

**Trait Emotional Intelligence Questionnaire-Short Form: Brazilian  
validation and measurement invariance between the United Kingdom and  
Latin-American datasets**

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### **Acknowledgements**

We are grateful to Prof. Dr Paulo Martins-Júnior, from the Federal University of Minas Gerais, FO-UFMG, for his collaboration in data collection. The study was additionally supported by the Federal University of Minas Gerais (UFMG), State University of Paraíba (UEPB), University College London (UCL), Austral University of Chile (UACH), the Chilean national commission of research, science and technology.

# **Trait Emotional Intelligence Questionnaire-Short Form: Brazilian validation and measurement invariance between the United Kingdom and Latin-American datasets**

## **Abstract**

The present study aimed to evaluate the psychometric properties of the Brazilian adaptation of the *Trait Emotional Intelligence Questionnaire-Short Form* (TEIQue-SF). In a sample of 512 participants, we tested model fit by bifactor Exploratory Structural Equation Modeling (ESEM), followed by measurement invariance testing against UK and Chilean datasets of the measure. The Big Five Mini-Markers, Satisfaction with Life Scale and Subjective Happiness Scale were also administered as external validation measures. We obtained the following results: a) final adequate bifactor ESEM model fit; b) a significantly higher global trait EI mean for men ( $d = .27$ ); c) high internal consistency for global trait EI ( $\alpha = .88$ ), in spite of lower Cronbach's  $\alpha$  values at the factor level (.60–.85); d) high correlation ( $r = .89$ ) in the test-retest; e) significant correlation between global trait EI and most of the Big Five dimensions ( $r = -.66-.46$ ), life satisfaction (.59) and happiness (.68); f) evidence of incremental validity of trait EI for life satisfaction and happiness over and above the Big Five; g) equivalent measurement across the Brazilian, UK and Chilean versions of the TEIQue-SF. We conclude that the Brazilian TEIQue-SF is psychometrically sound and can be recommended for research and practical use.

The Trait Emotional Intelligence Questionnaire (TEIQue) was specifically developed as the operationalisation vehicle for trait emotional intelligence (trait EI) theory, and is the only instrument that covers all facets of the construct comprehensively (Petrides, 2001, 2009). Trait EI (or 'trait emotional self-efficacy') is formally defined as a constellation of emotional perceptions assessed through questionnaires and rating scales (Petrides, Pita, & Kokkinaki, 2007). It has been moderately or strongly associated with positive affect ( $R^2 = .49$ ), meaning in life ( $R^2 = .53$ ), flourishing ( $R^2 = .64$ ; Di Fabio & Kenny, 2019), depression ( $R^2 = .49$ ; Rudenstine & Espinosa, 2018), career decision-making ( $R^2 = .38$ ; Farnia, Nafukho, & Petrides, 2018), psychopathology ( $R^2 = .45$ ; Petrides, Gómez, & Pérez-González, 2017), and many other psychological constructs (Abe, Niwa, Fujisaki, & Suzuki, 2018; Schinckus, Avalosse, Van den Broucke, & Mikolajczak, 2018; Udayar, Fiori, & Bausseron, 2020).

The full form of the TEIQue comprises 153 items, responded to on a 7-point Likert scale and yielding scores on 15 facets, four factors (Well-being, Self-control, Emotionality and Sociability), and global trait EI. The corresponding short form (TEIQue-SF) comprises 30 items and was designed to yield a global trait EI score, although it is possible to also derive from it scores on the four factors, albeit somewhat less reliable (Petrides, 2009). The family of TEIQue measures is used in research, medical, and commercial settings globally and has featured saliently in hundreds of peer-reviewed studies in the scientific literature (Andrei, Mancini, Baldaro, Trombini, & Agnoli, 2014; Petrides, 2009).

In Europe, the German TEIQue-SF was validated in a sample of occupational therapists ( $N = 405$ ) through higher-order Confirmatory Factor Analysis (CFA) using item parcels of the TEIQue-SF, with each parcel modelled onto its keyed factor and the four trait EI factors modelled onto global trait EI (Figure 1a). After allowing two covariances between parcel errors, a good model fit was obtained [ $\chi^2(84) = 143.45, p < .01$ ;  $CFI = .950$ ;  $RMSEA = .042$ , 90%- $CI = .030-.053$ ;  $SRMR = .04$ ]. Most alpha coefficients at the factor level were

below .70 ( $\alpha = .58-.67$ ), except for Well-being ( $\alpha = .85$ ; Jacobs, Sim, & Zimmermann, 2015). It is common to find lower alpha coefficients at the factor level of the TEIQue-SF, in contrast to the global score, whose internal consistency typically exceeds .80. Nevertheless, the Spanish validation of the TEIQue-SF resulted in factor level reliability indices above .70 ( $\alpha = .70-.83$ ). The Spanish TEIQue-SF, in contrast to the German adaptation, evaluated model fit based on four facets and a first-order factor (Figure 1b). The researchers submitted data from a sample of 1889 Spanish students to CFA analysis, which resulted in an excellent fit [ $\chi^2(2) = 6.29, p = .002; CFI = .99; RMSEA = .05, 90\%-CI = .03-.08.; SRMR = .02$ ; Laborde, Allen, & Guillén, 2016].

Separately from both European studies mentioned above, the Greek TEIQue-SF was validated in a general population ( $N = 602$ ) of various educational levels (Stamatopoulou et al., 2016). Although the Greek adaptation cannot be compared in terms of model fit since the authors did not report factor analyses, it presented a similar global reliability score ( $\alpha = .89$ ) with the German and Spanish adaptations ( $\alpha = .88$  and  $\alpha = .84$ , respectively). The high reliability for global trait EI is corroborated by previous cross-cultural research, including in Poland ( $\alpha = .89$ ; Szczygieł, Jasielska, & Wytykowska, 2015), Portugal ( $\alpha = .87$ ; Carvalho, Neto, & Mavroveli, 2010), and United Kingdom (UK,  $\alpha_{men} = .88, \alpha_{women} = .87$ ; Cooper & Petrides, 2010).

Cross-cultural adaptations of the TEIQue-SF around the world have shown methodological correspondences with the European studies. Similar to the Spanish adaptation, its Chinese counterpart was based on undergraduate students, and model fit was tested with four facets loading onto a global trait EI factor (Figure 1b). This study also compared cross-culturally the trait EI construct between a collectivistic (Chinese,  $N = 585$ ) and an individualistic (Canadian,  $N = 638$ ) society to test measurement invariance. Although most fit indices were considered acceptable in the Chinese TEIQue-SF [ $\chi^2(2) = 12.188; CFI = .980$ ;

$RMSEA = .096$ ,  $90\%-CI = .049-.151$ ;  $SRMR = .024$ ], the researchers reported a lack of measurement invariance between the two samples. Moreover, alpha coefficients at the factor level were somewhat lower in the Chinese ( $\alpha = .47-.82$ ), than the Canadian sample ( $\alpha = .67-.85$ ), although both showed high reliability for global trait EI ( $\alpha = .88$ ; Feher, Yan, Saklofske, Plouffe, & Gao, 2019). The Australian (Perera, 2015) and Urdu (Shahzad, Riaz, Begum, & Khanum, 2014) adaptations of the TEIQue-SF also revealed the same high global trait EI reliability values. However, the former was validated with university students ( $N = 496$ ), while the latter with 201 lay participants from different areas of Karachi in Pakistan. Perera (2015) corroborated the factorial structure of trait EI and further suggested that Exploratory Structural Equation Modelling (ESEM) may be the most appropriate technique for such investigations.

In Latin-America, research with the TEIQue-SF has been relatively scarce. The Mexican TEIQue-SF was validated on a sample of 155 undergraduate students and tested by first-order CFA with items modelled directly on their keyed factors (Figure 1c). This resulted in a lower-than-desired model fit [ $\chi^2(390) = 768.47$ ,  $p < .01$ ;  $CFI = .65$ ;  $RMSEA = .008$ ,  $90\%-CI = .071-.087$ ]. Furthermore, the reported reliability was rather low at the factor level ( $\alpha = .32-.82$ ; Neri-Uribe & Juárez-García, 2016). In contrast, the Chilean TEIQue-SF, which was studied both in a general population ( $N = 335$ ) and in clinical patients ( $N = 120$ ), presented much better model fit indices. The bifactor internal structure of the instrument was confirmed through ESEM (Figure 1d), with the fit statistics for the model being marginally better in the general population [ $\chi^2(293) = 409.77$ ,  $p < .01$ ,  $CFI = .957$ ,  $RMSEA = .034$ ,  $90\%-CI = .026-.042$ ,  $SRMR = .032$ ] than in the clinical population [ $\chi^2(291) = 370.77$ ,  $p < .01$ ,  $CFI = .923$ ,  $RMSEA = .048$ ,  $90\%-CI = .031-.062$ ,  $SRMR = .048$ ; Pérez-Díaz & Petrides, 2019].

Trait EI investigations are still at a nascent stage in Brazil and often based on psychometrically suboptimal measures (Gonzaga & Monteiro, 2011), precluding a definitive

investigation of the construct and its related interventions. The validation of the TEIQue-SF in Brazil represents an urgent and worthwhile task, as the instrument is psychometrically robust, straightforward to administer, and with a proven bibliography behind it (Pérez-Díaz & Petrides, 2019; Petrides, 2009). Accordingly, the present study sought to translate and cross-culturally adapt the TEIQue-SF into Brazilian Portuguese as well as to assess the psychometric properties and validity of this adaptation in relation to the Big Five, life satisfaction, and happiness. Moreover, this is the first study to test the measurement invariance of trait EI with data from Latin America.

[Figure 1 near here]

## **Method**

### ***Participants, setting and period of data collection***

We conducted a cross-sectional study to translate, cross-culturally adapt and validate the TEIQue-SF for use in Brazil. Data collection took place at the Dental School of the Federal University of Minas Gerais. The sample consisted of 637 undergraduate students, native in Brazilian Portuguese. The study was divided into two phases. The first phase translated and cross-culturally adapted the TEIQue-SF into the Brazilian Portuguese language. The second phase assessed the construct validity of the instrument. Participants in the first phase were excluded from the second phase. Participants completed the questionnaires in their classrooms under the supervision of the researchers. The administration took 15 minutes on average. We completed the two phases between March 2017 and June 2018.

We conducted our study following the Declaration of Helsinki. The study received approval from the Human Research Ethics Committee of the Federal University of Minas Gerais, Brazil, under protocol number 67189617.2.0000.5149.

### ***Translation and cross-cultural adaptation***

In the first phase of the study, the TEIQue-SF was translated and cross-culturally adapted according to standard guidelines (Beaton, Bombardier, Guillemin, & Ferraz, 2000; Eignor, 2013; Herdman, Fox-Rushby, & Badia, 1998). Two native Brazilian Portuguese speakers, fluent in English, translated the questionnaire independently into Portuguese. A revision panel of specialists in validation studies assessed the translations and developed the first synthesised version, which was back-translated into English by a native speaker. The back-translation was then sent to the original author of the instrument for his suggestions and for corroboration of conceptual and item equivalence. Subsequently, the panel compared the Brazilian Portuguese translation, the English back-translation, and the original English version incorporating the author's suggestions to produce the second synthesised Brazilian version. This draft was pretested on a gender-mixed sample of twenty students, who did not participate in the second phase of the study, as a result of which we introduced minor changes to improve the readability of the instrument. Finally, the panel of specialists discussed and approved the Brazilian version of the TEIQue-SF for psychometric validation.

### ***Psychometric properties***

In the second phase of the study, we conducted the assessments of reliability and validity according to the COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN) checklist (Paiva, Perazzo, Ortiz, Pordeus, & Martins-Júnior, 2018; Terwee, 2011). To this end, we administered the Brazilian TEIQue-SF along with the Big Five Mini-Markers (MR-25; Hauck Filho, Machado, Teixeira, & Bandeira, 2012), the Satisfaction with Life Scale (SWLS; Zanon, Bardagi, Layous, & Hutz, 2014), and the Subjective Happiness Scale (SHS; Damásio, Zanon, & Koller, 2014).



Five hundred and twelve students participated in this phase, which represented 84.0% of the eligible population. A small proportion of participants declined participation or was not present in their classrooms after two attempts. Most participants were women (73.2%) and single (99.8%). The mean age was 21.77 ( $\pm 2.71$ ) years. In addition to this dataset, we used UK and Chilean datasets included in previous studies (Cooper & Petrides, 2010; Pérez-Díaz & Petrides, 2019) in order to test for measurement invariance. The Chilean dataset ( $\alpha = .88$ ) comprised 335 participants from the general population (35.0% men, 45.0% women, 19.0% did not disclose their gender, 1.0% did not feel identified with either categories; *mean age* = 33.41 years, *SD* = 11.39) with a global trait EI mean of 5.03 ( $\pm .85$ ), while the UK dataset ( $\alpha = .87$ ) comprised 537 participants from the general population (59.8% men, 39.9% women, .4% did not disclose their gender; *mean age* = 31.24 years, *SD* = 10.80) with a global trait EI mean of 5.10 ( $\pm .67$ ).

Before data collection, we implemented a second pilot study with 10 participants to verify the methodological approach and the respondents' acceptance and compliance with the materials. Minor adjustments were necessary. The 10 participants of this pilot were excluded from the main study.

### ***Measures***

*Short Form of the TEIQue (TEIQue-SF)*. The TEIQue-SF is a 30-item questionnaire designed to measure global trait EI. It is derived from the full form of the instrument, which covers four factors and fifteen facets (Petrides 2001, 2009). Pairs of items were selected based on their correlations with the corresponding total facet score, which ensured broad coverage of the sampling domain of the construct. The TEIQue-SF consists of 26 items distributed across the four factors: Well-being (6 items), Self-control (6 items), Emotionality (8 items), and Sociability (6 items). The remaining four items contribute directly to the global trait EI

score without being keyed to any one factor. The response scale is a 7-point Likert scale, ranging from 1 (completely disagree) to 7 (completely agree). A global trait EI score is calculated by dividing the sum of the item scores by the total number of items. The TEIQue-SF does not yield scores on the 15 traits EI facets. We replaced missing values with the middle value 4, except for cases where more than 15.0% of the values were missing, which were deleted. The internal consistency of the Brazilian adaptation of the TEIQue-SF was  $\alpha = .88$  for the global score and ranged from  $\alpha = .60$  to  $.85$  for the four factors (Petrides, 2009).

*Big Five Mini-Markers (MR-25)*. This measure is based on 25 adjective markers equally distributed across the Big Five personality dimensions: Extraversion, Agreeableness, Conscientiousness, Neuroticism and Openness to experience. The MR-25 uses a 5-point Likert response scale, ranging from 1 (completely disagree) to 5 (completely agree). Respondents indicate their degree of agreement or disagreement with each statement, with higher scores indicating higher standing on a dimension. Cronbach's alpha coefficients on the present sample were:  $\alpha = .88$  for Extraversion,  $\alpha = .77$  for Agreeableness,  $\alpha = .81$  for Conscientiousness,  $\alpha = .76$  for Neuroticism, and  $\alpha = .64$  for Openness to experience (Hauck Filho et al., 2012).

*Satisfaction with Life Scale (SWLS)*. This five-item questionnaire measures how satisfied an individual is currently with their life. Items are responded to on a 7-point Likert scale, ranging from 1 = strongly disagree to 7 = strongly agree. Higher scores indicate greater life satisfaction. The Cronbach's alpha coefficient on the present sample was  $\alpha = .85$  (Zanon et al., 2014).

*Subjective Happiness Scale (SHS)*. This is a four-item measure of happiness. Items are responded to on a 7-point (disagree-agree) scale, with higher scores indicating greater happiness. The Cronbach's alpha coefficient on the present sample was  $\alpha = .82$  (Damásio et al., 2014).

### *Data analysis plan*

We performed the statistical analyses in SPSS, v. 21.0 and Mplus v. 8.3 (Muthén & Muthén, 2017). The bifactor structure of the Brazilian TEIQue-SF was analysed through Exploratory Structural Equation Modelling (ESEM) with Maximum Likelihood (ML) estimation. Model goodness of fit was assessed by the Comparative Fit Index (CFI), the Root Mean Square Error of Approximation (RMSEA) and the Standardised Root Mean Square Residual (SRMR; Hu & Bentler, 1999). The following thresholds were adopted to adjudge model fit: CFI > .90, RMSEA < .06, and SRMR < .10 for adequate fit; CFI > .95, RMSEA < .06, and SRMR < .08 for acceptable fit. We also reported the chi-square ( $\chi^2$ ) statistic, although this index is less useful, as it tends to be oversensitive to sample size and minor model misspecifications (Hu & Bentler, 1999).

We performed descriptive and inferential analyses using independent t-tests and Cohen's d effect sizes to compare women and men on global trait EI and the four factors of the construct. The test-retest reliability of the Brazilian TEIQue-SF was evaluated by a Pearson correlation using data from participants who had completed the questionnaire twice with a 7-14 day interval between administrations. We also calculated Pearson correlations to test for convergent/discriminant validity between trait EI and the criteria (Big Five, life satisfaction and happiness). Incremental validity was investigated through two-step hierarchical linear regressions, whereby life satisfaction and happiness regressed onto the Big Five dimensions at step 1, followed by trait EI at step 2.

*Measurement invariance.* We tested the Brazilian TEIQue-SF for measurement invariance through bifactor ESEM, contrasting it with its UK and Chilean counterparts in three distinct steps: Configural, metric (weak) and scalar (strong) invariance (Putnick & Bornstein, 2016). Since the UK dataset had not been previously analysed through an ESEM

bifactor model, we performed this extra analysis to fit the three datasets through the same measurement model, including three correlated errors between item pairs 18–3, 28–16, and 26–11.

Configural invariance represents the baseline, which assumes that groups hold the same conceptual framework without equality constraints on any parameter. Metric invariance requires equivalence among the factor loadings, meaning that each item contributes to the latent construct to a similar degree across the three groups. We tested scalar invariance by constraining intercepts to be equal among the groups. This level of invariance is required for the comparison of latent mean differences across groups (Putnick & Bornstein, 2016). If scalar invariance is achieved, scores from the Brazilian TEIQue-SF would have the same unit of measurement (factor loading) and origin (intercept) as the UK and Chilean versions (Chen, 2007; Tóth-Király, Bőthe, Rigó, & Orosz, 2017). We tested for both metric and scalar invariance by comparing the corresponding nested models. Changes within  $-.010$  units for the CFI and  $.015$  units for the RMSEA support the invariance of the more restricted (nested) model relative to the less restrictive one. Similarly, changes of SRMR within  $.030$  units are indicative of metric invariance, while changes within  $.010$  units are indicative of scalar invariance (Chen, 2007).

## Results

### *Exploratory Structural Equation Modelling*

The internal structure of the Brazilian TEIQue-SF was bifactor-modelled with four latent factors (Well-being, Self-control, Emotionality and Sociability) and a global trait EI dimension. The initial model yielded the following fit indices:  $\chi^2 = 846.662$  ( $p < .01$ ),  $CFI = .888$ ,  $RMSEA = .060$  ( $p < .01$ ,  $CI = .056$  to  $.065$ ) and  $SRMR = .039$ . Three correlations among indicator errors were modelled in line with the theoretical framework underpinning the

TEIQue-SF. Specifically, we freed up the error parameter indicators between items 9–24 (Self-esteem facet); 3–18 (Self-motivation facet) and 14–29 (Adaptability facet), obtaining the following improved model:  $\chi^2 = 584.344$  ( $p < .01$ ),  $CFI = .940$ ,  $RMSEA = .044$  ( $p > .05$ ,  $CI = .039$  to  $.049$ ) and  $SRMR = .032$ . Compared with the ESEM UK and Chilean TEIQue-SF fit, there is unmistakable similarity across the indices, including identical  $SRMR$  values (.032). However, as Table 1 shows, the Chilean model had a somewhat higher  $CFI$  (.957) than the Brazilian (.940) and UK (.922) models as well as a lower  $RMSEA$  index (.034,  $CI = .026$ -.042; compared to .044,  $CI = .039$ -.049 for Brazil and .044,  $CI = .038$ -.049 for the UK).

[Tables 1 and 2 near here]

### ***Reliability***

Cronbach's  $\alpha$  values exceeded .80 for global trait EI in women, men, and the total sample (Tables 2 and 3). As expected, the four trait EI factors presented lower alphas, ranging from .60 to .85. The Cronbach's  $\alpha$  values for the MR-25, SWLS and SHS are reported in Table 3. Almost all participants (493 individuals, 94.0%) completed the retest administration of the Brazilian TEIQue-SF. The uncorrected Pearson correlation between the two sets of scores was .89, indicating very high temporal stability.

### ***Gender differences in trait EI***

Table 2 displays the results of the comparison between women and men on the five trait EI variables (four factors and the global trait EI score). Men presented a significantly higher mean (4.98,  $\pm .75$ ) than women (4.77,  $\pm .79$ ) on global trait EI. This difference had a medium effect size ( $d = .27$ ). Men also showed higher means in the trait EI factors Self-control (4.53,  $\pm 1.01$ ) and Sociability (4.85,  $\pm .91$ ), with large ( $d = .51$ ) and medium ( $d = .42$ ) effect sizes, respectively.

### *Correlations and Hierarchical regressions*

The four Brazilian TEIQue-SF factors showed significant correlations with most of the Big Five ( $p < .01$ ). The only non-significant results were between Self-control and Extraversion, and between Sociability and Conscientiousness. As expected (Petrides et al., 2010), the global trait EI score presented a low-to-moderate correlation with all Big Five dimensions. Neuroticism reached the highest negative coefficient ( $-.66, p < .01$ ), while the other four dimensions yielded positive coefficients, ranging between .24 and .46 ( $p < .01$ ). Life satisfaction ( $.59, p < .01$ ) and happiness ( $.68, p < .01$ ) also showed moderate correlations with global trait EI. These results are depicted in detail in Table 3.

[Table 3 near here]

A two-step hierarchical regression was performed to investigate the incremental validity of the Brazilian TEIQue-SF. In all cases, we introduced the Big Five dimensions at step 1 and trait EI at step 2. Satisfaction with life was the criterion variable in the first regression. At step 1, four of the Big Five dimensions were reliable predictors in the equation,  $R^2_{adj} = .263, F(5, 504) = 37.363, p < .01$ . Specifically, Extraversion ( $\beta = .123, t = 2.94, p < .01$ ), Agreeableness ( $\beta = .108, t = 2.64, p < .01$ ) and Conscientiousness ( $\beta = .150, t = 3.75, p < .01$ ) were positively related to life satisfaction, whereas Neuroticism negatively ( $\beta = -.410, t = 10.16, p < .01$ ). At step 2, with trait EI added to the equation [ $R^2_{adj} = .372, F(6, 503) = 51.179, p < .01$ ], Neuroticism remained a significant negative predictor ( $\beta = -.119, t = 2.46, p < .05$ ), while Openness to experience became a significant negative predictor ( $\beta = -.124, t = 3.21, p < .01$ ). Trait EI was a reliable positive predictor of life satisfaction in the presence of the Big Five personality dimensions ( $\beta = .542, t = 9.38, p < .01$ ).

We performed the second hierarchical regression with Happiness as the criterion. All Big Five dimensions except Openness to experience ( $\beta = .013, t = .37, p > .05$ ) were related

to happiness at step 1 [ $R^2_{adj} = .483$ ,  $F(5, 501) = 95.727$ ,  $p < .01$ ]. At step 2 [ $R^2_{adj} = .538$ ,  $F(6, 506) = 99.081$ ,  $p < .01$ ], the predictors that reached significance were Extraversion ( $\beta = .081$ ,  $t = 2.36$ ,  $p < .05$ ), Neuroticism ( $\beta = -.365$ ,  $t = 8.73$ ,  $p < .01$ ) and trait EI ( $\beta = .384$ ,  $t = 7.73$ ,  $p < .01$ ). The results of the hierarchical regressions are summarized in Table 4.

[Table 4 near here]

### ***Measurement invariance***

We tested measurement invariance through a three-way analysis of the Brazilian, UK and Chilean datasets. Furthermore, two-way comparisons explored the presence of one possible noninvariance among the datasets (Table 5). Fit indices of the baseline model for the three-way analysis (i.e., Brazil, UK and Chile) were in line with the hypothesis of configural measurement invariance [ $\chi^2(877) = 1568.419$ ,  $p < .01$ ;  $CFI = .939$ ;  $RMSEA = .041$ , 90%- $CI = .038$ -. $045$ ;  $SRMR = .032$ ]. This was also the case for the pairwise (two-way) analyses ( $CFI = .935$ -. $945$ ;  $RMSEA = .041$ -. $043$ ;  $SRMR = .032$ ). Regarding metric invariance, although changes in the CFI were outside the threshold values ( $\Delta CFI \geq -.10$ ), changes in the RMSEA and SRMR were acceptable in two and three-way analysis ( $\Delta RMSEA < .015$ ,  $\Delta SRMR < .030$ ). Similarly, changes in the RMSEA and SRMR were satisfactory for scalar invariance in all models ( $\Delta RMSEA < .015$ ,  $\Delta SRMR < .010$ ).

[Table 5 near here]

## **Discussion**

We cross-culturally adapted the TEIQue-SF to Brazilian Portuguese and subsequently investigated its reliability and validity. Consistent with previous relevant studies (Di Fabio, Saklofske, & Tremblay, 2016; Stamatopoulou et al., 2016), the instrument presented robust

psychometric properties. Measurement invariance analyses showed that the Brazilian adaptation is factorially equivalent to the UK and Chilean forms.

### ***Exploratory Structural Equation Modelling***

The Brazilian TEIQue-SF factor structure was confirmed through bifactor ESEM, following the Chilean validation (Pérez-Díaz & Petrides, 2019). In contrast to previous validations that used hierarchical (i.e., first or higher-order) factor analyses (e.g., Jacobs et al., 2015; Laborde et al., 2016), bifactor ESEM is more suitable for the assessment of trait EI for two main reasons. First, ESEM is a flexible framework that provides a better representation of personality datasets. The approach does not preclude potential item cross-loadings common in broad personality constructs, such as trait EI (Marsh, Morin, Parker, & Kaur, 2014; Petrides, Jackson, Furnham, & Levine, 2003; Tóth-Király et al., 2017). Second, bifactor modelling allows items to load not only on factors, but also on a global construct, which is ideal for an instrument seeking to model the shared trait EI variance (Lee, Mahoney, & Lee, 2017).

As expected, the simplest trait EI model description proved inadequate for the Brazilian dataset. However, the values improved significantly after the inclusion of correlated error terms (see also Di Fabio et al., 2016; Perera, 2015). Some previous investigations of the internal structure of the measure relied on item parcels (Jacobs et al., 2015; Laborde et al., 2016), which, albeit not incorrect, may not have provided a highly accurate representation of item covariations. In any case, previous research has typically reported satisfactory model fits for the TEIQue-SF (Jacobs et al., 2015; Pérez-Díaz & Petrides, 2019). The fit indices in the bifactor ESEM model for the Brazilian dataset were similar to those for the UK and Chilean datasets.

### ***Reliability***



We evaluated the reliability of the Brazilian TEIQue-SF through internal consistency and test-retest procedures. As expected, the alpha coefficient for global trait EI was high ( $\alpha = .88$ ), although at the factor level, alphas were somewhat lower. This has been reported in other cross-cultural adaptations of the TEIQue-SF (Jacobs et al., 2015; Stamatopoulou et al., 2016) and reflects the fact that the instrument was specifically designed to measure global trait EI. The high test-retest correlation between the two sets of global trait EI scores ( $r = .89$ ) provided unequivocal evidence for the stability of the construct. Notably, very few studies have assessed the test-retest reliability of the TEIQue, but our results actually exceed hitherto reported values (e.g., UK  $r = .78$ , Petrides, 2009; Urdu  $r = .82$ , Shahzad, Riaz, Begum, & Khanum, 2014).

### ***Gender differences in trait EI***

A significant difference in global trait EI was observed between Brazilian women and men, with the latter scoring higher. This was also the case in the normative UK sample (Petrides, 2009) and samples in other countries, such as Greece (Stamatopoulou et al., 2016), France (Mikolajczak, Luminet, Leroy, & Roy, 2007), and China (Gökçen, Furnham, Mavroveli, & Petrides, 2014). However, the constitution of the sample (Dental school undergraduates) and the relatively small effect size ( $d = .27$ ) should be taken into account in the interpretation of these results. Concerning standard deviations, the values were similar for women ( $\pm .79$ ) and men ( $\pm .75$ ), suggesting similar score dispersions.

### ***Correlations and hierarchical regressions***

Correlational results supported the convergent and discriminant validity of the TEIQue-SF. More specifically, the low-to-moderate correlations between the Brazilian TEIQue-SF and the Big Five dimensions corroborate the interrelationships, but also the

distinctiveness of trait EI, with respect to the major personality dimensions (e.g., Petrides et al., 2010; Saklofske, Austin, & Minski, 2003). Trait EI was positively related to happiness and life satisfaction, confirming its criterion validity. These findings are in line with trait emotional intelligence theory (e.g., Petrides, 2001, 2010; Petrides et al., 2016) as well as with multiple previous studies from different contexts and cultures (e.g., Freudenthaler, Neubauer, Gabler, Scherl, & Rindermann, 2008 in Germany; Moutinho, Monteiro, Costa, & Faria, 2019 in Portugal; Stamatopoulou et al., 2016 in Greece; and Ye, Yeung, Liu, & Rochelle, 2019 in Hong Kong).

In addition, the Brazilian TEIQue-SF showed incremental validity in the prediction of happiness and life satisfaction over and above the Big Five. These results are also in line with the literature, which records strong incremental validity effects for trait EI (e.g., Andrei, Siegling, Aloe, Baldaro, & Petrides, 2016). There is little doubt that there is very significant overlap between trait EI and the Big Five, which has been highlighted from the earliest stages of trait EI theory (Petrides, 2001) and is actually reflected in the construct's label. It turns out that this overlap is due to the fact that trait EI is the fundamental integrative dimension of human personality (van der Linden et al., 2017, 2018). Additionally, the comprehensive coverage of the affective aspects of personality that the trait EI construct provides, renders it a powerful incremental predictor of emotion-relevant criteria beyond the Big Five personality dimensions.

### ***Measurement invariance***

The measurement invariance analyses suggested that the trait EI means are equivalent for the Brazilian, UK and Chilean TEIQue-SF. The CFI changes between the configural, metric (weak) and scalar (strong) analyses exceeded the recommended limits in all comparisons (two-way and three-way). However, conclusions about measurement invariance

analyses are based on an overall assessment of all fit indices and not solely on any single one of them (Putnick & Bornstein, 2016). In the present study, the changes in the RMSEA and SRMR indices were within the recommended thresholds and provided a basis for claiming invariance among the three datasets. From a psychometric perspective, this finding means that scores on these versions of the TEIQue-SF can be interpreted as estimates of the same underlying construct and directly compared, while from a theoretical perspective, it substantiates the cross-cultural robustness of the trait EI construct under different cultural, sociodemographic, and economic conditions.

### **Conclusion**

Based on these findings, the current adaptation of the TEIQue-SF can be unreservedly recommended for the efficient assessment of trait emotional intelligence in Brazil. The measurement equivalence between the Brazilian, UK and Chilean TEIQue-SF versions facilitates the expansion of relevant cross-cultural investigations (e.g., Di Fabio & Saklofske, 2014; Di Fabio et al., 2016; Feher et al. 2019; Petrides et al., 2010). Within the broader context of trait EI theory, the Brazilian TEIQue-SF can support the development and implementation of intervention programs designed to optimize emotional functioning across all educational levels (primary to tertiary) and beyond (e.g., McIlvain, Miller, Lawhead, Barbosa-Leiker, & Anderson, 2015; Nelis, Quoidbach, Mikolajczak, & Hansenne, 2009; Petrides et al., 2016; Ruttledge & Petrides, 2012). Overall, the growing trend of international validations of the family of TEIQue instruments confirms their status as gold standard measurements in the field of emotional intelligence.

### **Funding**

Funding was provided by the National Council for Scientific and Technological Development (CNPq) - N° 22/2018, under grant N°. 205043/2018-6, and financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brazil (CAPES) - Finance Code 001.

### **Declaration of interest statement**

The authors declare that they have no conflict of interest.

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Table 1. Goodness-of-Fit Statistics for the Brazilian, UK, and Chilean TEIQue-SF

<b>Models</b>	$\chi^2$ (df)	<b>CFI</b>	<b>RMSEA (90% CI)</b>	<b>SRMR</b>
Brazil ( $N = 512$ ) <sup>a</sup>	584.344 (292)	.940	.044 (.039- .049)	.032
UK ( $N = 537$ ) <sup>b</sup>	589.696 (292)	.922	.044 (.038-.049)	.032
Chile ( $N = 335$ ) <sup>c</sup>	409.765 (293)	.957	.034 (.026-.042)	.032

*Note.* CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardised Root Mean Square Residual.

<sup>a</sup>Correlated errors: 24-9, 18-3, 29-14. <sup>b</sup>Correlated errors: 18-3, 28-16, 26-11. <sup>c</sup>Correlated errors: 18

Table 2. Descriptive Statistics, Internal Consistencies, and Gender Differences in the Brazilian TEIQue-SF ( $N = 512$ )

Variable	Well-being		Self-control		Emotionality		Sociability		Global trait EI	
	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men
Mean	5.36	5.44	4.00	4.53	5.17	5.12	4.46	4.85	4.77	4.98
SD	1.16	1.21	1.08	1.01	.92	.83	.93	.91	.79	.75
Range	5.83	6.00	5.83	4.83	4.75	4.38	4.83	4.67	4.47	4,20
Cronbach's $\alpha$	.85	.86	.65	.60	.67	.55	.61	.55	.89	.87
Skewness	-.79	-1.13	-.15	-.12	-.50	-.87	-.25	.03	-.35	-.54
Kurtosis	.28	1.56	-.32	-.61	-.20	1.24	-.21	.34	-.12	.53
Effect Size	-		.51		-		.42		.27	
t-Test ( <i>p-value</i> )	>.05		<.01		>.05		<.01		<.01	

Table 3. Descriptive Statistics, Internal Consistencies, and Correlations for the Key Variables in the Study

Variable	1	2	3	4	5	6	7	Mean	SD	Range	Cronbach's alpha
<b>Big Five</b>											
<b>1 Extraversion</b>	1.00							16.12	5.31	5.00-25.00	.88
<b>2 Agreeableness</b>	.15**	1.00						2.89	2.91	7.00-25.00	.77
<b>3 Conscientiousness</b>	-.06	.27**	1.00					2.02	3.67	7.00-25.00	.81
<b>4 Neuroticism</b>	-.31**	-.18**	-.02	1.00				14.89	4.29	5.00-25.00	.76
<b>5 Openness</b>	.31**	.15**	-.10*	-.16**	1.00			15.02	4.04	6.00-25.00	.64
<b>6 Life satisfaction</b>	.24**	.23**	.19**	-.47**	.06	1.00		24.13	6.47	5.00-35.00	.85
<b>7 Happiness</b>	.34**	.32**	.14**	-.65**	.16**	.66**	1.00	5.02	1.18	1.00-7.00	.82
<b>TEIQue-SF</b>											
<b>Well-being</b>	.36**	.42**	.25**	-.66**	.20**	.69**	.79**	5.38	1.18	1.00-7.00	.85
<b>Self-control</b>	.05	.22**	.09*	-.55**	.19**	.30**	.37**	4.14	1.08	1.00-6.83	.65
<b>Emotionality</b>	.28**	.56**	.22**	-.34**	.23**	.35**	.41**	5.15	.89	2.25-7.00	.64
<b>Sociability</b>	.47**	.19**	.05	-.36**	.33**	.34**	.38**	4.57	.94	1.67-7.00	.60
<b>Global trait EI</b>	.40**	.46**	.24**	-.66**	.30**	.59**	.68**	4.83	.79	2.27-6.73	.88

Note. SD = Standard Deviation.

\*  $p < .05$ . \*\*  $p < .01$ .

Table 4. Two-step Hierarchical Linear Regressions with the Criteria of Life Satisfaction and Happiness Regressed on the Big Five Dimensions (Step 1) and Trait EI (Step 2)

	Life Satisfaction		Subjective Happiness	
	$\beta$	t	$\beta$	t
<b>Step 1</b>	<b>R<sup>2</sup>adj = .263</b> <b>F(5, 504) = 37.363**</b>		<b>R<sup>2</sup>adj = .483</b> <b>F(5, 501) = 95.727**</b>	
<b>Step 2</b>	<b>R<sup>2</sup>adj = .372</b> <b>F(6, 503) = 51.179**</b>		<b>R<sup>2</sup>adj = .538</b> <b>F(6, 506) = 99.081**</b>	
<b>Step 1</b>				
Extraversion	.123	2.94**	.142	4.04**
Agreeableness	.108	2.64**	.169	4.93**
Conscientiousness	.150	3.75**	.093	2.76**
Neuroticism	-.410	10.16**	-.571	16.82**
Openness	-.045	1.10	.013	.37
<b>Step 2</b>				
Extraversion	.036	.91	.081	2.36*
Agreeableness	-.039	.96	.065	1.86
Conscientiousness	.054	1.41	.025	.74
Neuroticism	-.119	2.46*	-.365	8.73**
Openness	-.124	3.21**	-.044	1.32
Trait EI	.542	9.38**	.384	7.73**

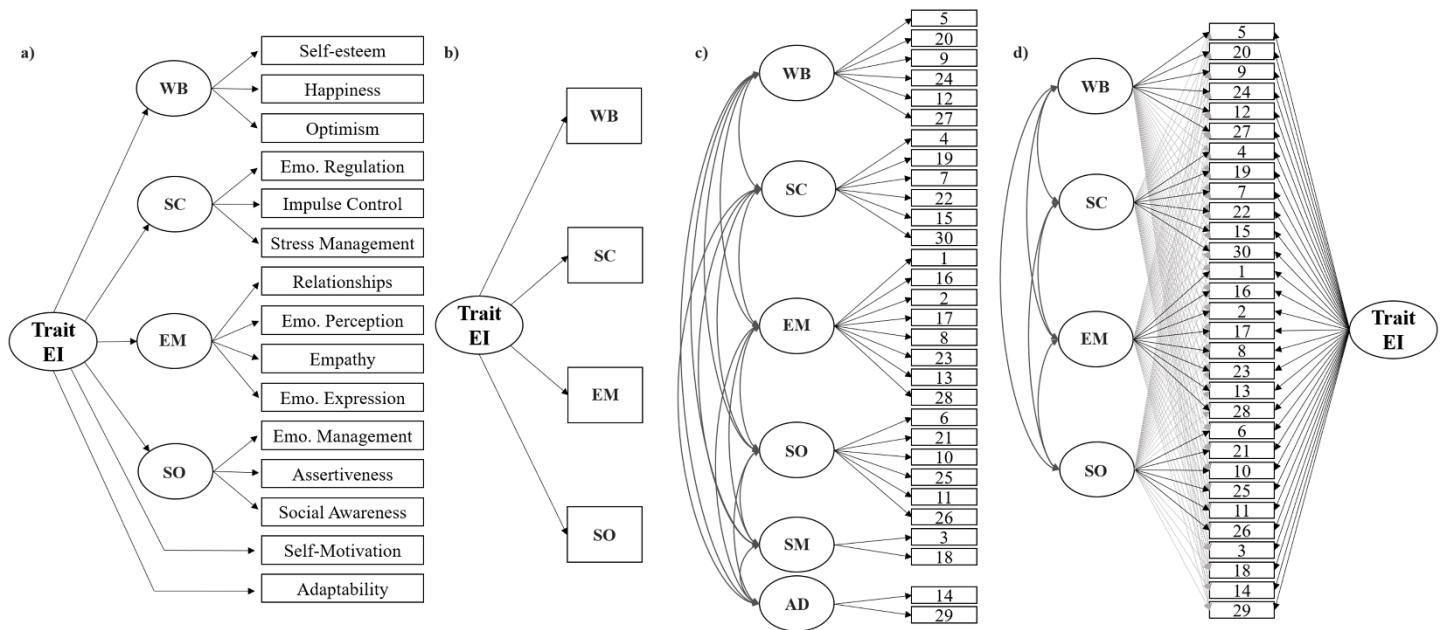
\*  $p < .05$ . \*\*  $p < .01$ .



Table 5. Measurement Invariance Analyses between the Brazilian, UK and Chilean Datasets

<b>Models</b>	$\chi^2$ ( <i>df</i> )	<b>CFI</b>	$\Delta$ <b>CFI</b>	<b>RMSEA (90% CI)</b>	$\Delta$ <b>RMSEA</b>	<b>SRMR</b>	$\Delta$ <b>SRMR</b>
<b>Brazil and UK</b>							
Configural	115.096 (584)	.935	-	.043 (.039-.047)	-	.032	-
Metric	1517.991 (709)	.907	-.028	.047 (.043-.050)	.004	.047	.015
Scalar	1711.492 (734)	.888	-.019	.050 (.047-.054)	.003	.050	.003
<b>Brazil and Chile</b>							
Configural	1001.264 (585)	.945	-	.041 (.037-.045)	-	.032	-
Metric	1312.837 (710)	.921	-.024	.045 (.041-.049)	.004	.048	.016
Scalar	1462.887 (735)	.904	-.017	.048 (.045-.052)	.003	.051	.003
<b>Chile and UK</b>							
Configural	1009.529 (585)	.935	-	.041 (.037-.045)	-	.032	-
Metric	1296.327 (710)	.910	-.025	.044 (.040-.047)	.003	.046	.014
Scalar	1468.090 (735)	.887	-.023	.048 (.044-.051)	.004	.052	.006
<b>Brazil, UK and Chile</b>							
Configural	1568.419 (877)	.939	-	.041 (.038-.045)	-	.032	-
Metric	2229.442 (1127)	.903	-.036	.046 (.043-.049)	.005	.051	.019
Scalar	2618.737 (1177)	.874	-.029	.052 (.049-.054)	.006	.056	.005

*Note.*  $\chi^2$  = Chi Square, *df* = degrees of freedom, *CFI* = Comparative Fit Index,  $\Delta$ *CFI* = CFI difference, *RMSEA* = Root Mean Square Error of Approximation,  $\Delta$ *RMSEA* = RMSEA difference, *SRMR* = Standardized Root Mean Square Residual,  $\Delta$ *SRMR* = SRMR difference.



**Figure 1.** TEIQue-SF models tested in validations around the world. a) Higher-order CFA model with item parcels as indicators (German adaptation); b) Global trait EI with the four trait EI factors as indicators (Spanish and Chinese adaptations); c) First-order CFA model with items as indicators (Mexican adaptation); d) Bifactor ESEM with items as indicators (Chilean adaptation). WB = Well-being; SC = Self-control; EM = Emotionality; SO = Sociability; SM = Self-motivation; AD = Adaptability.