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Longitudinal reciprocal dynamics between teacher emotional support and EFL learners' emotional engagement: Between- and within-person perspectives

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Abstract

Emotional engagement (EE) has emerged as a central factor in sustaining learners' motivation and cultivating environments that promote both academic success and personal well-being. Central to fostering EE is perceived teacher emotional support (PTES), characterized by teacher behaviors such as warmth, empathy, and responsiveness that contribute to a positive and motivating classroom climate. However, the complex and reciprocal relationship between PTES and EE remains insufficiently explored. This study seeks to address this gap through the lens of complex dynamic systems theory (CDST). Utilizing data collected over the course of a semester from 126 fourth-year English as a foreign language (EFL) learners, the study employed

cross-lagged panel models (CLPM) to investigate between-person effects and random intercept CLPM (RI-CLPM) to analyze within-person dynamics. The findings revealed a reciprocal relationship: Higher levels of EE enhanced learners' perceptions of teacher support, while greater teacher support contributed to increased EE over time. The results underscore the mutually reinforcing relationship between PTES and EE, illustrating how these dynamics vary both within and between individuals. This research offers practical insights for teachers, advocating for the creation of emotionally supportive classroom environments that enhance learner EE and ultimately contribute to greater success in second language (L2) learning contexts.

Keywords: emotional engagement; perceived teacher emotional support; reciprocal relationship; between-person effect; within-person effect

1. Introduction

The field of second language acquisition (SLA) has recently adopted an "affective turn" (Dewaele & MacIntyre, 2014; Gkonou et al., 2020; MacIntyre & Gregersen, 2012) that has been accentuated by the positive psychology movement (Dewaele et al., 2019; MacIntyre et al., 2016) within the field. While research on the role of learner emotions in foreign language (FL) learning was initiated long ago by pioneering researchers such as Horwitz et al. (1986), who focused on the conceptualization of foreign language classroom anxiety (FLCA) as a negative emotion, the new shift highlights the significance of emotions and supportive relationships in learners' experiences and success, underscoring the necessity of enhancing both well-being and academic advancement in the context of learning English as a foreign language (EFL) (Mercer & MacIntyre, 2014). In this context, emotional engagement (EE) has been conceived as a significant form of engagement, essential for maintaining learners' motivation and generating a supportive classroom atmosphere (Reeve, 2013). Unlike other types of engagement (i.e., behavioral, social, cognitive, and agentic), EE can be characterized as a dynamic psychological state that focuses on learners' affective responses, including their feelings of interest, enthusiasm, and belonging in the learning environment (Ryan & Deci, 2000). It is crucial for sustaining student motivation and fostering a positive educational atmosphere (Zhou et al., 2023). Teacher support (TS), characterized by sensitivity, responsiveness, and warmth, has been found to foster an emotionally enriching environment that enhances students' engagement, empowers learners, and bolsters their intrinsic motivation (Alrabai & Algazzaz, 2024). Perceived teacher emotional support (PTES), in particular, is pivotal in promoting EE by establishing a positive learning atmosphere in which students feel understood, supported, and motivated (Alrabai & Algazzaz, 2024; Mao & Fadri, 2024).

Despite the increasing body of research on the role of emotions in language acquisition, prior studies exhibit several deficiencies. A critical gap in the literature is the limited research on the dynamic, reciprocal relationship between PTES and EE. While PTES is known to be crucial for fostering a positive classroom climate, previous studies have not fully examined how the relationship between PTES and student EE changes and adapts over time. Complex dynamic systems theory (CDST) (Larsen-Freeman, 2019) offers a valuable framework for understanding such interdependent relationships, yet it has not been sufficiently applied to the association between PTES and EE (Alrabai & Algazzaz, 2024, 2025; Ruzek et al., 2016). Furthermore, PTES and EE are likely to have mutually reinforcing, reciprocal effects at both the individual and between-student levels. *Between-student effects* refer to differences in how students with higher EE tend to perceive greater PTES over time compared to those with lower EE, reflecting individual differences and rank-order stability between students. *Within-student effects,* on the other hand, focus on how changes in a single student's EE at a given time relate to changes in their PTES, capturing variations relative to each student's usual levels of engagement and perceived support. To capture the dynamic, reciprocal interactions between PTES and EE at both within-individual and between-individual levels, the current study employs two advanced statistical models: the cross-lagged panel models (CLPM) and the random intercept CLPM (RI-CLPM). These models are expected to explain how PTES and EE interact in a dynamic, evolving manner within the complexities of the classroom environment and have the potential to enhance our understanding of how PTES and EE interact and account for each other in the context of second language (L2) learning.

2. Literature review

2.1. Emotional engagement (EE)

Engagement, defined broadly as the action individuals take to achieve a goal by expressing motivational energy in observable ways (Oga-Baldwin, 2019), encompasses several dimensions: cognitive, behavioral, emotional, social, and agentic (Zhou et al., 2023). Other views (e.g., Mercer, 2019; Sulis, 2024) consider the social component of engagement as being by default embedded in the other dimensions of engagement, given that foreign language learning is a fundamentally socially situated process. Of the engagement dimensions, emotional engagement is of particular interest in the current study as it captures the affective turn in SLA that recognizes the importance of emotions in language learning processes (Hiver et al., 2024). EE can be defined as a mental state where students express a sense of interest, enthusiasm, enjoyment, belonging, identification, relatedness, and emotional

connections with their learning activities, the classroom environment, teachers, and peers (Zhou et al., 2023). This emotional involvement serves as a catalyst for students' deep engagement in learning, helping them feel personally invested and connected to their educational experiences (Alrabai & Algazzaz, 2024, 2025).

According to Hiver et al. (2024), EE does not occur in isolation but is instead deeply situated, emerging from and shaped by specific learning and instructional contexts, since second language (L2) learners might be emotionally connected to a topic, a person, a situation, or a task. Moreover, engagement in a broader sense is action-oriented and goal-directed (Hiver et al., 2024). This point applies to the emotional dimension of learner engagement as well, since engagement in general is a dynamic goal-oriented action and so is emotional engagement. That is, learners become emotionally engaged when their affective states are directed towards meaningful learning objectives. This implies that understanding the "person-environment fit" is essential to optimizing EE as learners' interaction with their context influences how deeply they connect with their learning tasks. Engagement is also characterized by its highly dynamic and malleable nature (Hiver et al., 2024; Sulis, 2024; Sulis & Mercer, 2025). Although research on the developmental trajectories of engagement is still emerging (Zhou et al., 2022, 2023), the fact that EE, as one dimension of engagement, can be shaped by both intrapersonal and contextual factors offers promising opportunities for SLA researchers and educators. This flexibility makes EE a particularly valuable dimension for SLA research, especially as it aligns with the affective turn in SLA that acknowledges the role of emotions in language learning.

2.2. Perceived teacher emotional support (PTES)

Teacher support is essential for promoting students' academic and personal development. It is defined as „the assistance, guidance, and encouragement provided by teachers to students to help them achieve academic and personal goals" (Wentzel et al., 2017, p. 435). Zhao and Yang (2022) introduced four key types of teacher support, namely academic (e.g., directing students towards the attainment of learning goals), informational (e.g., offering guidance and advice), appraisal (e.g., evaluative feedback), and emotional support, which is the primary focus of this study. PTES implies the emotional bond students experience with their teacher as well as the teacher's sensitivity and responsiveness to their emotional responses (Alrabai & Algazzaz, 2024, 2025).

The advantages of PTES are extensive and especially crucial in SLA settings. Emotionally supportive teachers foster positive relationships with their students, thereby enhancing learners' self-efficacy beliefs, mastery goals, and intrinsic

motivation (Lei et al., 2018; Liu et al., 2023; Wentzel et al., 2017). Language learners who view their instructors as emotionally supportive exhibit enhanced persistence (Granziera et al., 2022), heightened confidence in addressing challenging tasks (Liu et al., 2023), and increased effort in language acquisition (Hejazi & Sadoughi, 2022). These learners tend to exhibit a greater L2 willingness to communicate (MacIntyre et al., 2001), improved autonomy in their learning (Alamer, 2021), and, on top of that, heightened levels of EE (Alrabai & Algazzaz, 2024, 2025; Ruzek et al., 2016), leading ultimately to higher language proficiency (Piechurska-Kuciel, 2011). It is noteworthy that the associations between PTES and EE have mostly been detected via typical correlational analyses that can reveal such associations in superficial and directional ways. In fact, identifying the complex and reciprocal underlying links between PTES and EE is possible only through sophisticated statistical approaches, such as CLPM and RI-CLPM, which the present study employs.

2.3. The theoretical framework

This study draws on two key theories, self-determination theory (SDT) and CDST, to explore the connection between PTES and EE in language learning. SDT (Ryan & Deci, 2020) offers a framework for understanding how PTES boosts students' EE. In this respect, it emphasizes the importance of PTES in fulfilling three basic psychological needs identified by SDT, namely, autonomy, competence, and relatedness, as essential conditions for fostering students' motivation and EE (Alrabai & Algazzaz, 2024, 2025; Deci & Ryan, 1985; Ryan & Deci, 2000). Teachers who display PTES behaviors, such as offering encouragement, showing sensitivity, and using positive reinforcement, help meet students' psychological needs by creating a safe and supportive environment, which can ultimately lead to deeper EE in their learning (Aelterman et al., 2019; Reeve, 2016). From the perspective of CDST (Larsen-Freeman, 2019), the relationship between EE and PTES is not static but dynamic. These variables interact, adapt to one another, evolve over time through constant, reciprocal interactions, and vary across individuals and moments, showing differences between students (between-person) as well as fluctuations within the same student over time (within-person) (De Ruiter et al., 2019; Zhou et al., 2022, 2023).

Looking at EE through a between-person lens, some students naturally display higher levels of engagement than others, showing stable, trait-like differences. For example, one student may consistently feel more emotionally connected to learning than their peers. On the other hand, within-person variations reflect how a single student's engagement can shift from moment to moment, depending on classroom activities, teaching approaches, or changes in their motivation (Zhou et

al., 2022). These shifts provide valuable feedback to teachers, helping them adjust their emotional support strategies to better connect with students.

The same logic applies to PTES. From a between-person perspective, students in the same class may perceive their teacher's emotional support differently. Some consistently feel more supported than others, showing stable differences in PTES across individuals. Meanwhile, within-person fluctuations in PTES reveal how a teacher's emotional support can vary due to classroom dynamics, mood, or instructional goals. For example, students might perceive their teachers as more emotionally supportive on one day and less supportive on another. These shifts in PTES directly predict how students perceive their learning environment.

SDT and CDST provide a solid theoretical foundation for explaining teacher-student relationships by supporting both the teacher-facilitating and student-facilitating paths in the relationship. Jang et al. (2023) describe this interaction as having two pathways: the teacher-facilitating path (teachers supporting students) and the student-facilitating path (students inspiring teachers). This bidirectional relationship is key to understanding how PTES and EE continuously shape and enhance one another in the dynamic context of L2 classrooms.

The teacher-facilitating path, grounded in SDT, highlights the importance of teachers supporting students' needs for autonomy, competence, and connection (Ryan & Deci, 2017). This creates a safe foundation for students to explore, engage, and thrive both socially and academically (Ryan & Deci, 2020; Sadoughi & Hejazi, 2022). Research supports this point. For example, Ruzek et al. (2016) found that emotionally supportive classrooms lead to a higher sense of autonomy and peer connection, and ultimately help students feel emotionally tied to their learning environment. More recently, Alrabai and Algazzaz (2024) conducted an intervention study in L2 classrooms that demonstrated how PTES directly enhances students' satisfaction of basic psychological needs, improves emotional responses (such as boosting enjoyment and reducing anxiety), and deepens EE over time. Their findings show that teacher-provided emotional support has a lasting, positive influence on students' emotional involvement in learning, especially in language classrooms.

CDST also emphasizes the reciprocal relationship between EE and PTES. In light of this theory, PTES directly promotes EE by creating a positive, responsive environment that encourages students to engage emotionally. However, the connection does not end there. CDST suggests a feedback loop, where emotionally engaged students can influence their teacher's support. This reciprocal relationship is evident in past longitudinal research (e.g., Gaspard & Lauermann, 2021), where high levels of students' excitement, commitment, enthusiasm, or engagement have been found to elicit more subsequent supportive teacher behavior. This creates a positive cycle that strengthens classroom dynamics.

While the teacher-facilitating path is well-researched (Chiu et al., 2024; Hornstra et al., 2023; Power & Goodnough, 2019; Wu et al., 2023), the student-facilitating path is less explored, especially in L2 classrooms. However, evidence from CDST suggests that students' EE can encourage teachers to become more emotionally supportive (Jang et al., 2023). When students show interest, enthusiasm, and emotional investment in their learning, teachers are likely to respond by increasing their emotional sensitivity and support. Although no studies have directly examined this exact relationship between PTES and EE, Jang et al.'s (2023) research on the mutual effects of agentic student engagement and autonomy-supportive teaching shows that when students take initiative and engage more actively, teachers tend to provide greater autonomy support in return. This back-and-forth dynamic suggests that students' emotional expressions can shape how teachers approach their support (Sulis & Mercer, 2025). In essence, emotionally engaged students can inspire teachers to create even more growth-focused and supportive environments. This feedback loop is a reminder that engagement is not a one-way street; it is a collaborative process where both students and teachers influence each other to make the classroom experience richer and more engaging.

2.4. The current study

To capture the dynamic, reciprocal interactions between PTES and EE at both within-individual and between-individual levels, this study employed two advanced statistical models: CLPM and the RI-CLPM. CLPM is used to analyze between-person effects and is a well-established method for longitudinal analysis, allowing us to assess how earlier values of one variable influence later values of another (Jang et al., 2023). This model includes cross-lagged effects, which measure how one variable predicts another at the next time point, and autoregressive effects, which capture rank-order stability over time. In our study, the CLPM tests whether students with higher EE relative to peers experience an increase in perceived emotional support from teachers over time.

The RI-CLPM, on the other hand, is designed to examine within-person effects (Mulder & Hamaker, 2020). Unlike the CLPM, it accounts for individual trait-like effects by removing the variance attributed to stable, long-term characteristics. This allows us to focus on state-like fluctuations, moment-to-moment changes within the same individual. The RI-CLPM tests whether fluctuations in EE (relative to a student's typical level) lead to subsequent fluctuations in PTES, and vice versa. In the context of the random-intercept cross-lagged panel model (RI-CLPM), the typical level refers to a student's stable, average level of emotional engagement over time, which is unique to each individual.

This is captured by the random intercept in the model, representing the between-person differences that remain relatively consistent across measurement occasions. For example, one student might have a high typical level of emotional engagement (e.g., consistently enthusiastic and involved), while another might have a lower typical level (e.g., generally less engaged). The RI-CLPM isolates these stable, trait-like differences (the typical level) from within-person fluctuations, which are temporary deviations above or below a student's typical level at specific time points (e.g., being more engaged than usual due to a particular lesson). The model then tests whether these fluctuations in emotional engagement predict subsequent fluctuations in teacher emotional support, and vice versa, while accounting for the stable typical levels of both variables. Together, these models provide a nuanced view of how EE and PTES interact over time, both at the individual and group levels, offering valuable insights into these dynamic processes in language learning. To achieve this aim, this study adopted a longitudinal design with data collected at three time points: pre- (T1), mid- (T2), and end of semester (T3). This study is guided by the following research question:

> *How do perceived teacher emotional support (PTES) and student emotional engagement (EE) interact dynamically over time, and what are the within-individual and between-individual effects of these interactions?*

3. Methods

3.1. Participants

126 fourth-year EFL students (65 male (51.59%) and 61 female (48.41%)) took part in this study. Students were enrolled in the Bachelor of Arts in English program which offers students a robust foundation in English language, linguistics, and literature alongside practical training in translation and modern language technologies over four years (eight semesters). Participants came from four groups of levels 7 and 8, had been learning English for roughly 12 to 15 years and demonstrated an average level of EFL proficiency, as established by the results of the exit exam conducted by their institution (average score = 73 out of 100). These participants shared similar age ranges (M_{age} = 22.58, SD = 0.39), the same educational, cultural, and social backgrounds and they were all of the same nationality, and they all spoke Arabic as their mother tongue. Participants were students enrolled in the same course (Introduction to English Applied Linguistics) with a total number of three weekly contact hours (50 minutes each).

3.2. Measurements

Five items were taken from Sadoughi and Hejazi (2022) to assess PTES (e.g., "My English teacher really understands how I feel about things in the class") and five items were adopted from Zhou et al. (2023) to measure EE in language classrooms ("When I'm in this class, I feel good"). All items in the two scales were rated on a five-point Likert scale ranging from extremely untrue to extremely true, were all positively worded, and therefore no items were reverse-coded. To eliminate the risk that the limited English competence of some participants would influence the accuracy of their responses to the survey items in the original English version, students responded to a verified Arabic translation of the questionnaire. The internal consistency of PTES was acceptable across three data collection waves, with Cronbach's alpha values recorded as $\alpha_{T1} = .91$, $\alpha_{T2} = .93$, and $\alpha_{T3} = .93$. Similarly, the internal consistency of the EE scale demonstrated adequate reliability across all waves, with Cronbach's alpha values of $\alpha_{T1} = .92$, $\alpha_{T2} = .94$, and $\alpha_{T3} = .93$. The full survey items are listed in Table 1.

3.3. Data collection

Prior to data collection, formal clearance from the institution where the study was conducted had been obtained. The potential participants were then approached and thoroughly informed about the different aspects related to this study, and their informed consent for voluntary participation was granted. Data were collected in weeks 2, 7, and 12 of the semester. On the day of actual data collection across the three rounds, one of the researchers started by informing students about the goals of the study, its anticipated outcomes, their role in the study, and some instructions on how to respond to the questionnaire, reassuring them of the voluntary nature of their participation and the anonymity and confidentiality of their responses. The researcher then provided students with a link to the online survey, and they responded to the questionnaire in their classes in the absence of their teacher. Respondents accessed the survey using their mobile or other electronic devices, and it took them approximately 10 minutes to finish and submit it every time they responded to the questionnaire.

3.4. Data analysis

3.4.1. Preliminary analysis

The main analyses were preceded by several initial adjustments. In the first step, we standardized all items for PTES and EE using participants' responses from Time 1, setting

the mean to 0 and the standard deviation (*SD*) to 1. This transformation places the data on a common scale, making it easier to compare across variables. By setting Time 1 as the baseline, subsequent analyses focus on changes relative to initial scores, allowing us to interpret results as growth or changes over time. In the second step, we fixed the item factor loadings of each latent variable to a constant value across all three waves. This ensures that the measurement model remains consistent over time, so any observed differences are due to true changes in the constructs rather than shifts in measurement. Maximum likelihood robust estimation and full information maximum likelihood (FIML) were used to handle missing data (Enders, 2017). All analyses were conducted in Mplus (Muthén & Muthén, 1998-2017).

Since our study focuses on the directionality of the relationship between PTES and EE over time, rather than effects at specific time points, we used a longitudinal equilibrium test by constraining structural paths between the variables. This test checks if the relationships (both stability and cross-lagged effects) remain invariant over the academic year (Mulder & Hamaker, 2020). Specifically, we examined consistency in the relationships between PTES and EE in both rank order (using CLPM) and state change (using RI-CLPM). *Rank order invariance* tests if the relative standing of students' PTES and EE remains stable over time. For instance, if a student starts with high PTES relative to peers, do they maintain this relative position? *State change invariance,* on the other hand, assesses individual fluctuations in PTES and EE over time.

To do this, we constrained four key parameters in both the CLPM and RI-CLPM models (see Figures 1 and 2): (1) β_{XX} represents the invariance in PTES stability, testing if the impact of PTES at one time point remains stable over time; (2) β_{YY} assesses the invariance in EE stability, examining if EE levels stay consistent across waves; (3) β_{XY} is the invariance in the cross-lagged path from PTES to EE, measuring if changes in PTES influence EE at later times; and (4) β_{YX} examines the invariance in the cross-lagged path from EE to PTES, testing if changes in EE impact PTES at future time points.

3.4.2. CLPM: Between-individual perspective

We constructed latent variables using the five items to represent PTES and the five items for EE at each time point (see Figure 1). We then identified structural relationships between these latent variables at the between-individual level, including two autoregressive stability paths, three covariances, and two cross-lagged paths. The autoregressive paths capture the stability of PTES and EE over time, examining if a student's level of PTES and EE at Time 1 predicts their levels at Time 2, and so forth across the three waves. The covariances between PTES and EE at each time point

test whether emotional support and emotional engagement are associated within the same wave. Finally, the cross-lagged paths represent the direction of influence between PTES and EE across different time points, indicating how changes in one construct might lead to changes in the other over time.

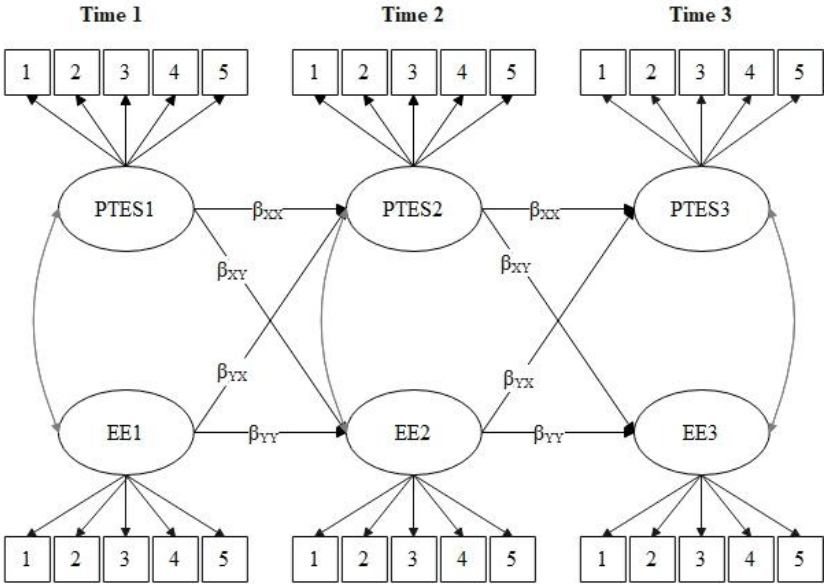

Figure 1 The hypothesized CLPM

Given the longitudinal nature of the data, we also accounted for shared error variance across time by correlating the error terms of the same items between time waves. Finally, we tested whether the structural relationships, both stability and cross-lagged paths, were consistent over time.

3.4.3. RI-CLPM: Within-individual perspective

Similar to the CLPM, in the RI-CLPM, we first constructed the latent variables (see Figure 2). This involved creating two sets of latent variables: basic latent variables and second-order latent variables (Mulder & Hamaker, 2020). The basic latent variables were identical to those in the CLPM, representing the measurement model.

In the RI-CLPM, we decomposed the variance in PTES and EE into trait-like and state-like components. To model the trait-like component, we created random intercepts for both variables, representing stable individual differences over time. Each trait is indicated by three latent variables (T1, T2, T3), with factor loadings fixed at 1, ensuring equal contribution from each wave. For the state-

like component, we built second-order factors for both PTES and EE, which load onto the basic latent variables at each time wave, with factor loadings fixed at 1 for consistency. It should be noted that given our small sample size (*N* = 126), equality constraints were necessary to achieve model parsimony and ensure sufficient statistical power for reliable parameter estimation (Mulder & Hamaker, 2020). In both the CLPM and RI-CLPM, freely estimating all paths across multiple waves significantly increases the number of parameters, risking overfitting and convergence issues, particularly with the complex structure of the RI-CLPM, which separates between- and within-person effects. By constraining paths to be equal, we reduced model complexity while maintaining the ability to test our core hypotheses about the reciprocal relationships between teacher emotional support and EFL learners' emotional engagement over time.

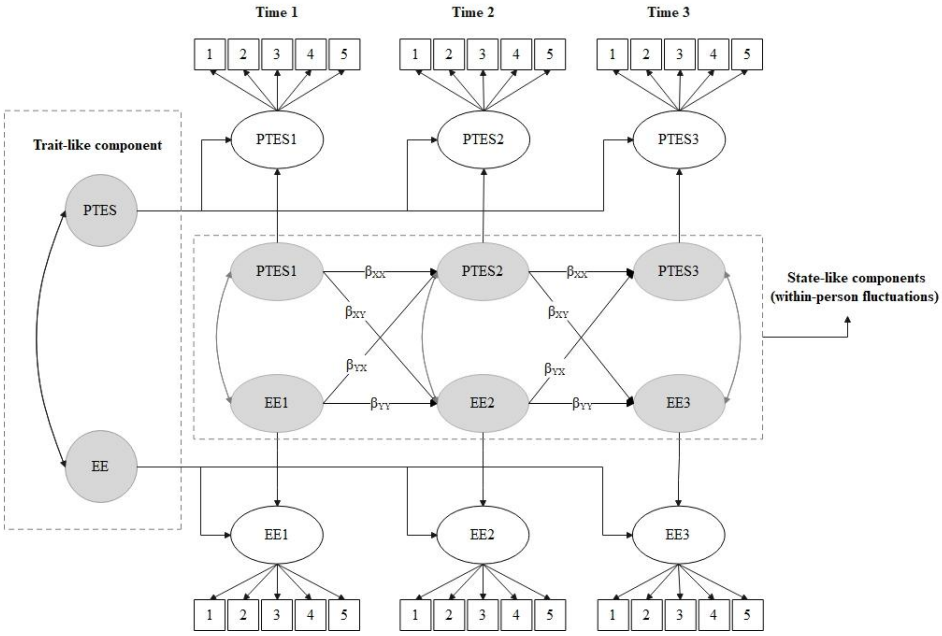

Figure 2 Hypothesized RI-CLPM

We identified the structural relations at the within-person level by including autoregressive stability paths to capture how a variable's current value predicts its future value within individuals. We also included correlations between the state-like components of PTES and EE at each time point to model how changes in PTES relate to changes in EE within the same wave. Cross-lagged paths were specified to estimate the direction of influence between PTES and EE over time, examining their reciprocal relationship. All analyses were conducted in Mplus

(Muthén & Muthén, 1998-2017) and further details on data preparation and preliminary analyses can be found in the Appendix in the online materials.

With respect to alignment with CDST principles, we should acknowledge that although equality constraints assume stationarity in the strength of autoregressive and reciprocal effects, our modeling approach aligns with CDST principles in several key ways. First, the RI-CLPM explicitly distinguishes between-person (trait-like) stability and within-person (state-like) dynamics, which is consistent with CDST's focus on individual-level variability and change over time. By including random intercepts, the RI-CLPM accounts for stable individual differences in teacher emotional support and emotional engagement, allowing us to model dynamic within-person fluctuations around these stable traits. This approach captures the person-specific, dynamic interplay emphasized by CDST (Ryan & Deci, 2020). Second, the reciprocal paths in both CLPM and RI-CLPM reflect feedback loops between PTES and EE, a hallmark of CDST's emphasis on bidirectional, interdependent processes. Third, our longitudinal design across three waves captures temporal dynamics, enabling us to examine how these reciprocal relationships unfold over time, even with constrained paths. Furthermore, to explore temporal variation beyond the constrained lag-1 paths, we conducted a sensitivity analysis by adding lag-2 paths to the model, examining relationships across two time points (e.g., Time 1 to Time 3) in addition to consecutive time points (VanderWeele et al., 2020). This analysis aligns with CDST's emphasis on complex, non-immediate temporal processes as it captures additional variation in how PTES and EE influence each other over extended intervals.

4. Results

4.1. Measurement model

Before testing the measurement model, data were screened for normality by calculating skewness and kurtosis for each measure. The values for both skewness and kurtosis were below the recommended threshold of .68 and 1.03, indicating that the data were relatively normally distributed (Kline, 2016). Additionally, measurement invariance analysis indicated that the association between PTES and EE was stable both in terms of rank-order invariance and state-change invariance. Table 1 provides an overview of descriptive statistics and standardized coefficients for each of the 10 indicators used in the measurement model.

Table 1 Descriptive statistics and standardized coefficients

	Time 1			Time 2			Time 3		
	λ	*M*	*SD*	*λ*	*M*	*SD*	*λ*	*M*	*SD*
Perceived teacher emotional support									
1. My English teacher really understands my feelings.	.86	3.20	1.20	.84	3.67	1.03	.89	3.94	.88
2. My English teacher does not take my feelings seriously.	.66	3.26	1.20	.65	3.74	1.12	.64	4.02	.68
3. My English teacher carefully listens to my concerns about learning English.	.85	3.41	1.16	.86	3.65	1.09	.83	3.98	.87
4. My English teacher cares for my progress in learning English.	.77	3.30	1.22	.73	3.88	1.09	.80	4.11	.91
5. I feel that my English teacher is friendly.	.76	3.68	.97	.74	3.89	.96	.76	4.24	.66
Emotional engagement									
1. This class is fun.	.64	3.36	1.12	.65	3.46	1.05	.68	3.66	.89
2. When I'm in this class, I feel good.	.82	3.58	1.23	.84	3.65	1.12	.85	3.82	.93
3. When we work on something in this class, I get involved.	.84	3.93	1.04	.88	3.46	1.03	.83	3.76	.76
4. When we work on something in this class, I feel interested.	.73	3.44	1.27	.74	3.77	.99	.77	3.93	1.09
5. I enjoy learning new things in this class.	.81	3.90	.97	.82	3.92	.98	.80	3.36	.64

Table 2 shows the statistical measurement invariance indices of the CFA model, which serve as a fit index to evaluate the model's fit to the data. Our analysis aimed to determine if the association between PTES and EE was stable both in terms of rank-order invariance (how each student's levels of PTES and EE fluctuate over time) and state-change invariance (how individual students' levels of PTES and EE fluctuated throughout the study period).

Table 2 Goodness of fit for CFA Measurement model: invariance of the measurement factor structure over three waves

	χ^2	df	RMSEA	CFI	TLI	SRMR	ΔCFI
Configural	814.26	276	.035	.960	.956		
Metric	898.14	303	.035	.963	.954	.028	.003
Scalar	994.38	336	.035	.962	.951	.028	.002

To assess measurement invariance in both metric and scalar models, we utilized the change in comparative fit index (ΔCFI) as a criterion. According to Cheung and Rensvold (2002), if the ΔCFI value is ≤ 0.01 upon adding constraints, invariance is supported. In our study, the ΔCFI values were .003 and .002, which indicates minimal changes in CFI, thereby supporting the presence of both metric and scalar invariance. This finding suggests that any observed variations are likely due to real changes in the constructs themselves, rather than inconsistencies in measurement. Such consistency is essential for accurately tracking the dynamics between PTES and EE over time (Jang et al., 2023). Table 3 below shows latent association values across the three-wave data collection.

Table 3 Latent correlations between PTES and EE over three waves

	PTES1	PTES2	PTES3	EE1	EE2	EE3
PTES 1	-					
PTES 2	0.71	-				
PTES 3	0.52	0.61	-			
EE1	0.63	0.59	0.49	-		
EE2	0.57	0.53	0.47	0.65	-	
EE3	0.42	0.41	0.36	0.43	0.54	-
Mean	3.37	3.76	4.05	3.64	3.65	3.70
SD	1.15	1.05	0.80	1.12	1.03	0.86

4.2. Between-individual variations

The hypothesized between-individual CLPM was assessed to determine its fit with the collected data (see Figure 3). Goodness-of-fit indices suggested that the model aligned with the data reasonably well: χ^2 (366) = 1082.133, p < .001; RMSEA = .036; CFI = .951; TLI = .948; SRMR = .059. These statistics indicate a strong fit, supporting the robustness of the hypothesized relationships. The autoregressive paths indicated the stability of each variable individually. For PTES, the autoregressive coefficient was β_{XX} = .41, SE = .03, p < .001, demonstrating that PTES at one time point was a strong predictor of PTES at the next. Similarly, the autoregressive path for EE was β_{YY} = .34, SE = .03, p < .001, indicating that EE also showed a high level of stability over time. These findings suggest that both PTES and EE are relatively stable constructs, with each strongly influencing itself at subsequent time points. It is worth noting that this "high stability" reflects both the data and the model specification, noting that the equality constraints assume stationarity in autoregressive effects. That is, the stability observed in the autoregressive paths reflects both the underlying consistency in PTES and EE over time and the constraints imposed to achieve a parsimonious model.

To assess the reciprocal influence between PTES and EE, we analyzed the cross-lagged paths. The findings reveal a significant teacher-facilitating effect, with a path coefficient of β_{XY} = .18, SE = .02, p < .001. This suggests that higher levels of PTES at an earlier time point led to increased EE at a subsequent time point, indicating that students who perceive greater emotional support from their teachers tend to show higher EE in the future. In addition, the analysis showed a significant student-facilitating effect, with a path coefficient of β_{YX} = .11, SE = .02, p < .001. This indicates that EE at an earlier time point positively influences PTES at the next time point. In other words, students who are more emotionally engaged in the classroom tend to perceive higher levels of PTES over time.

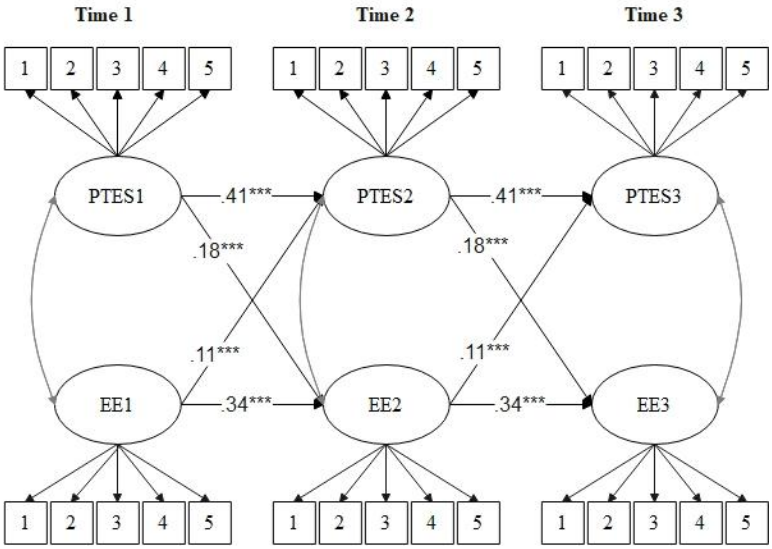

Figure 3 Estimated CLPM

We also conducted a sensitivity analysis by adding lag-2 paths to the model to determine if the findings held when accounting for relationships across two time points, rather than only between consecutive time points (VanderWeele et al., 2020). This extended model, which included lag-2 paths, showed a good fit to the data: $\chi^2(362) = 841.738$, $p < .001$; RMSEA = .034; CFI = .955; TLI = .950; SRMR = .038. Notably, the fit of the extended model was better than the original model without lag-2 paths ($\Delta\chi^2 = 240.395$, $p < .001$), suggesting that the extended model provides a more accurate representation of the data.

In this sensitivity model, the autoregressive paths remained stable, with PTES showing an autoregressive coefficient of β_{XX}= .37, SE = .02, $p < .001$, and EE showing an autoregressive coefficient of β_{YY} = .30, SE = .02, $p < .001$. These values indicate that each construct continued to be a strong predictor of itself over time, even with the inclusion of lag-2 relationships. The cross-lagged paths also continued to demonstrate reciprocal relationships in the extended model. The teacher-facilitating path, with a coefficient of β_{XY} = .15, SE = .02, $p < .001$, indicated that PTES at an earlier time point still positively influenced EE at a later time point. Similarly, the student-facilitating path, with a coefficient of β_{YX} = .09, SE = .02, $p < .001$, showed that EE at one time point continued to positively predict PTES at a subsequent time point. These findings reinforce the robustness of the reciprocal relationship between PTES and EE, suggesting that the mutual influence between teacher support and student engagement holds steady even when accounting for extended time lags. This strengthens our confidence in the stability and durability of these cross-lagged effects over time.

4.3. Within individual variations

To analyze the within-person relationships between variables over time, we applied an RI-CLPM (see Figure 4). This model allows us to distinguish between stable, trait-like influences and within-person fluctuations, thereby isolating the dynamic, time-varying relationships from more constant individual differences (Jang et al., 2023). The RI-CLPM showed a good fit to the data, with fit indices as follows: $\chi^2(351) = 989.546$, $p < .001$; RMSEA = .035; CFI = .956; TLI = .949; SRMR = .037.

In the RI-CLPM, the stable trait factors capture the aspects of PTES and EE that remain consistent for each student over time. The correlation between the stable traits of PTES and EE ($r = .31$, SE = .03, $p < .001$) suggests a meaningful association: students who have a high stable level of PTES also tend to exhibit a high stable level of EE. This indicates that students with a generally higher PTES were also those who, on average, maintain higher EE across time points.

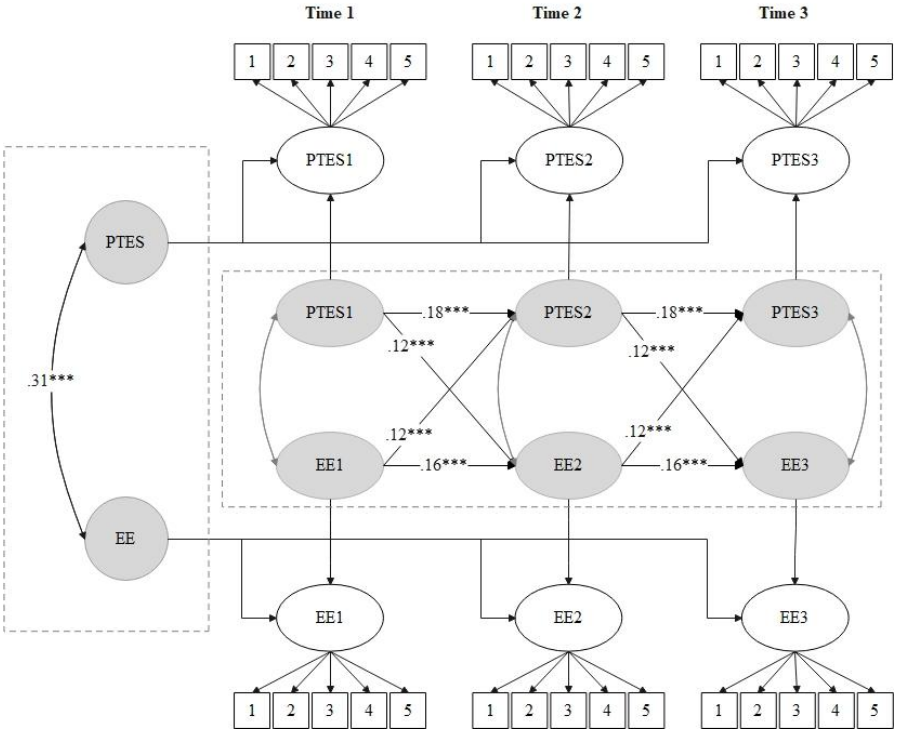

Figure 4 Estimated RI-CLPM

The within-person autoregressive paths suggest moderate stability from one time wave to the next. For PTES, the autoregressive coefficient was $\beta_{XX} = .18$, SE = .04, $p < .001$, showing a moderate level of persistence in PTES within

individuals over time. Similarly, for EE, the autoregressive coefficient was β_{YY} = .16, SE = .04, p < .001, indicating moderate stability but slightly less persistence compared to PTES. These autoregressive coefficients were notably smaller than those observed in the standard CLPM. This difference likely reflects the fact that the RI-CLPM separates out stable trait influences, effectively controlling for the individual differences that contribute to long-term stability. This makes the RI-CLPM particularly well-suited for analyzing how these constructs change dynamically within individuals, offering a clearer view of the short-term, reciprocal influences between PTES and EE.

The RI-CLPM also estimates cross-lagged paths at the within-person level. For the teacher-facilitating path, results show that prior PTES leads to increased EE for the same student at a later time (β_{XY} = .12, SE = .04, p < .001). Similarly, in the student-facilitating path, prior EE leads to greater PTES later (β_{YX} = .12, SE = .03, p < .001). These paths were invariant across time waves, indicating a consistent reciprocal relationship over time.

5. Discussion

The present study explored the causal, bidirectional associations between PTES and EE. Through the examination of bidirectional relations, the study extends beyond the one-sided view of only how these elements affect one another, to explore whether they reinforce each other mutually. We combined teacher-facilitating paths, those where PTES affects students' EE, and student-facilitating paths, those where students' EE may influence PTES, into a single, comprehensive model. Moreover, we compared both the between-person and within-person perspectives over a semester of language learning by using CLPM and RI-CLPM, respectively.

While previous studies considered influences to be directional rather than reciprocal (Alrabai & Algazzaz, 2024; Mao & Fadri, 2024; Pianta et al., 2011), the present study recognized that both are influential. These effects were significantly and positively bidirectional, even when examined simultaneously. This means a dynamic, interdependent relationship might be present, where both students' and teachers' actions reinforce each other in EE and emotional support. This finding supports the notion of emotional contagion, in which individuals may automatically adopt the emotional states of their social partners (Hatfield et al., 1994; Pekrun, 2006; Shao et al., 2025). The investigation further emphasized the importance of between-individual and within-person perspectives in estimating the extent to which the proposed reciprocal relationship between PTES and EE holds across time consistently and broadly.

Findings representing the between-person perspective showed that those L2 learners who reported higher levels of EE at one point in time also reported greater

emotional support from teachers at a subsequent point. Such support could be followed by students expressing their interest, enthusiasm, enjoyment, belonging, identification, relatedness, and emotional connection with their learning activities, classroom environment, teachers, and peers, which could prompt the teacher to be more enthusiastic, supportive, and emotionally committed to the learners, potentially creating a virtuous cycle. Correspondingly, L2 learners who perceived higher emotional support at one point also reported higher EE at a subsequent point. This suggests that when teachers support students' emotions, it positively influences students' emotional involvement and engagement in the instructional flow. The between-person perspective shows another important effect: Students with higher EE or PTES stand out compared to peers with lower levels of each factor, illustrating a relative, rank-order effect. Evidence from the literature shows that when students perceive teachers as emotionally supportive, it fosters a sense of security, motivation, and need satisfaction, which promotes sustained EE (Alrabai & Algazzaz, 2024; Downer et al., 2010). By proactively initiating emotional support, teachers create a positive environment that enables ongoing reciprocal interactions between EE and PTES.

The results for the within-person analysis yielded a positive correlation between trait-like PTES and trait-like EE. That is, a student who is generally emotionally engaged in language class is likely to perceive the teacher as more emotionally supportive, and vice versa. As noted, the within-person analysis goes beyond stable, trait-like levels to examine variations in EE and PTES within a student over time. The state-like component of the results indicates that when a student's emotional behaviors increase beyond their usual level, they perceive the teacher as more emotionally supportive than usual. Similarly, when a student perceives the teacher as more emotionally supportive than usual, they tend to display more emotional behaviors than usual. This pattern demonstrates a dynamic, real-time interaction between EE and PTES within individual students. When either EE or PTES rises above a student's typical level, the other variable tends to respond upward, suggesting an immediate, reinforcing effect. The implications of these findings extend into various practical domains, providing valuable guidance for practitioners on the exact nature of the association between PTES and EE and the role that each of the two factors plays for the other in the course of L2 learning and teaching.

The study has highlighted the role of teachers' emotional support in facilitating students' EE. Indeed, previous research on the teacher-facilitating path has shown that emotional support from teachers fosters student engagement through a caring and positive learning environment. For instance, studies by Pianta et al. (2011) and Zhou et al. (2023) document that teacher behaviors characterized by warmth, responsiveness, and attentiveness relate to higher levels of EE among students. According to SDT, such teacher behaviors support students' needs for belonging, competence, and autonomy (Aelterman et al., 2019;

Alrabai & Algazzaz, 2024, 2025; Reeve, 2016), thereby promoting engagement (Al-amer, 2021; Ryan & Deci, 2020).

In SLA contexts, research by Dewaele and MacIntyre (2019), and Alrabai and Algazzaz (2024, 2025) demonstrates that emotionally supportive teachers, through encouragement and positive reinforcement, are critical in reducing anxiety and enhancing enjoyment. These studies substantiate the teacher-facilitating pathway by detailing how PTES positively influences students' emotional involvement and motivation to engage in language learning. In line with these findings, the present study found that L2 learners who perceived higher emotional support at one point subsequently reported higher EE, reinforcing the view that PTES enhances students' EE. Practically, this means teachers have clear potential to foster EE through consistent positive feedback, constructive comments, and genuine care for each student's well-being (De Ruiter et al., 2019; Mercer & Dörnyei, 2020; Mercer & MacIntyre, 2014; Solhi et al., 2024).

The current study also points out how students' EE can act as a catalyst for increasing teachers' emotional support. This student-facilitating path emphasizes that when students feel enthusiastic, show interest, and are emotionally invested in learning, teachers are more likely to respond with additional support, creating a reinforcing cycle that benefits both sides. This is in line with CDST, suggesting that emotionally engaged students shape the educational environment, encouraging teachers to be more attuned to students' needs (Larsen-Freeman, 2019). When students actively participate, demonstrate interest, and express enthusiasm, they may inspire teachers to offer even more support, recognizing the positive effect this engagement has on the classroom atmosphere. This reciprocity suggests that students' behaviors may influence the emotional support they receive, implying that fostering students' EE could be a valuable approach to building a more supportive educational environment (Aldrup et al., 2019).

One of the important insights from this research is the understanding of the interaction between PTES and EE, showing that each is essential to the other. This interdependence suggests that a change in one variable leads to a corresponding shift in the other, creating a dynamic, self-reinforcing relationship between the two (Jang et al., 2023). As students experience higher levels of EE, they are likely to perceive more emotional support from their teachers, and vice versa, contributing to a synergy that enhances both engagement and support within the classroom (Alrabai & Algazzaz, 2024, 2025). This finding aligns with the concept of reciprocal adaptation within CDST, which proposes that students, through their EE, can encourage teachers to respond with greater support, reinforcing a positive emotional climate in the classroom (Sulis & Mercer, 2025).

This finding can also be explained through the concept of emotional contagion, meaning that emotions expressed by one person, whether a teacher or peer,

can influence the emotions of others (Hatfield et al., 1994; Pekrun, 2006; Shao et al., 2025; Talebzadeh et al., 2019). A supportive, positive emotional climate fostered by the teacher can directly affect students' EE by spreading enjoyment and enthusiasm. This concept helps us understand how positive emotions can become a shared experience among teachers and students in an L2 class, creating a cohesive, emotionally supportive environment. When teachers and students engage in this mutual positive emotional dynamic, the classroom climate becomes more resilient and conducive to learning (Solhi et al., 2024; Sulis, 2024; Sulis & Mercer, 2025).

6. Pedagogical implications

The findings of this study contribute to the broader SLA literature by empirically supporting the idea that teacher-student interactions are not unidirectional, but rather part of an interdependent system where the emotional investments of both parties play a vital role in shaping the emotional and motivational environment of the classroom. These collective experiences suggest that individual levels of emotional support and engagement work in tandem to create a positive emotional atmosphere, making the effects of support and engagement more powerful and lasting. Recognizing the mutual influences of teachers' emotional support on students' engagement, and vice versa, is crucial for teachers. Encouraging a balance between these factors can sustain a positive, supportive classroom environment, where both teachers and students contribute to a culture of emotional investment and mutual support.

Although the study showed a positive, bidirectional relationship between PTES and EE, maintaining this upward trend can be challenging. The findings suggest that if teachers' emotional support decreases, students' EE may decline as well, potentially leading to a downward spiral (Liu et al., 2023). Additionally, low levels of student EE can result in reduced emotional support from teachers, underscoring the difficulty in sustaining an upward trend over time. Addressing this challenge requires both proactive strategies from teachers and a deliberate focus on nurturing students' emotional investment (Elahi Shirvan & Taherian, 2020).

A number of strategies can be enacted by teachers in order to help nurture and maintain an upward spiral of PTES and EE. First, it would be important to be sensitive to students' emotions, responding warmly to their needs. This would include periodic checks with students regarding their emotions so that support could then be revised accordingly (Dewaele & MacIntyre, 2019; Gregersen & MacIntyre, 2014; Mercer & MacIntyre, 2014). Successes should be recognized and celebrated to maintain students' motivation and strengthen their emotional involvement in the process, thereby maintaining the cycle of support and engagement.

Teachers can help learners savor positive experiences by encouraging them to reflect on and broaden celebrations of their achievements related to language learning, from small to large (Elahi Shirvan et al., 2024). This helps students internalize the positive experiences and builds a more sustained, positive emotional connection with language learning.

In addition, teachers can create a supportive atmosphere where they let students express themselves. For example, during playful activities, such as language games, humorous role-plays, and interactive exercises, teachers should try to reduce levels of negative emotions in students and build positive types (Barabadi et al., 2022; Kruk et al., 2023; Shao et al., 2024). The results reported by Kruk et al. (2023) indicated that playful engagement allows learners to take agency in their learning within a low-stakes environment, making the process of language acquisition rather enjoyable, supportive, and engaging. Solhi et al. (2023) indicated that strategic humor in the language class decreases boredom and makes experiences more pleasurable in SLA. Teacher humor styles significantly affect learners' emotional states by balancing the level of engagement through the creation of a relaxed and inviting environment. In fact, humor can relieve negative feelings and enable students to show their continuing interest and engagement in class (Solhi et al., 2023). Spontaneous humor, memes, and cartoons can be used as the top three humor strategies (Neff & Dewaele, 2022). Neff and Dewaele (2022) argue that students preferred humor that felt natural and contextually relevant rather than overly contrived or childish, suggesting that humor in the FL classroom is most effective when it aligns with students' expectations and supports language goals without overshadowing the learning process.

Finally, the literature has demonstrated that instructors' emotional sensitivity and responsiveness to students' real-time emotional cues significantly influence learner EE (De Ruiter et al., 2019). For example, teachers can conduct brief emotion checks at various points during class to assess how students feel at that moment. This enables teachers to adjust their approach immediately, offering encouragement or providing additional explanations to students who feel challenged. Such real-time adjustments help keep students emotionally engaged and responsive throughout the class.

7. Limitations

Despite the significant contributions that the present research holds for SLA theory and practice, this study does, however, have some limitations that need to be acknowledged. First, the equality constraints on autoregressive paths (e.g., PTES at Time t predicting PTES at Time t+1, and similarly for EE) were applied to

ensure model parsimony and reliable parameter estimation, given our sample size (*N* = 126) and the complexity of the RI-CLPM, which separates between- and within-person effects. These constraints assume stationarity in the autoregressive effects across waves, reducing the number of parameters and mitigating the risk of overfitting and convergence issues in our longitudinal design over three waves. Without these constraints, the model would require estimating separate autoregressive parameters for each wave, which could be statistically untenable given our sample size. To further validate our interpretation of stability, we propose conducting an additional sensitivity analysis in future work, relaxing the equality constraints on the autoregressive paths to allow them to vary across waves. This would test whether the strength of within-person stability changes over time (e.g., whether PTES becomes more or less predictive of itself as the academic term progresses) and provide a more nuanced understanding of temporal dynamics. Second, our reliance on individual-level perception data obtained through students' self-reports suggests a need for future studies to incorporate data that directly capture behavioral interactions (Wilson & Dewaele, 2010). Behavioral data, such as classroom observations or video analyses, could provide further evidence of whether similar reciprocal patterns for teacher-student interactions exist academically and socially as those identified through self-report data (Sudina, 2021). Even with the emergence of recent studies that utilized novel approaches to test the dynamics of language learner and teacher engagement in certain contexts (e.g., Sulis & Mercer, 2025 in Austria), there remains a critical need to deploy additional approaches with EFL/ESL learners and teachers from a variety of contexts. Third, we were unable to control for various unmeasured contextual and individual factors, such as the school environment, students' L2 proficiency levels, evaluations of teaching effectiveness, and students' prior language learning experiences. Future research could benefit from accounting for additional variables to more fully explore their influence on the PTES-EE relationship. Fourth, the relatively small sample size (*N* =126) limits the generalizability of our findings. A larger, more diverse sample would provide greater statistical power and yield a more robust understanding of the dynamic relationship between emotional support and engagement across a broader learner population. Future research might also explore how these reciprocal relationships develop over extended periods or at various stages of language learning, capturing more nuanced insights into how emotional dynamics between teachers and students evolve in different learning environments. Additionally, examining the influence of cultural factors or variations in instructional style could provide deeper insights into how the reciprocal effects of PTES and EE function across diverse cultural and pedagogical settings.

8. Conclusion

This study provides valuable insights into the dynamic, bidirectional relationship between PTES and student EE within L2 learning contexts. By showing that PTES and EE both contribute to and result from a reinforcing cycle, this study enhances our understanding of how emotional exchanges between the language teacher and the L2 learner foster a supportive classroom climate that enhances language learning outcomes. Regarding future work, we suggest that sensitivity analyses relaxing equality constraints on autoregressive paths could reveal temporal variations in within-person stability, offering a dynamic view of PTES and EE trajectories. Moreover, larger and more diverse samples across cultural and instructional settings would enhance generalizability and uncover how these emotional dynamics evolve over longer timescales.

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