomes.

2.2 Learner engagement in language learning

Learner engagement has become one of the most prominent factors of successful language learning (Hiver et al., 2024; Mercer, 2019). Broadly defined, it is a multidimensional construct, comprising behavioral, emotional, and cognitive dimensions; that reflects the extent to which FL learners invest behavioral, emotional, and cognitive resources in language learning process (Fredricks et al., 2004; Hiver et al., 2024; Mercer, 2019). BE refers to learners' participation in classroom and social activities. EE has to do with the affective involvement in the learning process. CE denotes the mental effort and deep learning strategies to understand language materials (Hiver et al., 2024). Although a great flurry of research adopted this three-dimension engagement, some scholars

suggested other dimensions such as social dimension (Svalberg, 2009) and agentic (Oga-Baldwin, 2019).

The growing prominence of engagement in FL learning is widely attributable to its consistent link with language learning outcomes. An extensive body of past research found that FL engagement were linked to stronger motivation, greater language proficiency, improved academic achievement, and increased willingness to communicate (e.g., Hiver et al., 2024; Mercer, 2019; Shao et al., 2026). As such, because it reflects learners' active involvement in language activities, FL engagement is increasingly regarded as an influential and crucial proximal antecedent of successful language learning outcomes (Mercer, 2019).

Furthermore, a growing body of research has highlighted the central role of FL emotions in shaping FL engagement. CVT (Pekrun, 2024) posits that FL emotions have direct influence on FL engagement by shaping learners' motivation, attention and cognitive recourses. Positive emotions (e.g., FL-H) tend to enhance learners' engagement by helping them explore challenging tasks and invest greater effort. In contrast, negative emotions (e.g., FL-HL) diminish cognitive investment and reduce learners' willingness to participate in learning activities (Pekrun & Linnenbrink-Garcia, 2022). Consistent with CVT propositions, previous studies have found that positive emotions such as hope, enjoyment, and pride (e.g., Derakhshan & Yin, 2025) positively predict FL engagement, while negative emotions such as boredom (e.g., Derakhshan et al., 2022; Hiver et al., 2021; Tsang & Dewaele, 2023) are generally linked to disengagement.

Although the substantial effort made to understand FL engagement, several gaps remained relatively unexplored. Much of the existing research has focused on the role of specific emotions, including FL enjoyment, boredom and anxiety (e.g., Tsang & Dewaele, 2023; Wang et al., 2023), whereas less empirical attention has been paid to how activating and deactivation emotions such as FL-H and FL-HL are related to FL engagement. We strongly believe that examining how these prospective emotions jointly contribute to FL engagement, using an advanced analytical approach, will provide a more comprehensive understanding of learners' complex emotional states and offer insights into the affective indicators that boost or impede effective language learning.

2.3 Polynomial regression and Response Surface Analysis

Polynomial regression and RSA is an advanced analysis method used to probe how different levels of agreement, discrepancies and fit between two conceptually related predictor variables are linked to an outcome variable (Humberg et al., 2019). In the past research, researchers relied heavily on traditional approaches such as difference scores to explore such relationships. However, difference scores have been described as limited in terms of reliability and the inability to capture the unique contribution of each predictor variable (Shanock et al., 2010). Therefore, Polynomial regression and RSA emerged as a powerful tool, which overcome these shortcomings by simultaneously both predictor variables while allowing for nonlinear relationships. RSA converts the polynomial regression coefficients into a three dimensional response surface that makes the interpretation of the congruence and incongruence effects more comprehensive. Furthermore, the quadratic polynomial regression equation is $Z = b_0 + b_1X + b_2Y + b_3X^2 + b_4XY + b_5Y^2 + e$ (See Schröder-Abét et al., 2007), where Z is the outcome variable, X and Y are the predictors, b_0 is the intercept, b_1 and b_2 are the linear effects, b_3 and b_5 are the quadratic effects, b_4 is the interaction effect, and e is the error term. To reduce multicollinearity, predictors are mean-centered before estimation.

RSA provides a more comprehensive understanding of both the unique and joint predictive effects of the predictors through the examination of the shape of the regression surface. This is typically done through evaluating two different lines, the line of congruence (LOC) and the line of incongruence (LOIC). The LOC represents all the combinations where the predictor variables are equal ($X = Y$), reflecting perfect congruence between them. This allows researchers to explore how the outcome changes when the two predictors increase or decrease in tandem. The LOC is characterized by its slope ($a_1 = b_1 + b_2$) and its curvature ($a_2 = b_3 + b_4 + b_5$). A positive slope indicates that higher levels of agreement between the predictors are linked to higher levels of the outcome, while a significant curvature suggests a nonlinear association. On the other hand, the LOIC represents all the combinations where the predictor variables are opposite in directions ($X = -Y$), indicating discrepancies between them. The LOIC is characterized by its slope ($a_3 = b_1 - b_2$) and its curvature ($a_4 = b_3 - b_4 + b_5$). The slope along the LOIC suggests whether the outcome changes according to which predictor is relatively higher. A significant curvature reflects whether larger discrepancies between the predictor variables are related to high or low levels in the outcome variable.

In the present study, polynomial and RSA were employed to examine how congruence between FL hope and FL hopelessness influences the three dimensions of learner FL engagement. RSA was used to reveal several meaningful patterns, including the congruence and discrepancy effects, directional discrepancy effects and curvilinear congruence effect. For a more comprehensive interpretation of the results, such patterns were visualized using the examination of surface coefficients, three-dimensional surface plots and the contour plots. As such, the following research questions were explored in this study:

1. How do FL hope and FL hopelessness jointly relate to the three dimensions of FL engagement?
2. Does congruence between FL hope and FL hopelessness predict the three dimensions of FL engagement?
3. How do discrepancies between FL hope and FL hopelessness affect the three dimensions of FL engagement?

3. Method

3.1 Participants

The participants were 453 students enrolled at EFL courses at (university and country blinded). The sample comprised 319 females, 131 males, and 3 participants preferred not to disclose their gender, with ages ranging from 18 to 69 ($M = 29.36$; $SD = 11.60$). The sample included 182 bilinguals, 222 trilinguals, and 49 who spoke four or more languages. The sample was heterogeneous representing different academic levels, including 275 undergraduates, 168 masters, and 10 Ph.D. candidates, and represented a range of academic disciplines such as communication studies, language studies, and religious studies.

A convenience snowball sampling technique was adopted. Data were collected through an online questionnaire disseminated via Google Forms. Before completing the questionnaire, the participants were informed about the purposes of the study, anonymity, confidentiality, and provided informed consent. The dataset contained no missing responses as all questions were set as non-skippable.

3.2 Instruments

FL Hope ($\alpha = .770$, $\omega = .781$) and *FL Hopelessness* ($\alpha = .837$, $\omega = .843$)

FL-H and FL-HL were measured using scales from the achievement Emotions Questionnaire (Bieleke et al., 2021) and subsequently adapted to the FL context by Chen et al., 2025 (the achievement Emotions Questionnaire for Foreign Language Classroom-Short Form (AEQ-FLC-S)). Participants responded on all items using a 5-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree, with higher scores indicating higher levels of FL-H and FL-HL, respectively. Sample items for FL-H included “I am full of hope when I go to the college English class” and “I am confident when I go to the college English class”. Items for FL-HL included “I have lost all hope in understanding the college English class” and “I feel hopeless in the college English class”

Behavioral Engagement ($\alpha = .839$, $\omega = .842$), *Emotional Engagement* ($\alpha = .844$, $\omega = .846$), and *Cognitive Engagement* ($\alpha = .797$, $\omega = .805$)

The three dimensions of FL engagement (i.e., BE, EE, and CE) were measured using the short language classroom engagement scale (LCES) developed by Eerdemutu et al. (2024). The instrument conceptualized FL engagement as a multidimensional variable, including behavioural, emotional and cognitive aspects of FL learning. Participants responded to 9 items using a 5-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree, with higher scores indicating higher levels of FL engagement. Items included “When I cannot understand in my language class, I stay focused until I do” (BE), “I feel good when I am in my language class” (EE), and “I try to connect what I am learning in the language classroom to what I have learned” (CE).

3.3 Data analysis

The data were analyzed following a multi-step approach. First, preliminary analysis were performed to examine the data for potential univariate and multivariate outliers, normality, homoscedasticity and descriptive statistics using IBM SPSS Statistics (Version 26) (IBM Corp., 2019). Second, confirmatory factor analysis (CFA), using Lavaan (Rosseel, 2012) in R, was performed to examine the factorial structures of the measures prior to testing the proposed relationships between the study variables. Model adequacy was assessed using multiple fit indices, including chi-square/degrees of freedom ratio (χ^2/df), the Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and the Standardized Root Mean Square Residual (SRMR) following Kenny (2020) suggested values. In line with the aims of the present study, polynomial regression and RSA were employed to investigate the joint

effects of FL hope and FL hopelessness on each of the three dimensions of learner engagement. Internal consistency reliability was calculated using Cronbach's alpha, McDonald's omega, and composite reliability.

To examine the congruence and incongruence between FL hope and FL hopelessness on each of the student engagement dimensions, the RSA package in R studio (Schönbrodt & Humberg, 2018) was used. Before creating the polynomial terms, the two predictor variables (FL hope and hopelessness) were mean centered to avoid multicollinearity issues. A separate polynomial regression model was estimated and tested for each dimension of engagement, following polynomial regression equation $Z = b_0 + b_1X + b_2Y + b_3X^2 + b_4XY + b_5Y^2 + e$, where Z represents the outcome variables (i.e., BE, EE, and CE), X represents FL hope and Y represents FL hopelessness. Afterwards, the four surface test values (i.e., a_1 - a_4) were examined, where a_1 ($b_1 + b_2$) and a_2 ($b_3 + b_4 + b_5$) are the slope and the curvature along the line of congruence respectively. For the slope and the curvature along the line of incongruence, they were represented by a_3 ($b_1 - b_2$) and a_4 ($b_3 - b_4 + b_5$) respectively. Finally, to visually illustrate and interpret the relationships among the study variables, three-dimensional RSA plots were generated using RSA package in R.

Furthermore, to examine the distribution of predictor variables pairs, standardized scores were compared based on the half-standard-deviation criterion (Humberg et al., 2019). Three cases were determined (i.e., FL Hope = FL Hopelessness, FL hope > FL Hopelessness, and FL Hope < FL Hopelessness).

4. Results

4.1 Preliminary checks

Following Humberg et al. (2019) guidelines to perform a polynomial regression with RSA, a set of preliminary checks were evaluated and confirmed. After centering the predictor variables on the grand mean, the distribution of predictor variables pairs was relatively balanced. The findings yielded adequate representation of congruence and incongruence, supporting the data suitability for RSA. Multicollinearity for the five polynomial predictors was verified using variance inflation factor (VIF). All the values ranged from 1.68 and 2.87, indicating that multicollinearity is below the recommended cutoff of < 5 (Hair et al., 2019). In addition, CFA and standard indices were used to evaluate the factorial validity of the measurement model. The findings revealed satisfactory

factorial validity through a good to close fit to the data: $\chi^2/df = 3.08$; CFI = 0.955, TLI = 0.943; RMSEA = 0.068 (90% CI [0.060, 0.071]); and SRMR = 0.037 (Kenny, 2020). Regarding the average variance extracted (AVE) coefficients; they were all above .50 for all constructs (Hair et al., 2019). An exception was observed for FL hope (AVE = .441), where item three was weakly loaded (.441). The AVE improved to .546 after removal, supporting convergent validity. Furthermore, standardized estimates exceeded .60 and all factor loadings were statistically significant ($p < .001$), supporting adequate indicator reliability. All constructs revealed good internal consistency, with composite reliability, McDonald's omega and Cronbach's alpha values exceeding the recommended threshold of .70.

4.2 Descriptive statistics and correlation analysis of all variables

Table 1 presents the descriptive statistics for the study variables. The results show that participants reported high level of FL-H ($M = 3.72$, $SD = .83$), and FL engagement dimensions, including BE ($M = 3.81$, $SD = .77$), EE ($M = 3.86$, $SD = .78$), and CE ($M = 3.77$, $SD = .75$). These results indicate that participants were generally engaged in FL learning. In contrast, FL-HL exhibited a relatively low score ($M = 1.78$, $SD = .76$), reflecting limited experience of negative emotions during language learning activities.

Table 1

Descriptive Statistics

	Min	Max	M	SD
FL-H	1	5	3.72	.83
FL-HL	1	4.25	1.78	.76
BE	1	5	3.81	.77
EE	1	5	3.86	.78
CE	1	5	3.77	.75

Table 2 shows the correlation among FL-H, FL-HL, and the three dimensions of FL engagement (i.e., BE, EE, and CE). The findings yielded a significant correlation among all study variables (p

< 0.01). Following the benchmark guidelines proposed by Botes et al. (2025), FL-H was had a moderate to strong and positive correlation with BE ($r = .543$, $p < .001$), EE ($r = .583$, $p < .001$), and CE ($r = .538$, $p < .001$). Conversely, FL-HL showed a medium to large relationship with BE ($r = -.458$, $p < .001$), EE ($r = -.443$, $p < .001$), and CE ($r = -.397$, $p < .001$). In addition, FL-H and FL-HL were strongly and negatively correlated ($r = -.552$, $p < .001$). Finally, strong associations were found between FL engagement dimensions, with correlations ranging from .714 to .770 (all $ps < .001$). These strong correlations suggest that the three dimensions of FL engagement (i.e., BE, EE, and CE) are connected while remaining conceptually distinct.

These findings indicate that higher FL-H is linked to greater FL engagement, while higher FL-HL is related to lower FL engagement in FL learning. Additionally, the correlation between the predictors (i.e., FL-H and FL-HL) were in the expected magnitude and direction. Importantly, the correlation did not approach levels that would lead to multicollinearity problems, supporting collinearity requirement for polynomial and RSA.

Table 2

Correlation Matrix

	FL-H	FL-HL	BE	EE	CE
FL-H	1				
FL-HL	-.552**	1			
BE	.543**	-.458**	1		
EE	.583**	-.443**	.770**	1	
CE	.538**	-.397**	.714**	.757**	1

**. Correlation is significant at the 0.01 level (2-tailed).

4.3 Polynomial regression and Response Surface Analysis

Polynomial regression and RSA were conducted to assess the congruence and incongruence effects between FL-H and FL-HL on each of the three dimensions of FL engagement, including BE, EE, and CE. Concerning the distribution of respondents across congruence categories, 188 participants (41.5%) reported higher levels of FL-H than FL-HL, 116 (25.61%) showed congruent levels across FL-H and FL-HL, while 149 (32.89%) exhibited higher levels of FL-HL than FL-H. Among the

three RSA models, the strongest predictive power was observed for EE accounting for 36.9% of variance, followed by BE (33.9%) and CE (30.8%).

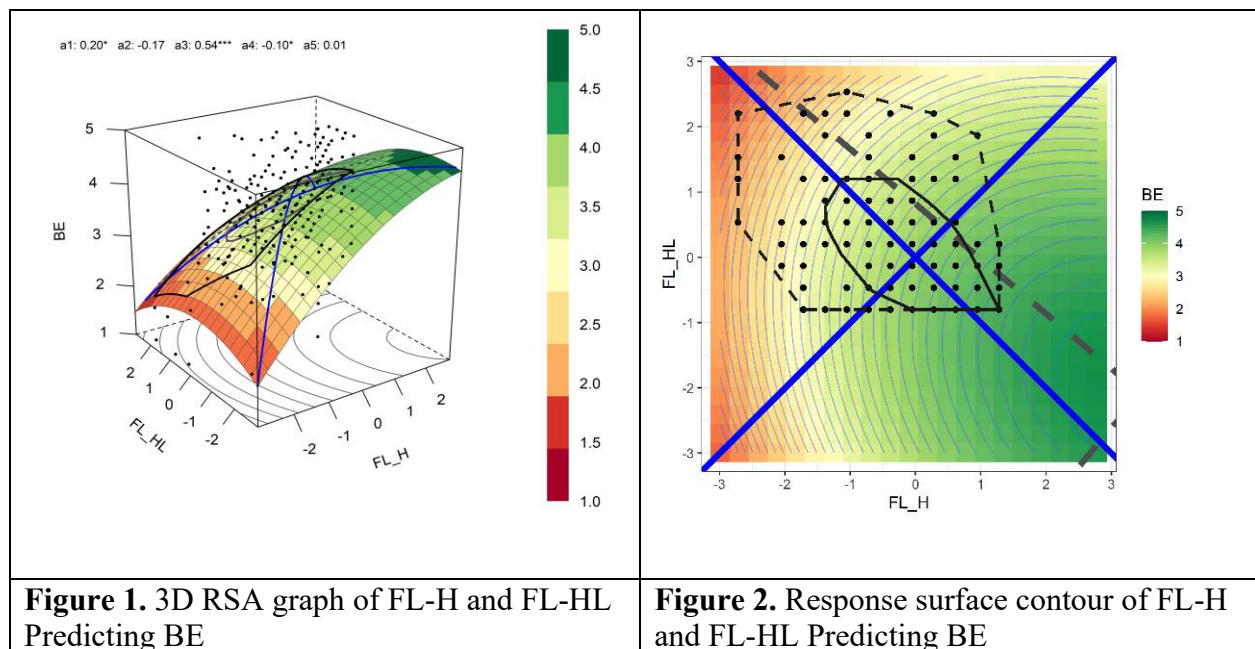
The full Polynomial regression model for FL-H and FL-HL effects on BE was statistically significant ($F(5, 447) = 45.91$; $p < .001$, $R^2 = .339$). As table 3 shows, the RSA yielded a significant positive slope along the LOC ($a_1 = .200$, $p = .019$), suggesting that BE increased as congruent levels of FL-H and FL-HL increased. Nevertheless, the curvature along the LOC turned out to be non-significant ($a_2 = -.172$, $p = .233$), indicating a linear rather than curvilinear relationship. In addition, the slope along LOIC was significantly positive ($a_3 = .541$, $p < .001$), suggesting that BE was substantially higher when FL-H exceeded FL-HL than when FL-HL exceeded FL-HL. The curvature along the LOIC was significant and negative ($a_4 = -.099$, $p = .043$), showing that BE decreased as discrepancies between the two predictor variables became larger, indicating a downward curvature (see figures 1 and 2). Therefore, although having more FL-H than FL-HL was helpful, very large discrepancies were linked to diminishing gains in BE.

Table 3

Polynomial Regression Results of FL-H and FL-HL on BE

	Est.	SE	ci. lower	ci. upper	β	P
b_1	.370	.045	.283	.458	.402	$p < .001^{***}$
b_2	-.170	.054	-.277	-.064	-.171	$p < .001^{**}$
b_3	-.065	.057	-.176	.046	-.090	$p = .254$
b_4	-.036	.074	-.182	.109	-.037	$p = .625$
b_5	-.071	.051	-.172	.030	-.090	$p = .168$
$a_1 = b_1 + b_2$	.200	.085	.033	.366		$p = .019^*$
$a_2 = b_3 + b_4 + b_5$	-.0172	.144	-.454	.110		$p = .233$
$a_3 = b_1 - b_2$	.541	.052	.439	.642		$p < .001^{***}$
$a_4 = b_3 - b_4 + b_5$	-.099	.049	-.196	-.003		$p = .043^*$

* $p < .05$. ** $p < .01$. *** $p < .001$.



The overall Polynomial regression model for FL-H and FL-HL effects on EE was statistically significant, ($F(5, 447) = 52.32, p < .001, R^2 = .369$), with a positive slope along the LOC ($a_1 = .307, p < .001$). Therefore, EE increased when FL-H and FL-HL moved together from low-low to high-high combinations. However, the curvature along the LOC was non-significant ($a_2 = -.271, p = .055$), showing that the relationship was linear rather than curvilinear. The results revealed a highly significant positive slope along the LOIC ($a_3 = .576, p < .001$). EE thus was substantially higher when FL-H exceeded FL-HL. The curvature along the LOIC was found to be non-significant ($a_4 = -.054, p = .364$), showing that discrepancies between FL-H and FL-HL did not exert nonlinear effects on EE (see table 4 and figures 3 and 4).

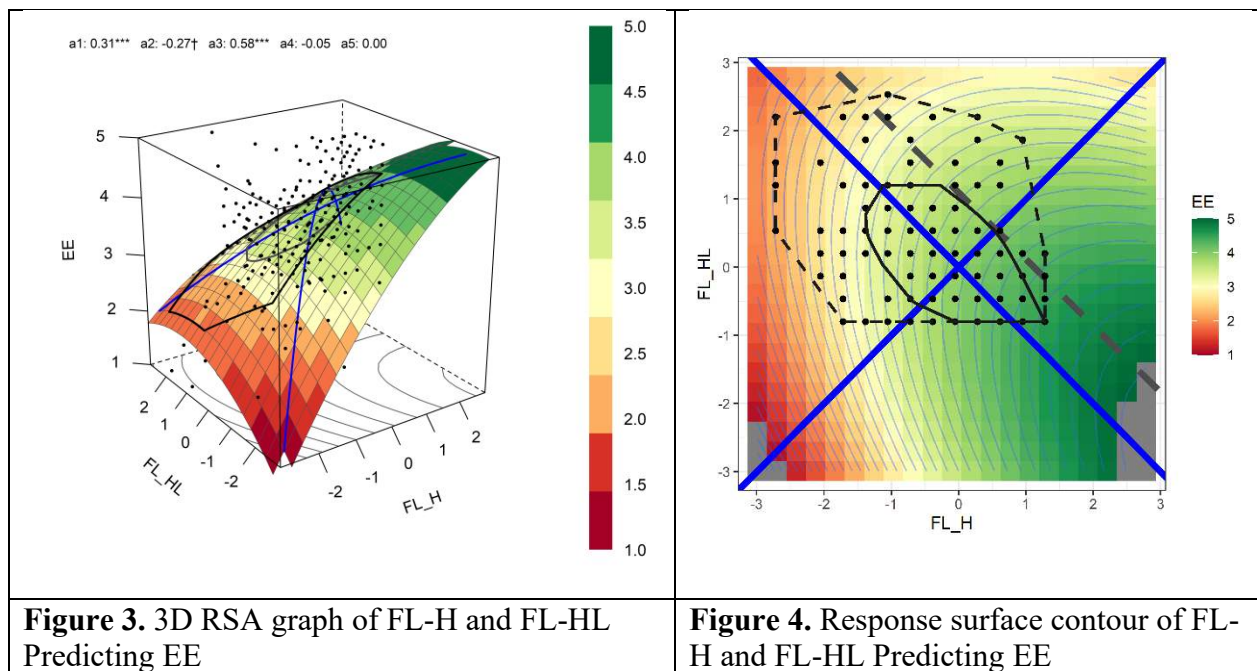
Table 4

Polynomial Regression Results of FL-H and FL-HL on EE

	Est.	SE	ci. lower	ci. upper	β	P
b ₁	.441	.046	.351	.532	.471	$p < .001^{***}$
b ₂	-.135	.056	-.245	-.024	-.133	$p = .017^*$
b ₃	-.080	.048	-.175	.015	-.109	$p = .099$
b ₄	-.108	.080	-.264	.048	-.107	$p = .173$

b_5	-.083	.053	-.186	.021	-.103	$p = .119$
$a_1 = b_1 + b_2$	.307	.090	.130	.484		$p < .001^{***}$
$a_2 = b_3 + b_4 + b_5$	-.271	.141	-.548	.006		$p = .055$
$a_3 = b_1 - b_2$	.576	.050	.479	.673		$p < .001^{***}$
$a_4 = b_3 - b_4 + b_5$	-.054	.060	-.171	.063		$p = .364$

* $p < .05$. *** $p < .001$.



The third Polynomial regression model for FL-H and FL-HL effects on CE was statistically significant $F(5, 447) = 39.80, p < .001, R^2 = .308$). as table 5 shows, the results yielded a significant positive slope along the LOC ($a_1 = .324, p < .001$), indicating that CE increased while FL-H and FL-HL increased together. No evidence for non-linear effect was found as the curvature along the LOC was found non-significant ($a_2 = .079, p = .521$). In a similar way, the slope along the LOIC was significant ($a_3 = .504, p < .001$), showing higher CE when FL-H exceeded FL-HL. The curvature along the LOIC approached statistical significance ($a_4 = -.096, p = .057$) (see figures 5 and 6).

Table 5

Polynomial Regression Results of FL-H and FL-HL on CE

	Est.	SE	ci. lower	ci. upper	β	P
b_1	.414	.045	.326	.502	.459	$p < .001^{***}$
b_2	-.090	.056	-.199	-.019	-.093	$p = .105$
b_3	-.013	.042	-.096	.070	-.018	$p = .759$
b_4	.088	.065	-.039	.214	.090	$p = .175$
b_5	.004	.055	-.103	.112	.006	$p = .935$
$a_1 = b_1 + b_2$	.324	.087	.153	.494		$p < .001^{***}$
$a_2 = b_3 + b_4 + b_5$	.504	.123	-.162	.320		$p = .521$
$a_3 = b_1 - b_2$	-.096	.051	.404	.605		$p < .001^{***}$
$a_4 = b_3 - b_4 + b_5$	-.018	.051	-.195	.003		$p = .057$

*** $p < .001$.

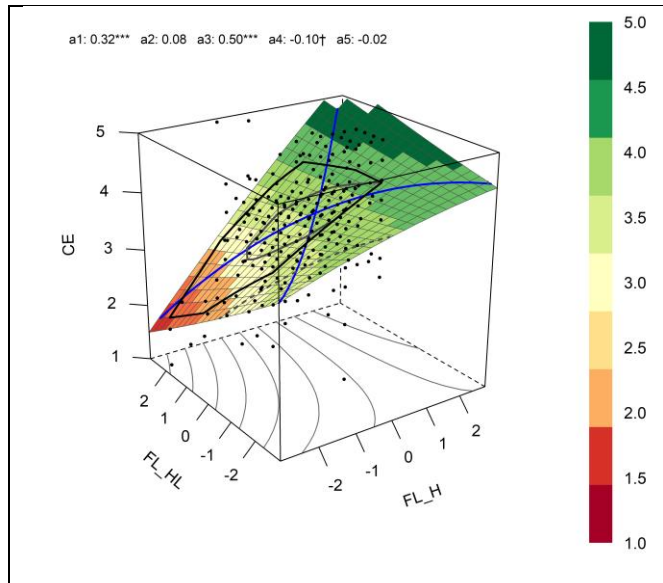


Figure 5. 3D RSA graph of FL-H and FL-HL Predicting CE

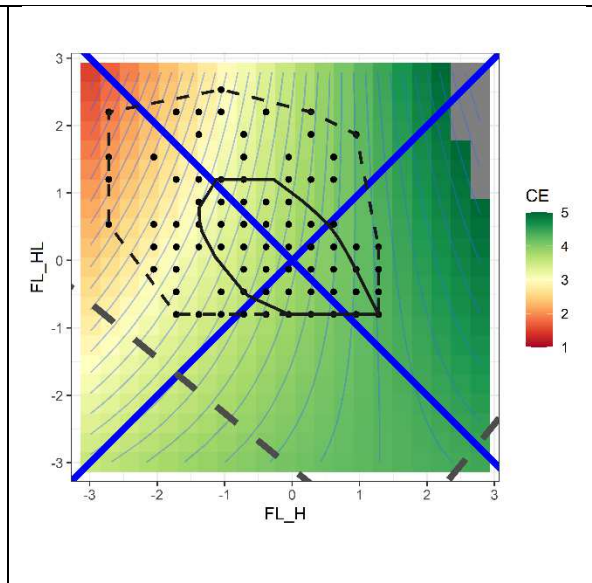


Figure 6. Response surface contour of FL-H and FL-HL Predicting CE

5. Discussion

The present study examined how FL-H and FL-HL jointly relate to the three dimensions of FL engagement (i.e., BE, EE, and CE) using polynomial regression and RSA. The findings revealed that FL-H and FL-HL were strongly and negatively correlated ($r = .552$). FL-H and FL-HL had

positive and negative correlations (correlations range from $-.397$ to $.583$) with each of the three dimensions of FL engagement respectively. In addition, the three full polynomial regression models for FL-H and FL-HL effects on BE, EE and CE were statistically significant. The RSA for the three models yielded a positive slope along LOC (a_1) and LOIC (a_3), while the curvature along the LOC turned out to be non-significant (a_2). Nevertheless, the curvature along the LOIC (a_4) was found to be non-significant for EE and CE and still significant only for BE.

RQ1. How do FL hope and FL hopelessness jointly relate to FL engagement?

The first research question probed the combined relationship between FL-H and FL-HL and the three dimensions of FL engagement. The findings showed that the three polynomial models significantly predicted BE ($R^2 = .339$), EE ($R^2 = .369$) and CE ($R^2 = .308$). FL-H emerged as a strong positive predictor across all models, whereas FL-HL had weaker negative impact and had no predicting effect on CE. In addition, the results revealed a positive and strong relationship between FL-H and BE ($r = .543$), EE ($r = .583$) and CE ($r = .538$), whereas FL-HL yielded moderate to strong association with the three dimensions of FL engagement (ranging from $-.397$ to $-.458$)

These findings largely align with prior linear analysis research indicating that FL-H is considered a central motivational mechanism that help learners show higher engagement through encouraging sustained effort, agency beliefs and pathways to overcome obstacles (e.g., Derakhshan & Yin, 2025; MacIntyre & Gregersen, 2012; Rand, 2018). Similarly, previous research grounded in CVT showed that positive future oriented emotions (e.g., FL-H) enhance learners' motivation to engage in learning activities, whereas negative future oriented emotions (e.g., FL-HL) tend to diminish active participation (e.g., Pekrun & Linnenbrink-Garcia, 2022; Shao et al., 2020). However, consistent with some prior research (e.g., Grewal & Porter 2007; Sullivan 2003), the present study extends this line of research by showing that FL-H and FL-HL are two distinct psychological processes and not opposite ends of a continuum. Although they were found to be strongly negatively related ($r = -.552$), each construct contributed uniquely and significantly to FL engagement. The present results suggest that FL-H serves as a powerful motivational asset that helps learners invest effort, enjoy learning and promote deeper cognitive investment. In contrast, FL-HL appears to play a limited role, undermining primarily BE and EE. These differential effects suggest that FL engagement is driven more by the presence of the positive beliefs about future achievement than merely by the absence of negative expectations. As such, the findings highlight

that fostering FL-H may be more effective in enhancing FL engagement rather than merely focusing on reducing FL-HL.

RQ2. Does congruence between FL hope and FL hopelessness predict the three dimensions of FL engagement?

The second research question investigated whether the three dimensions of FL engagement reached their highest level when FL-H and FL-HL were congruent. Although positive slopes along LOC for the three dimensions of FL engagement were found, the curvature parameters turned out to be non-significant, indicating that when FL-H and FL-HL increased together, FL engagement approximately linearly increased.

The LOC offers valuable insights into learners' FL engagement when FL-H and FL-HL co-exist at similar intensities. Across the three dimensions of FL engagement, learners reporting high levels of both FL-H and FL-HL substantially demonstrated higher FL engagement, whereas learners reporting low levels of both emotions consistently exhibited lowest FL engagement. Such finding is strongly consistent with a recent RSA study by Wang et al. (2025) that investigated the congruence effect of FL enjoyment and anxiety on learner engagement and interactions. Their RSA yielded a positive linear relationship, with the outcomes being high when the two constructs were high. However, this finding diverges from Botes et al., 2022 RSA study, which found that the congruence between FL anxiety and enjoyment at low levels produced higher perceived performance and produced moderate perceived performance at high levels. This pattern was interpreted as an evidence that the absence of FL anxiety could compensate for the absence of FL engagement. Our findings depart from this pattern. In the current study, low-low congruence between FL-H and FL-HL did not produce higher FL engagement. Rather, FL engagement was lower when both emotions were low and increased as both constructs rose. Such divergence may reflect the distinct emotional functions of these constructs. That is, FL anxiety represents an aversive psychological state that may be directly linked to perceived performance, while FL-HL may co-occur with hopeful expectations without negating learners' capacity to engage.

This finding suggests a compensatory interplay between FL-H and FL-HL. More specifically, high level of FL-H appears to partially buffer the detrimental effects associated to FL-HL. That is, hopeful learners who still harbor doubts about learning activities prospects remained behaviorally, emotionally, and cognitively engaged. Nevertheless, this notion of compensation is incomplete as

the significant ridge shifts observed across the FL engagement dimensions in all models suggest that the highest levels of FL engagement happened away from LOC. Hence, it is necessary to analyze the LOIC to have a full picture of the in/congruent effects. Importantly, this compensatory pattern extends theoretical understandings of FL-H and FL-HL, as future-oriented emotions, that they are not opposing forces. From the perspective of hope theory (Synder, 2002), hope is evoked from learners' capacity to identify pathways towards the valued goals and maintain motivational agency to pursue them despite obstacles. The present findings suggest that these hopeful expectations remain active even with the presence of hopeless beliefs, with their relative strength determining subsequent FL engagement. This interpretation aligns with contemporary PP perspective and studies (e.g., Held, 2004; Lomas & Ivztan, 2015), which posit that positive and negative emotions interact and co-exist and not representing opposing ends of the same continuum. Accordingly, hopeful FL learners may remain behaviorally, emotionally and cognitively engaged even when they have negative future expectations.

RQ3. How do discrepancies between FL hope and FL hopelessness affect the three dimensions of FL engagement?

The third research question explored whether the discrepancies between FL-H and FL-HL influence the three dimensions of FL engagement. More specifically, this question explored whether discrepancies reduce FL engagement and whether FL engagement is higher when FL-H exceeds FL-HL than when FL-HL exceeds FL-H. RSA results yielded a significant nonlinear effect along LOIC. As such, the pattern did not reveal that discrepancy effects per se reduce FL engagement. Rather, the direction of the discrepancy was more influential than its magnitude. This finding suggests that as FL learners moved from a psychological profile, characterized by high FL-HL and FL-H toward one characterized by high FL-H and low FL-HL a considerable nonlinear increase in the three dimensions of FL engagement was expected. Hence, the findings suggest that FL engagement is shaped less by the simultaneous presence of hopeful and hopeless beliefs, but by which of these orientations predominates. The findings of this LOIC are consistent with past research that used linear and correlation methods, namely that FL-H boosts FL engagement while FL-HL hinders its facilitating role (e.g., Pekrun, 2024; Pekrun & Linnenbrink-Garcia, 2022; Shao et al., 2020).

Importantly, the findings move beyond such simplistic interpretation and provide crucial theoretical insights into the nexus between FL-H and FL-HL. Although they have been considered as two opposite ends of the same continuum (Grewal & Porter 2007; Sullivan 2003), the present findings suggest that they operated as partially independent psychological systems whose relative balance is a key determinant of FL engagement. The findings also suggest that when learners' future-oriented positive cognitions predominate over hopeless beliefs, they remain willing to sustain behavioral, emotional and cognitive effort, even in the presence of some degree of uncertainty and doubt. In contrast, when FL-HL becomes dominant, learners appear to show less involvement because they perceive their effort as unlikely to translate into meaningful progress. Such distinction highlights the importance of considering not only whether FL-H and FL-HL diverge but also the direction in which they diverge. As such, the findings underscore one of the fundamental uses of polynomial with RSA over traditional different scores methods. This pattern closely parallels Botes et al. (2022) and Wang et al. (2025) findings that outcomes increased as FL enjoyment exceeded FL anxiety along LOIC.

Beyond the importance of discrepancy effects, the present RSA findings also yielded evidence of subtle nonlinearities. For BE, the significant negative curvature along LOIC suggests that the association between the discrepancy and FL engagement is not purely linear. Although BE increased as FL-H exceeded FL-HL, the magnitude of these gains gradually diminished at larger discrepancies. A comparable, albeit weaker, tendency emerged for CE, where statistical significance approached significance, indicating that cognitive investment may level off as FL-H dominates FL-HL. EE, in contrast, showed no significant curvature, indicating that it increased approximately linearly across the observed discrepancy range. The pattern where increasingly extreme discrepancy may cease to reveal additional FL engagement benefits echoes a recent RSA study by Amiri et al. (2025), which found that FL-H may have a potential dark side, suggesting that extremely high FL-H may reflect unrealistic future expectations and thus lead to disappointment if the expectations are not fulfilled. Collectively, these RSA results suggest that BE and CE may eventually stabilize once FL learners experience high FL-H compared to FL-HL, while EE remains more responsive to increases in hopeful thoughts.

5.1 Implications

The present findings have important theoretical and practical implications for understanding FL engagement. They suggest that FL-H and FL-HL should not be regarded as two mutually exclusive states. Teachers should be cautious in interpreting learners' future negative expectations as evidence that they have become behaviorally, emotionally, and cognitively withdrawn. A learner may feel pessimistic about the future or express doubts about success while continuing to participate actively in language learning activities. The consistent LOIC results reveal that across behavioral, emotional and cognitive domains, FL engagement was higher when FL-H predominated FL-HL. Pedagogically, this suggests that rather than trying to eliminate any hopeless expression, teachers should help learners boost sustained effort, agency beliefs and pathways while acknowledging genuine learning obstacles. Incorporating progress monitoring, goal setting, helping learners identify effective learning strategies may be valuable in maintaining active involvement in language learning activities when setbacks happen. In addition, the significant negative curvature of LOIC for BE and its marginal effect for CE, compared with the non-significant curvature for EE shows that the different dimensions of FL engagement may respond in a different way to discrepancy effects of FL-H and FL-HL. A learner may be behaviorally involved while experiencing different cognitive and emotional engagement. Teachers therefore should not treat FL engagement as a homogeneous construct. Methodologically, the findings show the importance of polynomial with RSA in capturing nonlinearities and configurations that traditional methods may overlook.

5.2 Limitations and future research directions

Despite its theoretical, methodological and pedagogical novel insights into the joint effects of FL-H and FL-HL on the three dimensions of FL engagement utilizing polynomial with RSA, the present study is not without limitations. First, the study employed a cross-sectional design, which prevents to draw causal conclusions concerning the associations between FL-H and FL-HL and FL engagement. This limitation is relevant to CVT that proposes causal and reciprocal relationships between FL emotions and engagement (Pekrun & Linnenbrink-Garcia, 2022). Hence, future research may adopt advanced methods, including cross-lagged models, intervention-based, experimental or longitudinal designs to explore the interplay and intricate nexus between FL-H and FL-HL and FL engagement over time. Second, the current study included a single set of future oriented emotions (i.e., FL-H and FL-HL). Yet, CVT proposes that several positive and negative

emotions shape educational experiences simultaneously. Future research could investigate the joint predictive effects of other relatively neglected emotions such as FL shame and pride. Third, the findings showed that FL engagement was higher when FL-H and FL-HL were higher and when FL-H predominated FL-HL. However, the potential mechanisms and configurations underlying this pattern remained unclear. Future research should probe the moderating and mediating effects of variables such as teacher support, self-efficacy, and growth mindset to understand why some learners remain highly involved in language learning activities despite having high negative future expectations.

6. Conclusion

The present study aimed to move beyond the traditional linear designs by probing how FL-H and FL-HL jointly shape the three dimensions of FL engagement, utilizing polynomial with RSA. The findings indicated that the relationships between these two future-oriented psychological states and FL engagement is more complex than a simple positive-negative dichotomy. FL-H and FL-HL did not operate as opposite forces. Rather, FL-H consistently emerged as the strongest significant predictor of all dimensions of FL engagement. Furthermore, the RSA findings added another important layer of insight by showing that emotional congruence did not produce higher FL engagement. The maximization instead occurred by configurations in which FL-H predominated FL-HL. This highlights the significance of examining the relative balance between these future-directed emotions rather than each emotion in isolation.

The study also contributes to the scarce body of research that applied advanced methods such as RSA in applied linguistics. Consistent with prior RSA studies investigating FL enjoyment and anxiety (Botes et al., 2022 ; Wang et al., 2025), grit and growth mindset (Zhao et al., 2026), teacher and student emotions (Amiri et al. (2025) (in)congruence, the present findings indicate that language learning outcomes are often configuration-dependent and cannot be adequately captured by linear analysis alone. Therefore, the psychological states are shaped by the complex mechanisms and ways in which FL emotions co-occur and interact. Furthermore, the results have implications for CVT. In line with the theory's assumptions of FL emotions as proximal antecedents of FL engagement, the findings revealed the importance of future-directed emotions in shaping learners' active involvement. They extended the theory by showing that FL-H exerts a uniquely powerful effect FL engagement even when learners have negative learning expectations.

The present study points out to an important message: learners do not become involved in language learning activities because they cease to feel hopeless; they become behaviorally, emotionally and cognitively engaged because FL-H gives them motivation and reasons to proceed. The results therefore consider FL-H as a significant emotional state in FL learning and suggest that enhancing learners' goal-directed thinking, agency, and positive expectations are effective pathways to promote FL engagement. This power of hope was famously captured by Dickinson (1861) that 'hope is the thing with feathers/that perches in the soul'. Finally, as applied linguistic research increasingly embraces advanced nonlinear methods, probing the joint predictive effects of FL emotions in shaping educational outcomes may provide fruitful direction for understanding FL engagement and related constructs.

Competing interest

The author declares none

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