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Longitudinal Reciprocal Relationship between Language Teachers' Trait Emotional Intelligence and their Learner's Trait Emotional Intelligence: A Dyadic Curve of Factors Model

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ABSTRACT

The current research aimed at exploring the dynamic patterns of simultaneous change in English as a foreign language (EFL) teachers and learners' trait emotional intelligence (TEI) in a language classroom context. A reciprocal effects model was proposed to relate EFL teachers to EFL learners' TEI to suggest that there are positive reciprocal relationships between teachers' and learners' TEI. The model was tested with 4-wave longitudinal dyadic data (LDD) collected in the first 6 months of an academic year from 238 EFL teachers and 2138 EFL learners. A dyadic curve of the factor model was used to analyze the data. Three research questions were formed to explore, firstly, the growth trajectories for teachers and their students' TEI over time, secondly, whether the initial levels of teachers' and students' TEI predict linear change in TEI of teachers and students over time, and thirdly, whether teachers and their students' trajectories (initial levels and slopes) of TEI were associated. The overall findings showed a slight increase in TEI in both dyad members over time. Also, a higher initial TEI was associated with more growth in TEI over time in both teachers and students. Finally, teachers who had a higher level of TEI at the beginning of the study showed were more likely to have students with an increasing TEI over time. This study is pioneering in providing longitudinal evidence for interactive emotion transmission between teachers and learners. Implications for prospective research and teacher education are provided.

KEYWORDS: Trait Emotional Intelligence; EFL Teachers; EFL Learners; Dyadic Curve of Factors; Longitudinal Relationship

INTRODUCTION

Emotional intelligence (EI) has its origins in the introduction of social intelligence by Thorndike and Stein (1937) as the capability of understanding human relations and acting effectively in social interactions, related to Gardner's multiple intelligences and the intra-personal and interpersonal intelligence types (Petrides, 2011). Exploring emotional intelligence in the language classroom has become increasingly popular, especially in the second language acquisition (SLA) domain because it is one of the important aspects of teachers' and students' progress in teaching and learning a language (Dewaele, 2020; Mavrou & Dewaele, 2020; Moskowitz & Dewaele, 2020a; Resnik & Dewaele, 2020). Two different approaches to EI, trait versus ability, are distinguished based on the operationalization method. Assessed through self-reports, the former involves the emotion-related self-perceptions; the latter, measured through tests called maximum performance, deals with the emotion-related cognitive abilities (Petrides, 2011).

Thus far, numerous models, descriptions, and measures including either self or other reports have been utilized for EI. Yet, the most comprehensive theory for a consistent interpretation of different findings from independent empirical studies is the trait emotional intelligence (TEI) theory (Pérez-González, Saklofske, & Mavroveli, 2020). Petrides and Furnham (2001) introduced the TEI theory to embrace human perceptions of the surrounding emotional world and how efficiently individuals act in perceiving, making sense of, handling, and benefiting from their and others' emotions (Petrides et al., 2018). This framework allows for a longitudinal exploration of changes in individuals' emotions and personalities throughout life (e.g., Revelle & Scherer, 2009).

There is empirical and meta-analytical evidence that TEI, which is a personality trait identified by self-perceived measures, enjoys a better criterion validity (than Ability EI, which is evaluated through performance-related measurements), and is significantly positively correlated with lifelong and subjective happiness, well-being, leadership, psychosocial balance, educational achievement, and occupational success (e.g., Di Fabio & Saklofske, 2019; Lea et al., 2018; Piqueras et al., 2020; Salavera et al., 2020; Szczygieł, & Mikolajczak, 2017; Ye et al., 2019). Thus, the assessment of TEI has been in the interest of several researchers. For one, Austin, Saklofske, and Smith (2018) developed and validated two scales on emotion managements to assess the interpersonal emotion regulation facet of TEI. Besides, two works of the research reported the psychometric qualities of the Chinese version, by Feher et al. (2019), and the Italian version, by Chirumbolo, Picconi, Morelli, and Petrides (2019), of the Trait EI Questionnaire (TEIQue) among university students. However, how these instruments can be best employed to assess the inter, as well as intra-individual changes in the construct in the reality of classroom learning, needs to be discussed. This means that the assessment of TEI along with its dynamic nature in EFL teachers and learners together with the probable mutual effects needs to be modeled and empirically explored. To do this, neither the one-shot assessment of the trait nor the separate repeated measure longitudinal studies can adequately represent the true changes to personality traits including TEI (Larsen-Freeman, 2016; Planalp, Du, Braungart-Rieker, & Wang, 2017). Indeed, longitudinal data describing a personality trait can more accurately indicate the genuine changes associated with individuals (Fitzmaurice, et al., 2011).

In a bulk of studies, the researchers have used latent growth curve modeling to examine longitudinal changes in a given trait and estimate growth trajectories (e.g., Byrne et al., 2008; Grimm et al., 2013; McArdle, 2009; Newhill et al., 2012). In addition, in psychological studies, often the data need to be gathered from two groups of related individuals within a target context, which is called dyadic data (Planalp et al., 2017), as is the case in the present research to explore EFL teachers and learners' TEI in the long run. The use of longitudinal dyadic growth curve modeling of data in multilevel models has been suggested for cross-sectional dyadic analysis of data so as to contribute to the interdependence in the data (Macho, & Kenny, 2011; Planalp et al., 2017). In the present research, the initial state and the later changes in EFL teachers' TEI and learners' TEI and their interdependence are measured through multiple stages of time during an EFL course. Also, the associations between EFL teachers' TEI and learners' TEI are tested for statistical significance.

REVIEW OF THE LITERATURE

TEI IN GENERAL PSYCHOLOGY

The TEI model has been used to describe individuals' subjective or self-perceived emotional capabilities measured by self-evaluating reports (Petrides, & Furnham, 2000), while ability EI refers to an individual's cognitive capabilities evaluated through performance-related measurements. The former is also referred to as trait emotional self-efficacy, while the latter is described as cognitive-emotional ability (Petrides et al., 2007). According to Petrides (2017), TEI entails comprehension, but not talents or abilities. It can thus be said that learners who have high levels of TEI cannot always be adaptive or flexible; moreover, low levels of TEI in learners would not necessarily mean that they are not adaptive or flexible. The reason for this could be the fact that being adaptive is context-bound. TEI is measured along fifteen dimensions divided into four subdomains; they include emotionality, sociability, self-control, and well-being (Petrides & Furnham, 2003). Two dimensions of well-being and self-control focus on an intrapersonal perspective of TEI, while the other two dimensions, emotionality, and sociability, address the interpersonal perspective. The interpersonal perspective to TEI represents the major role that interpersonal development plays in successful learning, and the intrapersonal perspective shows the significance of intrapersonal development meaning that learners should be able to be aware of their emotions and the cognition and behavior associated with these emotions (Humphrey, 2013; Kusché & Greenberg, 2006; Merrell & Gueldner, 2010).

TEI IN THE SLA DOMAIN

In the SLA domain, the significant role of TEI and its effect on language learning and teaching has been recently explored (e.g., Dewaele, et al., 2008; Perera, & DiGiacomo, 2013; Carlos Torrego-Seijo et al., 2021; Li, Huang, & Li, 2020; Taherian, et al., 2021a, 2021b; Resnik & Dewaele, 2020). A higher level of TEI has also indicated to anticipate a lower language anxiety (Dewaele et al., 2008; Shao et al., 2013), but higher threshold of positive educational emotions such as foreign language enjoyment (FLE) (Li & Xu, 2019; Li et al., 2020), as well as affirmative attitudes towards second language education (Oz et al., 2015). Improved EI skills have been also revealed to help language learners to experience positive emotions in social interactions and support their peers towards a better academic achievement (Dewaele, et al., 2018).

Additionally, research has also indicated that developed EI skills contribute to teachers' psychological and occupational well-being (Brackett et al., 2010; Holmes, 2005; Mercer et al., 2016; Zembylas, 2005). Moreover, prior research has revealed that teachers' level of TEI is likely to affect the quality of teacher-student relationships as well as group dynamics and classroom management (Dewaele, et al., 2018a; Moskowitz, & Dewaele, 2020b). As the related literature show, TEI is crucial for language teachers, to survive and make progress in their profession, and for language learners, to adhere to their experience of language learning.

A body of research showed that EI is changeable and that individuals who receive training on EI become more self-aware and better capable of empathizing with others and regulating their emotions in social contexts (Brackett & Katulak, 2006; Li & Xu, 2019; Taherian et al., 2021a & 2021b; Zins et al., 2004). Using an exploratory sequential design, for instance, Li and Xu (2019) in their study demonstrated that there is a relationship between TEI and the negative and positive foreign language emotions, say, classroom anxiety and enjoyment. Furthermore, in their study, the 55 participants responded to the open questions right after participating in a six-week positive pyschology-inspired EI intervention which contained both the participants' reflection on their emotions as well as their consciousness-raising. Their findings highlighted the usefulness of such interventions to develop positive and decrease negative emotions and to enhance the learners' EI.

Taherian et al. (2021b), in another study, investigated the developmental progress of TEI as well as also its subcategories throughout an EFL course in a longitudinal study utilizing a factor of curve modeling along with parallel-process modeling. Their results revealed a significant increase through the passage of time in four categories of TEI as well as global TEI. These findings highlight the dynamic nature of TEI throughout language learning. The trait characteristic of TEI leads us to conclude that TEI can be developed more through experience, attention and sustained effort (Dewaele et al., 2018). The related literature attests to the developmental dynamics of TEI in the context of language learning and teaching (Taherian et al., 2021a); yet it remains unclear whether teachers' and learners' TEI co-develop through parallel change processes. Thus, the present research aimed to model dyadic interrelations between teachers and their learners among initial status and change over time in TEI. Dyadic data implies the type of data for which observations from the two members of a dyad are present (Planalp, et al., 2017). To analyze dyadic data, it is necessary to use the right data-analysis methods that make up for the above-mentioned interdependencies. One of the appropriate models that can be employed to analyze data from dyads over time is Dyadic Curve-of-Factors Model (CFM) (Wickrama et al., 2016). This model enables investigators to measure the developmental outcomes of an individual's trajectories which consist of an initial stage and slop, referring to the changes for each member in particular time frames (Wickrama et al., 2016) as well as the relations between trajectories of both dyad members (Lee et al., 2021). Using a Dyadic CFM, the present research addressed the following three research questions:

RQ1. What are the growth trajectories for EFL teachers and their students' TEI over time?
RQ2. Do initial levels of EFL teachers' and students' TEI predict linear change in TEI of teachers and their students over time?
RQ3. Are EFL teachers' and their students' initial levels and growth levels of TEI associated?

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METHODOLOGY

PARTICIPANTS AND SETTING

According to the researchers' availability to the participating L2 teachers in the private language institutes of six metropolises in China, a convenience sampling method was used in this study. There were also learner participants who studied EFL in private language institutes. They shared the same native language. The one-with-many design was used in order to collect the dyadic data, in which each individual is paired with multiple others, but these others are not paired with any other individuals. The data were collected from 71 private language institutes with a range of 3 to 8 dyad members per institute. As is typical of longitudinal research, there was a participant mortality during the phases of data collection. A total number of 238 teachers (134 female, 104 male) and 2138 (1156 female, 982 male) language learners were at Time 1. Valid responses to items, until Time 4, were 229 for teachers and 2016 for language learners.

All learner participants in this study were adults with the proficiency level ranging from beginner to upper-intermediate levels. Their average age was 26 years (SD= 8.1; R= 17-37) and the skewness and kurtosis of the distribution were found to be 0.51 (SE= .06) and 0.27 (SE= .11), respectively. The average age of teachers was 32 years (SD= 12.7; R= 19-44) and the skewness and the kurtosis were found to be .64 (SE= 0.08) .33 (SE=0.14), respectively. The English proficiency level of teachers ranged from upper-intermediate to advanced. Both teachers and learners filled in a self-report scale and provided details regarding their English proficiency, nationality, first language, age, and gender.

INSTRUMENTATION

The Trait Emotional Intelligence Questionnaire – Short Form

Petrides's (2009) 30-item TEIQue-SF scale consists of four TEI factors including self-control (e.g., I find it hard to keep myself motivated), well-being (e.g., I'm a very motivated person), sociability (e.g., I'm unable to change the way other people feel), and emotionality (e.g., Sometimes, others complain that I treat them badly). The mean scores of the subdomains were 4.92 (SD=.84), 5.23 (SD=.83), (M=5.02, SD=.77), and 4.71 (SD=.58), respectively. The global mean score of the scale was 3.98 (SD = .57), ranging from 1.91 to 5.32 (absolute min= 1, absolute max= 7). Cronbach's coefficient α and McDonald's ω were respectively used for determining the internal consistency of the measure and assessing the composite reliability of the scale (Şimşek & Noyan, 2013) (see Table 1). Indeed, we decided to use both approaches because running only Cronbach's α is likely to insufficient for precise reliability estimation of multidimensional scales (Osburn, 2000).

Table 1
Reliability of TEI and dimensions

	No of items in the final analysis	Cronbach's α	ω
Well-being	6	.81(.75-.87)	.79(.74- .82)
Self-control	7	.70 (.64-.75)	.68(.63- .73)
Emotionality	8	.77 (.62- .80)	.75 (.68 - .78)
Sociability	8	.72(.68- .76)	.69(.65- .73)
Global TEI	30	.80 (.73- .84)	.78 (.75 - .83)

DATA ANALYSIS

In the present study, we used Mplus 8.4 to maximize the likelihood estimates when analyzing the latent variables.Below are the procedures for data analysis: *Estimating an unconstrained Dyadic-CFM*: In this step, the long-term associations among the global latent factors were tested via a dyadic-unconstrained CFM (a configural model). To this aim, the factor loading (λ) of an indicator was set as 1 for each time point (well-being~4), and its intercept was set as zero for the purpose of model identification. This is called a marker variable scale setting for confirmatory factor analysis models. This marker variable approach has implications for the estimates of latent factors as the definition of the variance of each latent factor and the covariance of the latent factors depend on the metric of the marker variable (e.g., well-being) (Brown, 2006). Besides, all models that are estimated contain covariances that are freely estimated in Dyadic-CFM. Residuals of the target items across measurement steps within each dyad group could covary as certain aspects of a given construct may be correlated through time (see Loehlin, 2004). In the present study, the covariances in the second-order growth factors within and between dyad members were measured as well (Figure 3).

The goodness-of-fit indices were measured to make sure that the model fits. These were Tucker-Lewis index (TLI), comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root means square residual (SRMR). The acceptance range included CFI and TLI ≥ .90 and ≥ .95, RMSEA and SRMR ≤ .08 and ≤ .05 (Hu & Bentler, 1998; Marsh et., 2004).

Longitudinal Measurement Invariance: Longitudinal equivalence and invariance were measured by constraining several parameters at different measurement stages so as to make them equal. These equality constraints are normally assessed hierarchically so as to increase order of stringency of equivalence or invariance (Meredith, 1993). The three levels that were measured in increasing strictness order were (a) weak or metric longitudinal invariance, in which the relevant factor loadings are equivalent in all measurement steps, b) strong or scalar longitudinal invariance, in which the corresponding factor loadings and indicator variable intercepts are equivalent through steps of time, and (c) strict longitudinal invariance, in which all indicator variable intercepts, the respective factor loadings, and indicator variable error variances remain unchanged through time.

Two criteria were used to measure invariance adopting maximum likelihood estimator. These included a nested chi-square difference test, $\Delta\chi 2$, between the unconstrained model and the model(s) enforcing equality constraints (Ferrer et al., 2008) and changes in the comparative fit index (ΔCFI). The ΔCFI was used besides $\Delta\chi 2$ since the literature showed that the $\chi 2$ statistic is largely dependent on sample size (Meade et al., 2008). For model comparison, the use of an alternative fit index such as CFI was recommended by virtue of being less sensitive to sample size and more to a lack of invariance than the $\chi 2$ statistic. Cheung and Rensvold (2001) suggested that the assumption of measurement invariance is met if the change in the CFI (ΔCFI) between the unconstrained model and the constrained model is lower than .01.

Dyadic Measurement Invariance: In the examination of the non-exchangeable dyads' longitudinal development, not only can we find whether the change (in the target construct) from time to time is because of actual changes in the construct itself, but we can also see whether the change in the construct from time to time is similar for each member (of the dyad). Measurement invariance, in the dyad–group context, refers to the degree to which the relationships between indicator variables and the underlying latent constructs are similar across dyad groups. In the present study, dyadic measurement invariance was measured by constraining a number of parameters to be equal among dyad member groups. Similarly, these equality constraints were tested using $\Delta\chi^2$ and ΔCFI.

RESULTS

A set of parameterizations of the Dyadic CFM is evident in Table 2. Individual averages and plots of the four items at each of the four time points were graphed for students and teachers to scrutinize whether it was possible to model a linear trajectory across time. Also, the intercept was used to reveal the initial growth amount of the TEI construct.

Table 2
Description of the Estimated Dyadic –CFM Models

Estimating Model	***Model Description***
ULGM	Unconditional unconstrained Dyadic –CFM with linear growth Modeled
FMIM	Linear Dyadic –CFM with full factor loading constraints across time and dyad groups
FSIM	Linear Dyadic –CFM with full factor loading and item intercept constraints across time and dyad groups
PSIM	Linear Dyadic –CFM with full factor loading and partial item intercept constraints across time and dyad groups
FRIM	Linear Dyadic –CFM with full factor loading, partial item intercept, and full residual variance constraints across time and dyad groups
PRIM	Linear Dyadic –CFM with full factor loading, partial item intercept, and partial residual variance constraints across time and dyad groups

Note: ULGM=Unconstrained linear growth model; FMIM= Full metric invariance model; FSIM = Full strong invariance model; PSIM = Partial strong invariance model; FRIM = Full residual invariance model; PRIM= Partial residual invariance model.

THE UNCONDITIONAL UNCONSTRAINED LINEAR GROWTH MODEL

First of all, the unconditional, unconstrained Dyadic CFM with linear growth was tested in which the factor loadings, intercepts, or strict variances of none of the items (except for the reference indicator) were constrained to be equivalent among time steps or dyads. The unconstrained linear growth model (ULGM) adequately fits the data (see Table 3 for model fit information). Second-order factor (growth trajectory) parameter estimates are shown in Table 4and the second-order factor covariances with respective correlations are included in Table 5 for the first set of models estimated. The intercept factor mean for teachers ($M_{\alpha\text{-}T}$ = 0.453) and students ($M_{\alpha\text{-}s}$ = 0.361) was significantly above zero. There was significant variability in the initial measurement of TEI among teachers ($V_{\alpha\text{-}T}$ = .042) and students ($V_{\alpha\text{-}s}$ = .041). The slope factor means for teachers ($M_{\beta\text{-}T}$ = .008) and students ($M_{\beta\text{-}S}$ = .007) indicated a significant increase in linear growth across time in the TEI construct. Thus, there tended to be a linear increase (on average) in TEI across measurement occasions for both teachers and students. Significant variability was found in the increasing rates of TEI among the teachers ($V_{\beta\text{-}T}$ = .001), and among the students ($V_{\beta\text{-}S}$=.001).

Also, the teachers' and students' initial level of TEI was significantly and positively correlated with their increasing trajectory in TEI ($\boldsymbol{r}_{(T)\alpha(T)\beta}$ = .342; $\boldsymbol{r}_{(T)\alpha(T)\beta}$= .381). Thus, teachers and students with high initial levels of TEI showed to experience more increase in TEI across measurement levels compared with teachers and students with low initial levels of TEI, who tended to experience less increase in TEI across measurement occasions. The covariance between teachers' and students' intercept factor disturbance variances was not statistically significant ($\boldsymbol{r}_{(T)\alpha(S)\alpha}$= .121). This indicates that there is no relationship between teachers' and students' initial level of TEI. However, the covariance between teachers' and students' slope factor disturbance variances was statistically significant ($\boldsymbol{r}_{(T)\beta(S)\beta}$= .223), showing that the linear trajectory through time for teachers was related to the linear trajectory across time for their students. The covariance between the teachers' intercept factor and the students' slope factor was also statistically significant ($\boldsymbol{r}_{(T)\alpha(S)\beta}$= .218), which shows that the teachers' initial level of TEI was significantly correlated with the students' increasing trajectory in TEI. Furthermore, there was no statistically significant correlation between the teachers' increasing rate of TEI and students' initial level of TEI ($\boldsymbol{r}_{(T)\beta(S)\alpha}$= 109).

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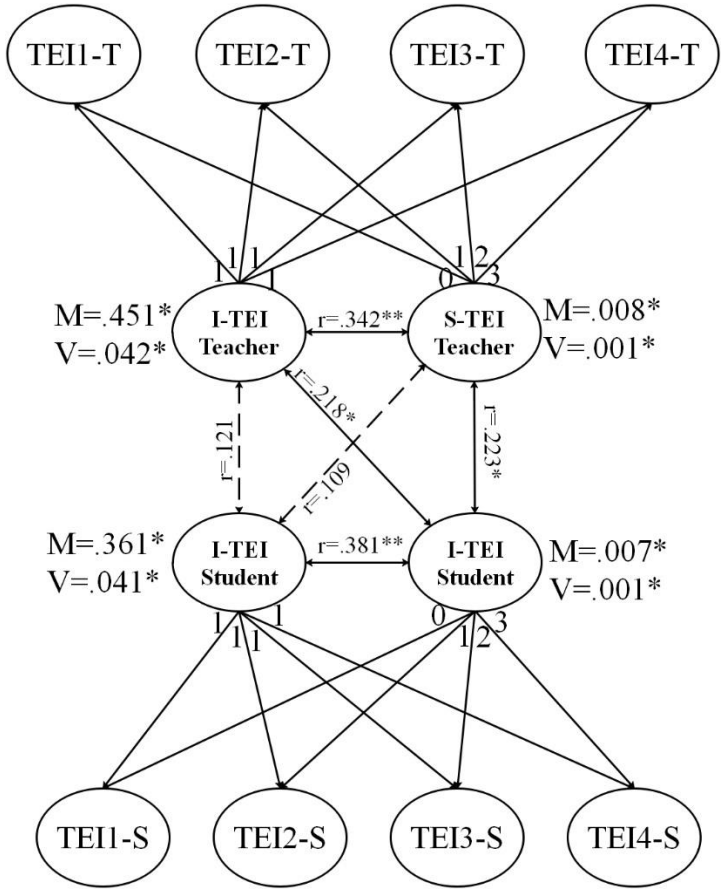

Figure 1. A Dyadic Curve-of-Factors Model (D-CFM).
Note: Unstandardized coefficients are shown. I = Intercept. S = Slope. TEI= Trait emotional intelligence. T= Teacher. S=Student.

Table 3
Global Fit Indices and Information Criteria for the TEI Dyadic Curve-of-Factors Models Estimated

	Global Fit Indices and Information Criteria									
Estimating Model	***df***	***χ2***	**Δ *χ2***	***CFI***	**Δ*CFI***	***TLI***	***RMSEA [90% CI]***	***SRMR***	***AIC***	***BIC***	***aBIC***
ULGM	**74**	424.128*	--	.968	-	.961	.031[.025-.037]	.051	28032.567	28647.144	28185.462
FMIM	**71**	458.348*	34.220	.967	.001	.953	.032[.026-.037]	.054	28041.187	28592.812	28174.345

FSIM	**76**	537.043*	78.695*	.984	.017	.933	.039[.034-.043]	.058	28152.471	28591.213	28257.441
PSIM	**70**	476.713*	18.368*	.976	.009	.948	.031[.026-.035]	.053	28084.321	28512.213	28154.168
FSIM	**73**	642.618*	165.905*	.992	.016	.918	.042[.038-.047]	.059	28051.316	68607.844	28317.812

Note. Italicized values represent the smallest information criteria values among the first six comparison models estimated. CFI = comparative fit index; TLI = Tucker–Lewis Index; RMSEA = root mean squared error of approximation; SRMR = standardized root mean squared residual; AIC = Akaike's Information Criterion; BIC = Bayesian Information Criterion; aBIC = sample size adjusted BIC. See Table 2 for a description of the models estimated. ∗p <.05.
ULGM=Unconstrained linear growth model; FMIM= Full metric invariance model. FSIM = Full strong invariance model; PSIM = Partial strong invariance model; FRIM = Full residual invariance model; PRIM= Partial residual invariance model.

Table 4
Unstandardized Parameter Estimates of Second-Order Factor Means and Factor Variances for the First Six Dyadic Curve-of-Factors Model Models Estimated

	Mean				**Variance**			
Estimating Model	$M_{\alpha\text{-}T}$	$M_{\alpha\text{-}S}$	$M_{\beta\text{-}T}$	$M_{\beta\text{-}S}$	$V_{\alpha\text{-}T}$	$V_{\alpha\text{-}S}$	$V_{\beta\text{-}T}$	$V_{\beta\text{-}S}$
ULGM	.453*	.361*	.008*	.007*	.042*	.041*	.001*	.001*
FWIM	.452*	.361*	.008*	.007*	.052*	.037*	.001*	.001*
FSIM	.448*	.372*	.007*	.007*	.052*	.038*	.001*	.001*
PSIM	.462*	.347*	.008*	.006*	.051*	.041*	.001*	.001*
FSIM	.466*	.351*	.008*	.007*	.054*	.037*	.001*	.001*
PRIM	.463*	.343*	.008*	.007*	.053*	.036*	.001*	.001*

Note. α= intercept factor; β = slope factor; T = Teacher; S = student. See Table 2 for a description of models estimated. ∗p < .05.

Table 5
Parameter Estimates of Second-Order Factor Covariances and Corresponding Correlations Within and Across Dyad Member Groups for the First Six Dyadic Curve-of-Factors Model Models Estimated

	$V_{(T)\alpha(T)\beta}$	$r_{(T)\alpha(T)\beta}$	$V_{(S)\alpha(S)\beta}$	$r_{(S)\alpha(S)\beta}$	$V_{(T)\alpha(S)\alpha}$	$r_{(T)\alpha(S)\alpha}$	$V_{(T)\beta(S)\beta}$	$r_{(T)\beta(S)\beta}$	$V_{(T)\alpha(S)\beta}$	$r_{(T)\alpha(S)\beta}$	$V_{(T)\beta(S)\alpha}$	$r_{(T)\beta(S)\alpha}$
ULGM	.006**	.342**	.008	.381*	.017	.121	.004*	.223*	.006*	.218*	.001*	.109

FWIM	.006**	.383**	.008	.384**	.016	.134	.004*	.222*	.006*	.214*	.001*	.113
FSIM	.006**	.378**	.007	.387**	.016	.131	.004*	.225*	.006*	.216*	.001*	.117
PSIM	.006**	.381**	.008	.383**	.018	.130	.005*	.223*	.006*	.213*	.001*	.114
FSIM	.006**	.382**	.007	.391**	.019	.133	.004*	.234*	.006*	.207*	.001*	.118

Note. α= intercept factor; β= slope factor; T = Teacher; S = student. See Table 2 for a description of models estimated. ∗p <.05.

LONGITUDINAL DYADIC INVARIANCE CONSTRAINTS

To follow the sequential order of testing invariance in the longitudinal and multiple-group existing body of research, at first, weak invariance was tested in multiple steps of time and dyad member groups simultaneously. Then, scalar/strong invariance was tested across time and dyad member groups simultaneously. Next, strict invariance was tested through time and in dyad member groups simultaneously. While these invariance levels were tested simultaneously, they could be tested consecutively too (i.e., first longitudinally and then by dyadic invariance or the other way round).

Full Weak Invariance Model (FWIM): At first, the indicators' respective factor loading constraints were imposed on the linear D-CFM in multiple steps of measurement and across dyad member groups to see whether the weak longitudinal and dyadic invariance was supported. The full weak invariance model (FWIM) showed to adequately fit the data (see Table 3). The test between the unconstrained linear growth model and the constrained factor loading model was not statistically significant ($\Delta\chi^2_{TS}$ = 34.220, ΔCFI_{TS}=.001), which supports the less parameterized weak invariance model and proves that the correlation between the respective items and TEI factors was similar in different steps of time and dyad member groups (see Tables 4and 5for the second-order parameter estimates of interest with these particular constraints imposed).

Full Strong Invariance Model (FSIM): Then, the indicators' intercepts were constrained across the measurement occasions as well as dyad member groups to see whether scalar/strong longitudinal and dyadic invariance was supported. The full strong invariance model (FSIM) showed to adequately fit the data (see Table 3for model fit information and Tables 4and 5for parameter estimates). The test of the constrained factor loading model and the constrained item intercept model showed to be statistically significant ($\Delta\chi^2_{TS}$ =78.695, ΔCFI_{TS}= .017, p> .05). Modification indices were used to help pinpoint which item intercepts may be non-invariant across time and/or dyad member groups. Each item intercept associated with the largest modification index was freely estimated in sequential order so that the test between the FWIM and the current partial strong invariance model (PSIM) was not statistically significant any longer.

Partial Strong Invariance Model (PSIM): Five item intercept constraints were released, which resulted in the last partial strong invariance model (PSIM; see Table 3for model fit information and Tables4and 5for parameter estimates). It was shown, for example, that the intercept for item three was higher in the first step of measurement for students than in all four steps of measurement for teachers. Also, the intercept of item three was higher at the first point of measurement than the same item's intercepts on the three measurement occasions for students. Accordingly, students had lower TEI at the first point of measurement than teachers did at all four points of measurement. In addition, students had a lower TEI at the first point of measurement than at the next three points. Of note is that the

non-invariant intercepts showed some source other than the factor affecting the mean differences. So, latent mean differences were not just influenced by the factor, but as well by differences in the intercepts.

Full Strict Invariance Model (FSIM): To examine the strict longitudinal and dyadic invariance, respective item strict variances were constrained to be equal in multiple steps of measurement and across dyad member groups. The full strict invariance model (FSIM) adequately fits the data (see Table 3for model fit information). Yet, the test between the partial strong invariance model (PSIM) and the fully constrained strict variance model was statistically significant ($\Delta\chi^2_{TS} = 165.905$, $\Delta CFI_{TS} = .016$, $p > .05$). Echoing our findings, Wickrama et al. (2016) put forward that strong measurement invariance is the minimum level of measurement invariance so as to use the second-order modeling.

DISCUSSION

A longitudinal dyadic curve of factor (dyadic-CFM) design was employed in this study to provide quantitative evidence for the developmental process of EFL teachers and students' TEI. The findings pointed to the participants' interdependence on TEI in the constant changes between dyad members (parallel change processes). The discussion of the answers to the research questions is as follows:

The first research question enquired about the growth trajectories of EFL teachers and students' TEI over time. Firstly, the significant slope factor means for teachers and students suggests that, on average, both teachers and students show a slight increase in TEI over time. Numerous factors, as Pekaar et al. (2020), are likely to influence the development of TEI and its dimensions, including contextual factors that trigger emotions in the self and others as well as situational and dispositional causes which can spark off the dynamics of TEI. Thus, the contextual as well as situational factors in the practice of foreign language education might have corresponded to the growth of students' TEI dimensions. In line with Taherian's et al. (2021a) study, there was a statistically significant growth in foreign language learners' level of TEI over a span of one year.

Results also indicated a statistically significant difference between the initial and growth level variances in both teachers' TEI and that of the students, exhibiting an inter-individual variability in initial levels and slopes for teachers' and students' TEI. This finding implies that a group of participants indicated a greater level of change in TEI in comparison with the individuals with a lower rate of variation in the subdomains over time. It is worth stating that, some other participants' TEI level did not chance over time.

The finding among EFL students can also be discussed in relation to the ergodicity issue. The statistical findings on an average basis, as (Tarko, 2005) asserts, does not deliver the identical results on an individual basis. Although the average of TEI indicated an increasing pattern, at the individual level the pattern was not indicative of the change in subdomains. The finding then can be attributed to the non-ergodic nature of foreign language learners (see Lowie & Verspoor, 2018). According to the ergodicity issue, the average of individual learners' attributes in research on individual differences does not essentially reflect the reality of the target attributes. Hence, the individual variations are inevitable in the average-based measurement of group behaviors or attributes. Additional case studies would be illuminating with respect to the nuances of variation in TEI. Several variables such as gender, age, personality, and cognitive intelligence have also been identified to be contributing factors to the emergence of variance in the intercept and slope of the TEI subdomains (e.g., Côté & Miners, 2006; Doerwald et al., 2016; Fischer et al., 2018; van der Linden et al., 2017).

Concerning the second research question, whether the initial level of teachers' and learners' TEI is associated with their growth over time, the findings indicated that the teachers' growth level of TEI is positively predicted by their initial level. The same result was also found for EFL students' TEI. This finding suggests that a higher initial TEI is associated with more growth in TEI over time in both teachers and students. This can be explained in a number of ways: First and foremost, the initial state of TEI influences the proportion of change in TEI over time. This indicates the dynamicity of TEI in general and, as de Bot et al. (2005) assert, changes in its dynamic system in the initial stage can affect the posterior states of the system through time. The susceptible nature of each TEI subdomain can be discussed further in respect of spillover effects (Bakker & Demerouti, 2013; Hareli & Rafaeli, 2008), in which one's emotional status at the end of an emotional episode is an influencing factor in subsequent emotional experiences in the posterior episodes. Indeed, the variable of time is an overlooked parameter in the TEI studies (Mesquita & Boiger,

2014), and thereby the positive association between the intercepts and slopes of TEI subdomains underlines the significance of spillover in the dynamic nature of TEI in the passage of time.

For the third research question, which explored teachers and their students' trajectories (the initial level and growth level) of TEI, two significant positive covariances were found: (a) a covariance between teachers' initial level of TEI and students' growth level over time, and (b) a covariance between teachers' growth of TEI and students' growth of TEI over time. The significant covariance between initial levels of teachers' TEI and students' growth level of TEI suggests that teachers who had a higher level of the TEI at the beginning of the study are more likely to have students with an increased TEI over time. Also, students tended to experience a greater increase in TEI overtime when their teacher experienced a greater increase in TEI over time. The association between the growth of teachers' TEI and the growth of their learners' TEI pointed to the developmental nature of TEI in a parallel change process. This indicates why an analytic approach like dyadic-CFM is needed to explore the co-development of TEI in language teachers alongside their learners dyadically and longitudinally and not on one side of development or on one occasion of measurement.

The related literature on TEI in language classrooms has relevant points to consider in explaining the parallel process in teachers' and learners' TEI development. Firstly, the entire interactive nature of a language classroom hosts different forms of teachers and students invariably influencing each other. From a relational perspective of classroom life, Gkonou and Mercer (2018) argued that teachers who score highly in EI are in the best position to build quality interpersonal relationships in their classrooms with and among learners, which can lead to the development of learners' TEI over time. Besides, learners' high TEI could influence the teachers' developmental processes of TEI during teaching a language. Secondly, Dewaele (2020) maintained that teachers with a high TEI are more intrinsically motivated to be good teachers and they have a stronger identified regulation. Thus, these teachers are likely to influence the quality of teacher-student relationships as well as group dynamics and also classroom management, leading to the development of their language learners' TEI.

However, the results indicated that the associations between teachers' initial level of TEI and students' initial level of TEI as well as the association between teachers' growth of TEI and learners' initial level of TEI were not statistically significant. Research about teachers' actual emotions experienced in class related to interactions with students is lacking. Thus, little is known about how teachers' emotions and perceptions of these emotions are affected in the context of one-on-one or dyadic teacher-student interactions (Koenen et al., 2019). The effect of teacher-student relationships on teachers' perceived emotions has been shown to diverge significantly across students in class depending on the match or mismatch between the specific characteristics of the student and those of the teacher (Hamre & Pianta, 2001; Pianta et al., 2003). Thus, growth in teachers' TEI can be associated with other learner-related factors, rather than learners' initial state of the trait. As pinpointed by Zembylas (2007), from a social-constructivist viewpoint, teachers' perceived emotions are linked with their daily social interactions and communication with specific others, particularly students, and this relationship is conceived as a dynamic transactional process. So as the present findings showed, it does not necessarily guarantee a significant correlation at the opening of the course before any constructive interactions are made between the teacher and students. Koenen et al. (2019) drew attention to the dearth of research on the dyadic teacher-student relationship as a source of developing certain emotions in teachers and forming a certain perception toward them. The present study was an attempt to partly fill this gap and pave the way for more detailed and comprehensive investigations.

CONCLUSION

Considering the dearth of research on the dynamicity of TEI in language teaching/learning, the present study pioneered in exploring the interactive growth and potential associations between EFL teachers and learners' TEI in the long run. Admittedly, the analysis of longitudinal data is very complicated, and in the case of longitudinal dyadic data (LDD), the case is even more challenging (Kenny et al., 2006). To deal best with LDD, growth modeling approaches are recommended (Planalp et al., 2017), as used in the present study to assess change over time in distinguishable dyads and to account for the non-independence in LDD.A curve of factor growth modeling helped us find an increasing rate of both dyad members' TEI through time and the associated nature of their initial state and growth of the trait.

Further research is recommended to explore the contextual factors that can have accounted for the increasing rate of TEI in the EFL classroom. More specifically, the under-researched domain of teacher's TEI requires the use of innovative data analysis approaches similar to the curve of factor model used in this study to further explore the

nuances of change and growth in the trait of interest. The value of analyzing LDD in language teaching and learning is further emphasized as it explores changes in the most related members of the classroom context, namely the teacher and students simultaneously. When used in growth modeling approaches, analysis of the LDD collected from EFL teachers and students helps trace the real time-bound changes and growth in a trait in the reality of classroom experiences. The results can be, thus, the more realistic and better representative of the dynamic nature of the trait. The value is even more when the trait of interest is under-researched in the EFL teaching and learning domain, as is the case with TEI. It is hoped that the present findings pave the way for a more innovative and fruitful line of research in L2 teacher/learner psychology.

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