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# Teacher education students' emotional intelligence and teacher self-efficacy: a cross-cultural comparison

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**Abstract**
Existing research has shown that emotional intelligence (EI) and teacher self-efficacy (TSE) play an important role in the work of in-service teachers. However, there is limited research on these variables and their associations among pre-service teachers. Also, the cultural context is expected to influence EI and TSE. Therefore, this study examined the associations between EI and TSE in two cultures, Finland and Greece. A comprehensive evaluation of EI was done by including both trait EI and ability EI measures. Data from primary education student teachers from Finland ($N = 82$) and Greece ($N = 117$) were collected online. The measures of EI and TSE exhibited full configural and metric measurement invariance and partial scalar and residual/strict measurement invariance across cultures. Finnish students had significantly higher scores on all EI variables than Greek students, whereas Greek students scored higher on self-efficacy for student engagement. Structural equation modelling showed that trait EI was moderately associated with one facet of ability EI, namely emotional management, but not with emotional understanding, implying that trait EI and ability EI can be considered as partially distinct constructs. A statistically significant positive association between trait EI and TSE was found in Finland, whereas a statistically significant negative association between ability EI and TSE was found in Greece. The findings have important implications for the models of trait and ability EI, for understanding the links between trait and ability EI and TSE during the critical phase of teacher education in the two cultural contexts studied, and for culturally informed teacher education.

**Keywords** Emotional intelligence · Teacher self-efficacy · Teacher education · Pre-service teachers · Cross-cultural

## Introduction

Teachers' competence development both in pre-service and in-service phases has been the focus of research in the past few decades. Previous research has shown that teachers' emotional intelligence (EI) and teachers' self-efficacy (TSE) are significant determinants of teaching quality (Zee & Kooman, 2016). For example, EI has been found to be negatively associated with burnout in teachers (Mérida-López & Extremera, 2017), and TSE has been found to be associated

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with higher student engagement, occupational commitment, enthusiasm for teaching, and classroom management abilities (Klassen et al., 2013). Most studies on EI and TSE have focused on in-service teachers and much less research has been done with pre-service teachers (Gürol et al., 2010).

Although there is a large body of research on EI, more cross-cultural comparisons of this construct are needed. Huynh and colleagues (2018) noted that the cultural context is relevant to EI because different cultures have different ways of understanding, expressing, and regulating emotions. Culture is also expected to play a significant role in TSE. A comparison across 23 countries has shown that, although TSE is a universal construct, it tends to be higher in countries with more individualistic cultural orientations compared to those with more collectivistic ones, a pattern explained by values such as less modesty and more extremity in self-presentation (Vieluf et al., 2013). Therefore, more cross-cultural research is needed on EI and TSE, and on the links between them among pre-service teachers.

## Trait and ability approaches to emotional intelligence

Emotional intelligence (EI) has typically been conceptualised as trait EI, ability EI, and mixed EI. According to the trait EI approach, EI is a set of emotion-related self-perceptions and dispositions for dealing with emotion-arousing situations, and emotionality (Petrides et al., 2007). Trait EI dimensions encompass a balanced state of happiness and contentment, adept stress management, emotional understanding for nurturing relationships, and effective social engagement and communication skills. Trait EI operates at the lower levels of personality hierarchies, suggesting that EI is related to and interacts with the more general personality traits (Petrides et al., 2007). In contrast, according to the ability approach, EI is considered the individual's ability to identify, understand, express, use, and manage their own and others' emotions (Salovey & Mayer, 1990). This ability comprises the so-called four-branch model. Researchers consider the branches of understanding and of managing emotions as the strategic part of ability EI, which contributes the most to global EI (MacCann, 2010). Ability EI has been extensively investigated but its measurement has been criticised on both theoretical and psychometric grounds (Zeidner et al., 2008). The trait and the ability approaches are associated with different measurement practices: trait EI is assessed with self-reports of self-perceived tendencies to process emotional information (Petrides & Furnham, 2006), whereas ability EI is assessed with the maximum performance standardised scales, in which the occurrences of correct and incorrect responses are counted (Allen et al., 2014).

The two EI approaches are often considered conceptually incompatible or contradictory because they offer different definitions of the nature and dimensions of EI. Another view, however, is that the two EI approaches are complementary and constitute a comprehensive and holistic conceptualisation of EI. Thus, mixed models of EI have been proposed, integrating the trait and the ability approaches (Nelis et al., 2011). However, empirical evidence on the associations between trait EI and ability EI is limited and partly inconsistent. For example, prior research has shown that the correlations between trait and ability measures of EI range from very low or negligible (0.04; Bastian et al., 2005) to moderate (0.34; O'Connor & Little, 2003). Consequently, there is a need to investigate the extent to which trait EI and ability EI are distinct or conceptually relevant and interrelated constructs. In this study, we compared the associations between trait EI and ability EI of student teachers across two diverse cultural contexts, that is, Finland and Greece.

## Emotional intelligence in teachers' work

Emotions are at the heart of teaching because teachers experience a multitude of emotions, both positive and negative, in classrooms and school environments when teaching and interacting with students, colleagues, and families (Sutton & Wheatley, 2003). They also engage in emotional exchanges with all members of the school community. Teachers need to recognise their own emotions, and understand how they are triggered and how they can be regulated in socially acceptable ways. Teachers also need to be able to recognise their students' emotions, to understand the cognitive appraisals that may be associated with these emotions and to discern how these cognitions and emotions motivate students' behaviour (Jennings & Greenberg, 2009). Because teaching is a challenging and inherently stressful profession, teachers need to be able to understand and regulate their emotions, as well as express them in appropriate ways.

The concept of EI captures the varied ways in which teachers understand and manage emotions in themselves and others. Previous research has shown that both trait EI and ability EI are associated with many aspects of teachers' work. Teachers' trait EI has been shown to predict higher social support at the workplace, which in turn predicts lower teacher burnout (Ju et al., 2015). Teacher's ability EI has been found to foster students' self-perceptions of ability and self-esteem, and therefore students' achievement (Curci et al., 2014). Previous studies have also shown that teachers' EI is positively associated with teacher efficacy, job satisfaction, and teacher well-being (Vesely & Saklofske, 2013). However, much less research on this issue has been conducted with pre-service teachers. Existing data indicate a

lower-than-average level of ability EI in pre-service teachers, with females scoring higher on EI than males (Corcoran & Tormey, 2012). Taken together, these findings highlight the importance of EI for in-service and pre-service teachers' effectiveness and wellbeing.

## Teacher self-efficacy

The construct of self-efficacy, introduced by Bandura (1977) within the context of his social cognitive theory, refers to the individual's beliefs about their ability to perform an action and produce a foreseen outcome. In education, teacher self-efficacy (TSE) is central to teachers' perceptions of their abilities to perform teaching-related actions (Tschannen-Moran & Hoy, 2001). The importance of TSE beliefs has been supported by research with in-service and pre-service teachers. Teachers with elevated levels of self-efficacy believe in their ability to overcome difficulties and tend to persevere to accomplish their tasks (Tschannen-Moran & Hoy, 2001). Chesnut (2017) suggested that teacher education plays a vital role in supporting future teachers with the development of their TSE. Because these beliefs can be malleable (Bandura, 1977), it is crucial to cultivate and monitor self-efficacy beliefs during teacher education, particularly at the initial stages, to foster student teachers' confidence and subsequent effectiveness.

Prior research has shown that TSE fluctuates during the pre-service phase (Duffin et al., 2012; Poulou, 2007). Student teachers often have few opportunities to accumulate real teaching experiences within classrooms so as to discover their strengths and explore their identities as teachers, which may be reflected in their rather limited ability to differentiate between different dimensions of TSE (Duffin et al., 2012; Tschannen-Moran & Hoy, 2001). Duffin and colleagues (2012) suggested that further research could examine student teachers' TSE at later stages of teacher education, when student teachers have gained teaching experience and are familiar with teaching practices. This argument is supported by the finding that fourth-year Greek student teachers were more able to distinguish between different dimensions of TSE, which means that their experience from teaching practice had impacted their self-beliefs (Poulou, 2007). This evidence-based perspective is adopted in this study, in which we focused on third- and fourth-year teacher students, who are expected to have acquired some degree of teaching experience in the field.

## Associations between emotional intelligence and teacher self-efficacy

Empirical studies on the relationship between EI and TSE are scarce. A study by Vesely and Saklofske (2013) highlighted the importance of EI and its contribution to in-service teachers' TSE and well-being. Their findings indicated that EI and TSE were moderately associated. A recent study by Kostić-Bobanović (2020) examined the relationship between trait EI and TSE among novice and experienced foreign language teachers. The results indicated a positive association between trait EI and self-efficacy. Other studies further indicated positive significant associations between trait EI and TSE (Gürol et al., 2010; Mouton et al., 2013). Similarly, Valente and colleagues (2020) found that ability EI correlated positively with TSE among Portuguese schoolteachers. Despite these positive associations, recent findings in the context of ability EI research suggest that individuals with high EI levels of emotional understanding may have an increased tendency for self-doubt, thus having low scores in self-reports of self-efficacy (Udayar et al., 2020). This implies that the associations between EI and TSE may be more complex than previously believed. As this observation contradicts the findings from the studies mentioned above, it guided our interest in this study. Moreover, as EI is often understood and measured using either the trait or the ability approach, we sought to provide a more holistic view of EI by assessing both constructs.

## The cultural contexts of the study and the need for cross-cultural comparisons

In this study, a cross-cultural comparison between Finland and Greece is conducted. Both countries, Finland and Greece, share similar aspirations concerning the European 21st century competencies (Caena & Redecker, 2019), but, in practice, there are differences in the processes of student selection, initial teacher education, and student teachers' performance.

Entering the primary teacher education programme in Finland is competitive and involves a rigorous application process, with an acceptance rate of 10%. The selection process has two paths whereby, based on their matriculation exam scores, applicants can proceed directly to the interview phase, or first enter a screening multiple-choice digital exam, based on which they are selected for the interview phase (Metsäpelto et al., 2022). In the interview phase, their social and emotional skills and motivation to teaching career are assessed using several short interviews (Metsäpelto et al., 2022). Therefore, the student teachers who are accepted will have stronger emotional skills as assessed by interview methods. To obtain the primary teacher education degree in Finland, students need to complete a bachelor's and master's degree in Education (a total of 300 ECTS credits). Teacher education studies include content studies on school subjects (e.g., crafts, maths, mother tongue), at least 60 ECTS credits on pedagogical studies, and bachelor and master thesis

studies. Finnish teacher education also includes teaching practice (see Saloviitta & Tolvanen., 2017).

To enter teacher education in Greece, students pass a school-specific matriculation exam in addition to a nationwide university entrance exam at the end of their upper secondary or vocational education. Primary school teacher education in Greece is a four-year bachelor degree, consisting of courses, seminars, workshops, and compulsory teaching practices in all curricular subjects (a total of 240 ECTS credits). To enter the profession after graduation, one must apply to the Ministry of Education. Postgraduate studies, for example a master or doctoral degree, may be an asset but not necessary for entering the profession (Overview of National Education Systems - Greece, 2024).

It is important to note that Finland has long been recognised for high rankings in education quality and student performance. The most recent results of the Programme for International Student Assessment (PISA) (OECD, 2023) show that Finnish young people's performance in mathematics, reading and science has declined, as in almost all OECD countries, but is still above the OECD average. The same downward trend was observed for Greek students, although Greece scored below the OECD average.

Considering the above evidence, we conducted a cross-cultural comparison of student teachers' EI and TSE between Finland and Greece with the aim of gaining more insight into possible differences in these constructs and in their associations as a function of the cultural context. Differences are likely to emerge, mainly because of the different cultural value orientations that are prevalent in each of these countries: more individualistic in Finland and more collectivistic ones in Greece. As noted above, previous research has shown cross-national differences in TSE (Vieluf et al., 2013). However, Finland and Greece were not included in this cross-national study. It is expected that student teachers from these two distinct cultures will differ in their understanding of teachers' work and appraisals of classroom events, as well as in their emotional experiences (e.g., understanding, expressing, and dealing with emotions) and self-perceptions as teachers.

### Aims and hypotheses of the current study

In this study, we investigated both trait EI and ability EI and their associations with TSE among Finnish and Greek student teachers. In particular, this study addressed the following research questions (RQ):

RQ1: What are the associations between trait EI and ability EI?

RQ2: How are trait EI and ability EI related to TSE?

RQ3: Do associations vary depending on the cultural context, that is, Finland and Greece?

The hypothesized model of the study is presented in Fig. 1. It was hypothesised that a latent trait EI factor (second-order factor model 1) could account for the first-order factors of well-being, sociability, self-control, and emotionality. Additionally, consistent with previous research (MacCann, 2010), it was anticipated that a latent ability EI factor (second-order factor model 2) could account for emotional understanding and emotional management. Although we expected trait EI and ability EI to form separate latent factors, we hypothesised, based on earlier research (O'Connor & Little, 2003), that their correlations would be sufficiently high to form a higher-order factor of emotional intelligence (RQ1; higher-order factor model). We anticipated a positive correlation between the EI factor and a latent TSE factor (RQ2; second-order factor model 3). Finally, the hypothesised model (Fig. 1) was tested in both the Finnish and Greek samples (RQ3).

## Method

### Participants and procedure

Participants were third- and fourth-year pre-service teachers, registered in primary teacher education programmes in Finland and Greece. The final sample of 199 participants included 82 respondents from universities in Finland (Jyväskylä, Helsinki, Tampere, Turku and Eastern Finland) and 117 respondents from universities in Greece (Athens and Crete). The mean age of the participants was 22.68 ($SD = 4.34$); 83.4% were females ($n = 166$). The data were gathered online via Webropol surveys (due to the social distancing measures necessitated by the pandemic) in autumn 2020. The participants were recruited by their course instructors during their online courses. Participation was contingent upon informed consent, anonymity, and voluntary participation. No course credit was awarded to the students for their participation.

### Measures

*Trait Emotional Intelligence Questionnaire — Short Form* (TEIQue-SF; Petrides & Furnham, 2006). The questionnaire comprises 30 items assessing trait EI and rated on a seven-point Likert scale (1 = *completely disagree*, 7 = *completely agree*). The items are arranged in the following four subscales: well-being (i.e., a generalised sense of wellness, including positive, happy and fulfilled feelings; 6 items, e.g., "I feel that I have a number of good qualities"), self-control

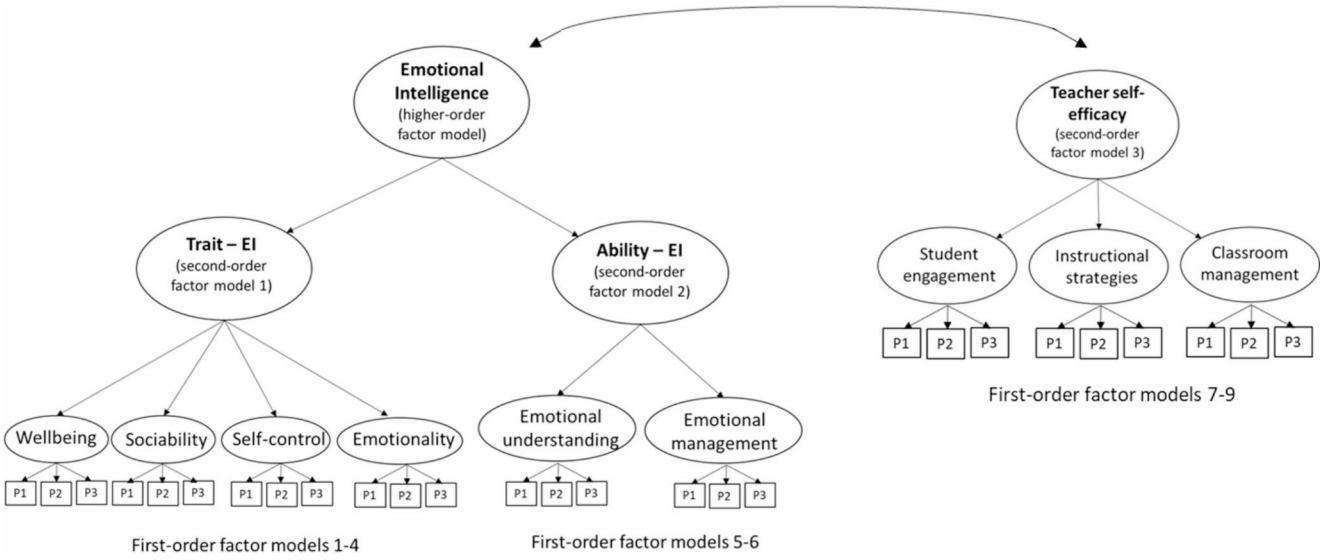


**Fig. 1** Hypothesised structural equation model

(i.e., adaptive regulation of stress and desires; 6 items, e.g., "I usually find it difficult to regulate my emotions"), emotionality (i.e., ability to perceive and express emotions and use this skill to develop and sustain close relationships; 8 items, e.g., "Expressing my emotions with words is not a problem for me"), and sociability (i.e., ability to function effectively in social interactions, such as listen and communicate; 6 items, e.g., "I'm usually able to influence the way other people feel"). The remaining four items do not belong to the subscales and are used to compute the global trait EI score. The questionnaire was translated into Finnish by certified translators. The version of the TEIQue-SF was initially translated and used in Greek by Stamatopoulou and colleagues (2016) and has good psychometric properties, such as satisfactory internal consistency (a = 0.60 to 0.89) as well as convergent and incremental validity.

*Situational Test of Emotional Understanding — Brief* (STEU-B; Allen et al., 2014) and *Situational Test of Emotional Management — Brief* (STEM-B; Allen et al., 2015). These measures assess ability EI. STEU-B contained 19 scenarios in which participants were asked to judge which emotion was most likely to be felt in a series of scenarios, for example, "Clara receives a gift. Clara is most likely to feel? (a) happy, (b) angry, (c) frightened, (d) bored, (e) hungry", with acceptable psychometric properties (a = 0.74). STEM-B consists of 18 scenarios in which emotional management is required, for example, "Manual is only a few years from retirement when he finds out his position will no longer exist, although he will still have a job with a less prestigious role. What action would be the most effective for Manual? (a) Carefully consider his options and discuss it with his family; (b) Talk to his boss or the management about it; (c) Accept the situation, but still feel bitter about it; (d) Walk out of that job.", with good psychometric properties (a = 0.83). Participants were asked to choose the correct emotion or the most effective action in each situation from four response options. The final score is calculated using partial scoring, "*with scoring weights determined by the proportion of experts who select each option as the best answer*" (Allen et al., 2015, page 196). The scores ranged from 0 to 19 for STEU-B and from 0 to 18 for STEM-B. These measures were translated into Finnish and Greek by the authors in collaboration with a bilingual Finnish-Greek speaker and individually proofread by native speakers of both languages. These measures were selected based on the existing literature, which suggests that emotional knowledge and its application are the most essential elements of ability EI (McCann et al., 2019).

*Teachers' Sense of Efficacy Scale* (TSES; Tschannen-Moran & Hoy, 2001). The scale assesses TSE and consists of 24 items scored on a nine-point Likert scale (1 = *nothing*, 9 = *a great deal*) and arranged in the following three subscales with eight items each: efficacy for student engagement (e.g., "How much can you do to get students to believe they can do well in schoolwork?"), efficacy for instructional strategies (e.g., "To what extent can you use a variety of assessment strategies?"), and efficacy for classroom management (e.g., "How much can you do to control disruptive behavior in the classroom?"). The scale has satisfactory internal consistency reliability (Tschannen-Moran & Hoy, 2001). The Finnish version of the scale was based on a previous study in Finland ([webpage deleted for peer review]). The Greek version of the scale has exhibited good psychometric properties in previous studies (Poulou, 2007; Tsigilis et al., 2010).

## Data analysis

Descriptive analyses were conducted with *t*-tests to examine mean differences between Finnish and Greek student teachers. Before addressing our research questions (RQ1-RQ3), we tested the measures of trait EI, ability EI, and TSE for measurement invariance using confirmatory factor analysis (CFA) with a multigroup procedure.

Examination of measurement invariance was employed to assess the psychometric equivalence of constructs across the groups of Finnish and Greek student teachers (Putnick & Bornstein, 2016). The measurement invariance was tested for all four measures and their seven subscales. More specifically, first, we estimated the multigroup CFA without constraints between the groups and checked whether the item loadings of each scale were statistically significant (Model 1; configural invariance). With the addition of several residual covariances, we respecified the model to better fit the data. Factor loadings were then set equal between the groups (Model 2; metric invariance), and the second model was compared to the less constrained model. Next, factor loadings and intercepts were set equal between the groups (Model 3; scalar invariance), and the model was compared to the less constrained model. Finally, the model was tested by setting the factor loadings, intercepts and residuals equal between the groups (Model 4; residual/strict invariance). In each step of studying measurement invariance, modification indices were examined to identify factor loadings, intercepts and residuals, which should be estimated free rather than constrained (modified model), indicating partial invariance. Partial invariance refers to a situation in which some items of the scale are different across groups and must be released to obtain acceptable model fit (Putnick & Bornstein, 2016). Partial invariance is suggested to be sufficient to compare constructs cross-culturally (Little, 2000).

After establishing partial invariance, a CFA was conducted to examine how well the measured variables represented the latent variables. We tested all scales for first- and second-order factor structures (as hypothesised in Fig. 1). According to Chen and colleagues (2005), if the first-order factors are correlated, higher-order factors exist, following which a second-order factor is more appropriate, if also supported by theory. When constructing the first-order measurement model for trait EI, we used observed variables (six–eight items each), and the first-order factors were then used to generate a second-order factor of trait EI. For TSES, we used the average value of eight items per factor to specify the factors. TSES consists of three factors, but because the factors correlated with each other near to one, we used average values for each factor.

To construct the first-order factors for the ability EI scales (STEM-B, STEU-B), we used a parcelling procedure (Little et al., 2002). The rationale for administering parcelling was the inability to use the original items of the scales, which would lead to a non-acceptable high ratio of estimated parameters according to the sample size. Moreover, the ability EI scales did not have initial subscales, as trait EI and TSE did; thus, parcelling was the most suitable way of analyzing the constructs and their associations. Therefore, the first-order factors were based on three parcelled scales, each including six to seven items. Parcelling was performed by systematically adding every third variable of the scale.

After establishing measurement models for each scale, we tested whether trait EI and ability EI formed a higher-order latent factor for EI (RQ1). Finally, we investigated the associations of trait and ability EI with TSE (RQ2) and whether the associations differed between the countries (RQ3). The modification indices were examined to identify the paths that should be allowed to differ between the countries.

The analyses were conducted using the MPlus statistical package (version 7) (Muthén & Muthén, 2007). The method of estimation was MLR, which produces maximum likelihood parameter estimates with robust standard errors and scale-corrected chi-square test statistic (Muthén & Muthén, 2007). The data did not have any missing values. The model fit was satisfactory based on a non-significant chi-square *p*-value, Comparative Fit Index (CFI) with the values $\geq 0.95$, Root Mean Square Error of Approximation (RMSEA) with the values $\leq 0.06$, and Standardised Root Mean Square Residual (SRMR) with the values $\leq 0.08$ (Hu & Bentler, 1999). The Satorra and Bentler (1994) chi-square difference test was used to compare the nested models.

# Results

## Descriptive statistics

The descriptive statistics, including the mean scores and *t*-tests for differences between Finnish and Greek student teachers are presented in Table 1. Finnish students had significantly higher scores in all EI variables than Greek students. However, the pattern of findings was similar in both samples. Specifically, in both samples, student teachers had especially high scores on the trait EI factor of well-being, indicating high general wellness and positive feelings. In addition, in both samples, the lowest scores emerged for the trait EI factor of self-control, indicating less developed skills of regulating stress and desires. As for emotional understanding (STEU-B) and emotional management (STEM-B), in both samples, the student teachers had moderate scores for ability EI measures, with relatively high standard deviations indicating a wide range of scores. Finnish student

**Table 1** Descriptive statistics and t-tests

| Variables | Finnish sample ($N=82$) | Greek sample ($N=117$) | t-test |
|---|---|---|---|
| | *M (SD)* | *M (SD)* | |
| TEI | 5.43 (0.53) | 4.93 (0.69) | $t_{197}=5.18$*** |
| TEI W | 5.82 (0.79) | 5.34 (0.99) | $t_{188.48}=3.52$** |
| TEI S-C | 4.84 (0.79) | 4.47 (0.96) | $t_{191.98}=2.94$** |
| TEI E | 5.71 (0.68) | 5.06 (0.78) | $t_{197}=5.55$*** |
| TEI S | 5.28 (0.66) | 4.51 (0.96) | $t_{195.64}=6.20$*** |
| STEU-B | 13.18 (2.12) | 9.91 (2.23) | $t_{197}=10.36$*** |
| STEM-B | 11.35 (1.83) | 10.06 (2.11) | $t_{197}=4.50$*** |
| TSES | 6.02 (0.96) | 6.31 (2.04) | $t_{176.34}=-1.32$ |
| TSES SE | 5.98 (0.96) | 6.45 (2.06) | $t_{175.38}=-2.18$* |
| TSES IS | 6.13 (1.02) | 6.25 (2.18) | $t_{175.68}=-0.54$ |
| TSES CM | 5.96 (1.04) | 6.22 (1.98) | $t_{184.84}=-1.19$ |

*TEI* = Trait EI; Trait EI factors: *TEI W* = Well-being; *TEI S-C* = Self-control; *TEI E* = Emotionality; *TEI S* = Sociability; *STEU-B* = Situational Test of Emotional Understanding– Brief; *STEM-B* = Situational Test of Emotional Management– Brief; *TSES* = Teacher Self-Efficacy Scale. TSES factors: *SE* = Student engagement; *IP* = Instructional practices; *CM* = Classroom management. Scale range: 1-7 for TEI; 1-9 for TSES. The maximum score was 19 for STEU-B and 18 for STEM-B

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

teachers reported significantly higher levels of EI ability than their Greek counterparts.

In both samples, the student teachers' perceived TSE was moderate. The differences between Finnish and Greek student teachers were small and did not reach statistical significance, except for the TSE subscale of efficacy for student engagement, where Greek students scored significantly higher than their Finnish counterparts.

## Measurement invariance across culture

To test for measurement invariance across culture, nine models were constructed (see Table 2), including well-being, self-control, emotionality, sociability (TEI factors), emotional understanding (STEU-B), emotional management (STEM-B), student engagement, instructional practices, and classroom management (TSES factors). We tested for configural, metric, scalar, and residual/strict invariance. It was found that all item loadings of each factor were statistically significant and almost all factor loadings were invariant across the groups, indicating (almost) full configural and metric invariances. The scalar invariance (equal factor loadings and intercepts between the groups) was partially met, as was the residual/strict invariance (equal factor loadings, intercepts, and residuals between the groups). Based on the acceptable model fit values, it was concluded that the partial invariance was satisfactory in all scales, allowing for comparisons of the constructs between the Finnish and the Greek sample.

## Confirmatory factor analysis

**Trait EI model** Using CFA, we estimated four first-order factor models, one for each EI trait subscale (i.e., well-being, sociability, self-control, emotionality) separately. The factor loadings, intercepts, and error variances that were found to be invariant across Finnish and Greek samples in prior analyses were set equal. After allowing sociability and emotionality residuals to correlate in the Finnish data, the model fit was acceptable regarding RMSEA. However, it did not meet the criteria for SRMR: $\chi^2(554)=830.19$, $p<.001$, RMSEA = 0.071, SRMR = 0.117. A more detailed analysis of the model fit showed that the normalised residuals were normally distributed and the number of large residuals (<

**Table 2** Tests of measurement invariance across culture

| | | Number of invariant items/parcels | | | | | Model Fit values | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Variables | Items/ parcels per scale | Number of added residual covariances | Metric (or partial) | Scalar (or partial) | Residual (or partial) | Final model | $\chi^2(df)$ | $p$ | CFI | RMSEA | SRMR |
| TEI W | 6 | 2 | 6 | 4 | 0 | M3 Mod | 71.69 (24) | 0.00 | 0.98 | 0.05 | 0.06 |
| TEI S-C | 6 | 1 | 6 | 5 | 4 | M4 Mod | 29.06 (21) | 0.11 | 0.95 | 0.06 | 0.08 |
| TEI E | 7 | 3 | 6 | 5 | 3 | M4 Mod | 38.47 (34) | 0.27 | 0.98 | 0.04 | 0.12 |
| TEI S | 6 | 2 | 6 | 5 | 0 | M3 Mod | 24.31 (23) | 0.39 | 0.99 | 0.02 | 0.08 |
| STEM-B | 3 | 0 | 3 | 0 | 0 | M2 | 2.16 (2) | 0.34 | 1.0 | 0.03 | 0.04 |
| STEU-B | 3 | 0 | 3 | 3 | 0 | M3 | 3.24 (7) | 0.52 | 1.0 | 0.00 | 0.05 |
| TSES SE | 8 | 7 | 8 | 3 | 0 | M3 Mod | 42.60 (35) | 0.18 | 0.99 | 0.05 | 0.08 |
| TSES IP | 8 | 5 | 8 | 3 | 6 | M4 Mod | 48.24 (45) | 0.34 | 1.0 | 0.03 | 0.08 |
| TSES CM | 8 | 6 | 6 | 4 | 5 | M4 Mod | 51.15 (41) | 0.13 | 0.99 | 0.05 | 0.10 |

*TEI* = Trait EI; Trait EI factors: *TEI W* = Wellbeing; *TEI S-C* = Self-control; *TEI E* = Emotionality; *TEI S* = Sociability; *STEU-B* = Situational Test of Emotional Understanding– Brief; *STEM-B* = Situational Test of Emotional Management– Brief; *TSES* = Teacher Self-Efficacy Scale; *TSES* factors: *SE* = Student engagement; *IP* = Instructional practices; *CM* = Classroom management. The models including 'Mod' are modified. *CFI* = Comparative Fit Index; *RMSEA* = Root Mean Square Error of Approximation; *SRMR* = Standardized Root Mean Square Residual

−2 or > 2) were 10 in the Finnish data and 18 in the Greek data. Because the expected number of large residuals was 32 in total, the model fit was deemed acceptable.

Next, we estimated a second-order factor model, wherein the four first-order factors were used to generate a second-order factor trait EI (second-order factor model 1, Fig. 1) The Satorra and Bentler chi-square difference test [$\chi^2(3) = 2.66$, $p = .446$] showed that the second-order factor loadings could be set equal between the Finnish and the Greek data, and the model fit was acceptable: $\chi^2(557) = 831.91$, $p < .001$, RMSEA = 0.070, SRMR = 0.119. The chi-square difference test [$\chi^2(5) = 4.96$, $p = .420$] also indicated that the residual variances of the first-order factors and the variance of the second-order factor could be set equal between the groups. The model fit was $\chi^2(562) = 834.97$, $p < .001$, RMSEA = 0.070, SRMR = 0.138. The normalised residuals were normally distributed, and the number of large residuals (< −2 or > 2) was 44 (43 negative) in the Finnish data and 21 (17 positive) in the Greek data. The expected number of large residuals was 32 in total. The reason why the model overfitted the Finnish data and underfitted the Greek data was the equal variance of the second-order factor. Freeing this variance did not result in a statistically significant change in the model fit: $\chi^2(1) = 2.10$, $p = .147$; the resulting model fit was $\chi^2(561) = 831.97$, $p < .001$, RMSEA = 0.070, SRMR = 0.119. Consequently, the issue of over- and underfitting model was resolved, the normalised residuals were normally distributed, and the number of large residuals (< −2 or > 2) was 11 in the Finnish data and 18 in the Greek data. Because the expected number was 32 in total, the model fit was deemed acceptable. The second-order factor fitted the covariance structure of the first-order factors when one residual correlation was allowed. In essence, the factor structure hypothesised in Fig. 1 for trait EI was corroborated by our dataset.

**Ability EI model** When computing CFAs to test the first-order factor structures for emotional understanding (STEU-B) and emotion management (STEM-B) (see Fig. 1), the factor loadings, intercepts and error variances, which were found to be invariant across the Finnish and Greek samples, were set equal between the groups. The model fit was acceptable: $\chi^2(25) = 32.29$, $p = .035$, RMSEA = 0.076, SRMR = 0.104, although the SRMR was slightly higher than the cut-off value for a model with a good fit. The normalised residuals were normally distributed, and their values were between −2 and 2 in both countries. The Satorra and Bentler chi-square difference test [$\chi^2(2) = 1.22$, $p = .845$] showed that the factor variances were equal between the two groups with an acceptable model fit: $\chi^2(27) = 39.12$, $p = .062$, RMSEA = 0.067, SRMR = 0.118. Further, the factor covariances were equal [$\chi^2(1) = 2.52$, $p = .112$], and the model fit was acceptable: $\chi^2(27) = 41.41$, $p = .049$, RMSEA = 0.069, SRMR = 0.121. The normalised residuals were normally distributed, and only two of them had the absolute value larger than 2, which was an expected number in this case.

We did not test for the second-order factor (ability EI) because there was only a moderate correlation ($r = .36$) between emotional understanding (STEU-B) and emotion management (STEM-B) first-order factors. Consequently, the anticipated second-order factor structure for ability EI (see Fig. 1) was not substantiated by the present dataset. Furthermore, the higher-order factor structure for EI was not corroborated by our data either.

**TSE model** To assess the first-order factor structure for TSE, we initially tested a three-factor model with eight items in each factor (see first-order factor models 7–9 in Fig. 1). The first-order factors correlated very highly, especially in the Finnish sample (exceeding one). Consequently, it was inferred that the proposed factor structure was not viable within the present dataset. As an alternative approach, we computed the average values for each of the three factors and employed these averages in the analysis of TSE. Given the presence of three average values, the freely estimated model became saturated, fitting the data perfectly. The factor loadings were equal: $\chi^2(2) = 2.85$, $p = .241$, RMSEA = 0.065, SRMR = 0.086. The model also fitted well to the data because the normalised residuals were between −2 and 2. The intercepts of the observed variables and residual variances, however, could not be set equal; they were $\chi^2(2) = 22.81$, $p < .001$ and $\chi^2(3) = 8.72$, $p = .033$, respectively.

In sum, conducting CFA presented challenges in the analysis due to the large size of the models. The fit indices, along with the number and magnitude of the normalised residuals, were carefully analysed to ensure that the models fitted the data. Judging from the CFA, all models were found to be statistically acceptable for further analysis.

## Structural equation modelling

With the use of structural equation modelling (SEM), we examined the associations of the higher-order latent trait EI and two latent second-order factors for ability EI (RQ1) with the first-order latent factor for TSE (RQ2). We also examined the possible cross-cultural differences in these associations (RQ3).

The model combining trait EI, ability EI, and TSE had a marginally acceptable fit, $\chi^2(1070) = 1548.60$, $p < .001$, RMSEA = 0.067, SRMR = 0.126. The expected number of normalised residuals was 60 in total. We found 56 negative

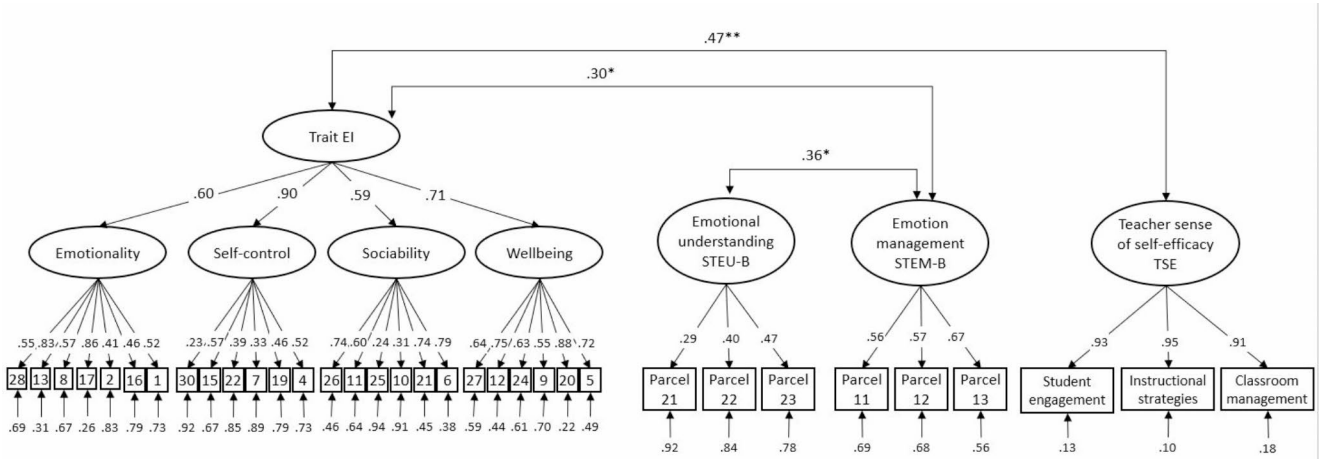


**Fig. 2** Structural equation modelling of the trait EI, ability EI and TSE associations for the finnish sample. Only statistically significant factor loadings and associations are presented. *$p < .05$, **$p < .01$

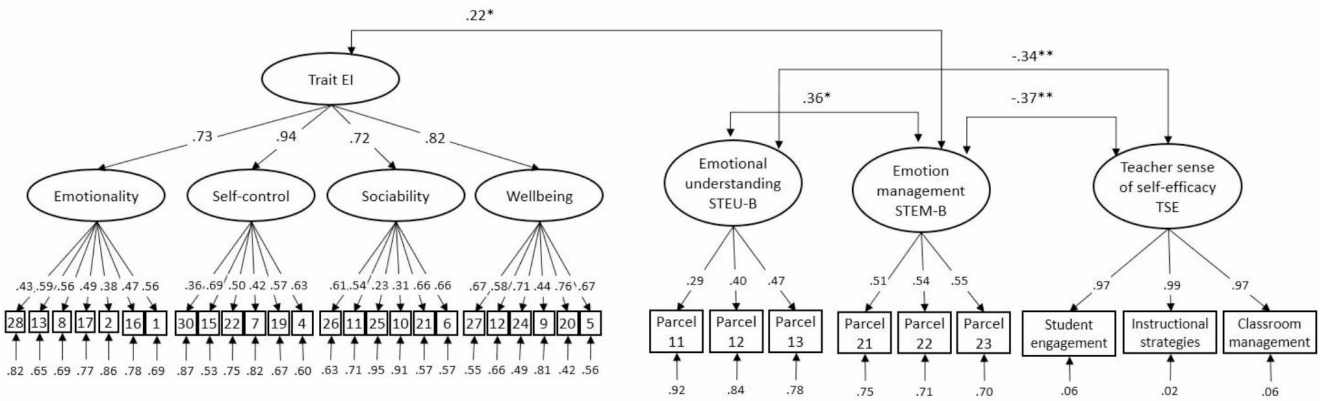


**Fig. 3** Structural equation modelling of the trait EI, ability EI and TSE associations for the greek sample. Only statistically significant factor loadings and associations are presented. *$p < .05$, **$p < .01$

residuals and five positive residuals in the Finnish data and 12 negative residuals and 26 positive residuals in the Greek data. After accepting non-equal variances of trait EI, the model fit was $\chi^2(1069) = 1543.95, p < .001$, RMSEA = 0.067, SRMR = 0.113. The number of large (absolute values ≥ 2) normalised residuals was 58, which was within the expected range (16 negative and 10 positive in the Finnish data, 16 negative and 16 positive in the Greek data). The models of the Finnish and Greek samples and their in-between construct associations are shown in Figs. 2 and 3, respectively.

The final SEM showed that emotional understanding (STEU-B) and emotional management (STEM-B) correlated positively and significantly at the level of 0.36 in both samples, indicating a moderate positive relationship. Trait EI was associated with emotional management in both Finnish and Greek samples (0.30 and 0.22, $p < .05$, respectively). However, for both samples, the associations of trait EI with emotional understanding were non-significant (RQ1).

In line with our hypothesized model, there were statistically significant associations of both trait EI and ability EI with TSE (RQ2). However, statistically significant differences were observed in the associations of trait EI and ability EI with TSE between the Finnish and the Greek sample (RQ3). Specifically, in the Finnish sample, trait EI had a statistically significant positive association with TSE (0.47), whereas this association was non significant in the Greek sample. Conversely, in the Greek sample, both emotional understanding and emotional management had statistically significant negative associations with TSE (−0.34 and −0.37, respectively), whereas these associations were non significant in the Finnish sample.

## Discussion

This study examined the associations between trait EI and ability EI (RQ1), the associations of trait EI and ability EI with TSE (RQ2), and whether these associations differed as a function of the cultural context (RQ3), among student teachers in Finland and Greece.

First, the association between the two facets of ability EI, that is, emotional understanding and emotional management, was positive but moderate. In addition, we found that trait EI was moderately associated with one facet of ability EI, namely emotional management. This finding is consistent with existing research indicating moderate correlations between trait EI and ability EI (O'Connor & Little, 2003). However, the lack of a significant association between trait EI and emotional understanding suggests that these are distinct domains of EI. This means that the possession of certain inherent EI traits does not necessarily translate into an individual's ability to accurately understand emotions, or vice versa. These domains appear to operate somewhat independently within the overall framework of EI. Furthermore, a higher-order latent factor comprising both trait EI and ability EI was also not confirmed, suggesting that these constructs are distinct. This is consistent with previous research suggesting low or negligible associations between ability EI and trait EI (Bastian et al., 2005).

In addition, a positive association between trait EI and TSE in the Finnish sample of student teachers was found, which is in line with prior research (Mouton et al., 2013). The latent higher-order factor of trait EI, capturing student teachers' self-perceptions of wellness (well-being), adaptive regulation of stress (self-control), skills of perceiving, expressing and using emotions to support relationships (emotionality), and skills of social interaction (sociability), was associated with student teachers' self-efficacy beliefs, that is, beliefs regarding their ability to employ effective instructional strategies, manage the classroom, and engage students in learning. It seems that possessing higher levels of trait EI may help student teachers to practice their emerging teaching skills more effectively and to accumulate valuable experiences in real classroom settings, which, in turn, may enhance their positive beliefs in their teaching abilities. It should be noted that our sample consisted of student teachers in their third and fourth year of studies who had already had some experience of teaching practice, and thus had the opportunity to observe and monitor their teaching skills as well as to reflect on them.

However, an unexpected negative association between ability EI and TSE was found in the Greek sample. Student teachers with higher self-reported emotional understanding and emotion management experienced a sense of low self-efficacy as teachers. Previous research has shown that the level of ability EI affects self-appraisals of performance. Individuals with higher ability EI (in particular, emotional understanding) executed a stressful task better than those with lower EI; however, self-appraisals of performance in the high EI group were not higher than those of their lower EI counterparts (Udayar et al., 2020). This may mean that individuals with high ability EI may have stronger self-doubt, which results in a lower sense of self-efficacy, nevertheless, this would require further research.

The differences between the Finnish and the Greek sample regarding the associations between EI and TSE may stem from a complex interplay of cultural, educational, and contextual factors shaping perceptions of effective teaching and the importance assigned to emotional skills in each cultural context. For instance, in Finland, where higher trait EI was associated with higher TSE, cultural values prioritize emotional skills as crucial components of effective teaching. In contrast, Greece may prioritize different teaching competencies or qualities in determining teacher efficacy, leading to weaker or even negative associations between emotional understanding or emotion management and self-efficacy. Understanding these contextual variations is crucial in interpreting and addressing the nuances in the relationship between EI and TSE across different cultural and educational landscapes.

These explanations are further supported by the finding that the Finnish sample scored higher than the Greek sample in trait EI, emotional understanding, and emotion management, which may also be attributed, at least in part, to differences in cultural values. A possible explanation is that in a more individualistic culture (i.e., Finland) individuals tend to score higher on self-presentations, whereas in a more collectivistic culture (i.e., Greece), individuals tend to respond with greater compliance with the group norms and are predisposed to modesty (Vieluf et al., 2013). Additionally, this finding may be attributed to the different admission procedures for entering teacher education. Finland's entry exams to initial teacher education include a rigorous student selection test that assesses motivation for the teaching profession as well as social and emotional skills (Metsäpelto et al., 2022), while Greece's exams are more cognitively oriented, including assessment of general knowledge and knowledge in a variety of subjects.

Finally, student teachers' TSE scores in instructional strategies and classroom management were at an average level, and the differences between the countries were very small. However, there was a significant difference in student engagement: Greek student teachers reported higher levels than their Finnish peers. This finding contrasts Vieluf and colleagues (2013), who found that individualistic countries had a higher level of TSE than Mediterranean countries (Finland and Greece were not included in this comparison).

Apparently, Greek student teachers have stronger beliefs in their ability to support students' engagement in learning, even when students are "difficult" or unmotivated. This higher confidence of Greek student teachers regarding their ability to engage students in the classroom may be attributed to the other-oriented values that are typical of the Greek culture.

## Limitations, directions for future research, and practical implications

This study is not without limitations. First, it is a cross-sectional study, therefore possible bidirectional effects or causal relations between EI and TSE were not examined. Only with a longitudinal design can possible trajectories or fluctuations of TSE, in association with EI, be identified during student teachers' education and pre-service periods. Second, this study relies only on self-reports, therefore not controlled for the common method bias. Although the subjective sense of self-efficacy is crucial for teachers' work, how EI is related to more objective teachers' efficacy, as assessed, for example, with observation methods, is an important avenue of future research.

Another limitation of this study is the relatively small sample size.However, the small sample size was taken into account in multiple ways in the SEM. More specifically, to enable a comparison between countries, the factor loadings in the measurement models were at least partially equal. We identified the items that did not clearly measure the phenomenon in equal strength, although due to the limited sample size testing this invariance was conducted with one scale or subscale at a time. Moreover, to increase the statistical power and identify differences between the two countries, we fixed all the possible parameters equal between countries in the measurement models including, for instance, factor loadings, intercepts, and residual variances. The testing for invariance extended to intercepts and residual variances and, when employing parcels, the invariance test was conducted for parcels. Thus, when the majority of parameters in the measurement models were set equal across countries, only a few parameters specifying associations underwent testing for equality between countries. Nonetheless, the replication of this study with a larger sample is another aim of future research.

Future research should adopt the holistic model of EI which guided this study, that is, the examination of both trait EI and ability EI, to further investigate the role of EI in various facets of pre-service and in-service teachers' work, in all education levels. To this end, the full version of the TEIQue, which assesses trait EI, can be used. Future studies should also include broad cross-cultural comparisons, with the inclusion of diverse countries and cultural groups, as well as a detailed assessment of cultural factors, for example cultural norms and value orientations, to further explore how culture determines the associations of EI with teaching quality. Finally, variables that possibly mediate the associations between EI and TSE, such as coping strategies or resilience, and moderate this association, such as age level, gender, socio-economic status, or level of teaching experience, could also be examined.

Regarding the practical implications of this study, we suggest that socio-emotional learning be an integral part of the teacher education and training curriculum, with the aim of promoting student teachers' EI qualities, as they are found to play an important role in TSE. Because, as shown by the findings of this study, a variety of EI facets are related to TSE, in complex and sometimes unanticipated ways, a multidimensional framework for the promotion of EI through the teaching education curriculum is clearly needed. The findings of this study also imply that stakeholders, policy makers, and teachers alike need to be aware about the possible role of contextual and cultural factors, for example norms and values, in EI and TSE. This awareness entails caution when comparing teachers' EI and TSE scores across countries. Yet, it may also enable reflection and cultivate a critical attitude towards teacher education, as well as towards educational aims, processes, and outcomes.

## Conclusions

Both EI and TSE are important factors in teachers' work and necessary elements in teacher education. This study contributed to the existing literature by providing a detailed assessment of EI and examining the role of various facets of EI in TSE during the critical phase of teacher education in two different cultures, that is, Finland and Greece. Another contribution of this study is that it focused on an underresearched population regarding this issue, namely student teachers in the European context. The associations found in this study indicate that the relationship between EI and TSE may be more complex than anticipated. Moreover, this relationship varies as a function of the cultural context, serving as a starting point to a culturally sensitive teacher training. This study has important implications for the theoretical models of EI (trait EI and ability EI) and for culturally-informed promotion of socio-emotional learning in the education of primary school teachers, even within the European education framework.

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**Author contributions** All authors contributed to the study conception and design. Material preparation and data collection were performed

by Myrto Kyriazopoulou, Riitta-Leena Metsäpelto, Sotiria Varis, Anna-Maija Poikkeus, Evangelia P. Galanaki, and Mirjamaija Mikkilä-Erdmann. The first draft of the manuscript was written by Myrto Kyriazopoulou and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript. The analysis was performed by Asko Tolvanen together with Myrto Kyriazopoulou, Riitta-Leena Metsäpelto and Anna-Maija Poikkeus.

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**Data availability** Not applicable.

## Declarations

**Ethics approval and consent to participate** All ethical procedures were taken into consideration throughout this study and the participation at this study was on a voluntary basis. A consent to participate was obtained from all participants.

**Consent for publication** An informed consent for publication has been obtained from all participants.

**Competing interests** No potential conflict of interest was reported by the author(s)



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