Adaptation and Psychometric Properties of the Self Report Emotional Intelligence Test (SSEIT) among Brazilian athletes

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Abstract

Emotional intelligence (EI) is a psychological skill that aids athletes in the control of emotions and optimization of sports performance. The present study investigated the psychometric properties of the Self-Report Emotional Intelligence Test (SSEIT) in 508 Brazilian youth and adult athletes (mean age 18.55±4.68 years). Data analysis was conducted through Exploratory (EFA) and Confirmatory (CFA) Factor Analysis, Cronbach's alpha, composite reliability and Pearson's Correlation ($p<0.05$). EFA revealed the one-factor model with 26 items with the best adjustment. CFA confirmed the one-factor model with 26 items with best greater fit. No evidence of invariance was found, suggesting that the SSEIT must be used with caution when comparing gender and age groups. The external validity was found in the correlation of EI and cognitive anxiety and self-confidence. It is concluded that the Brazilian version of SSEIT for the sports context presented acceptable psychometric properties, however, showed limitations that should be explored in the future.
Keywords: psychometrics, emotions, sports psychology, sport.

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Inteligencia emocional en el deporte: propiedades psicométricas de la prueba de inteligencia emocional Self Report (SSEIT) entre atletas brasileños

Resumen

La inteligencia emocional (IE) es una habilidad psicológica que ayuda a los atletas a controlar las emociones y optimizar el rendimiento deportivo. El presente estudio investigó las propiedades psicométricas de la Prueba de Inteligencia Emocional de Autoinforme (SSEIT) en 508 atletas jóvenes y adultos brasileños (edad media 18.55 ± 4.68 años). El análisis de los datos se realizó a través del análisis factorial exploratorio (EFA) y confirmatorio (CFA), alfa de Cronbach, fiabilidad compuesta y correlación de Pearson (p <.05). EFA reveló el modelo de un factor con 26 artículos con el mejor ajuste. CFA confirmó el modelo de un factor con 26 ítems con el mejor ajuste mayor. No se encontró evidencia de invariancia, lo que sugiere que el SSEIT debe usarse con precaución al comparar grupos de genero y edad. La validez externa se encontró en la correlación de la IE y la ansiedad cognitiva y la autoconfianza. Se concluye que la versión brasileña de SSEIT para el contexto deportivo presentó propiedades psicométricas aceptables, sin embargo, mostró limitaciones que deberían explorarse en el futuro.
Palabras clave: psicometría, emociones, psicología deportiva, deporte.

Introduction

Emotions are usually intensely present in sports and exercise (Lavoura & Machado, 2018), influencing decision-making and athlete's performance in training and competitions (Allen et al., 2013; Laborde et al., 2014; Vaughan & Laborde, 2018). Thus, athletes with higher ability to manage their emotions stand out with more effectiveness in the competitive sports environment (Gerber et al., 2018).

One of the emotional constructs that has been receiving attention in the international scenario of Sports Psychology is Emotional Intelligence (EI) (Cowden, 2016; Lee & Chelladurai, 2018). EI refers to individual responses to emotional interpersonal or intrapersonal stimuli, and is strongly related to the regulation of self-emotions and/or emotions of others (Mayer et al., 1997; Petrides & Furnham, 2003). Investigations regarding EI date from the 90's (Lima & Quevedo-Silva, 2016), however, the investigative line of this variable aiming the sports context only occurred in the 21st century (Ribeiro et al., 2018). In this period, researchers considered it to be relevant to investigate EI as an important psychological ability in the sports domain (Botterill & Brown, 2002), helping athletes to control emotions and influencing in their performance (Botterill & Brown, 2002; Lott & Turner, 2018).

Studies have associated EI with the management of emotions (anger, calmness, happiness, angst, confusion) as intervenient factors of ideal and dysfunctional performance in athletes (Arribas Galarraga et al., 2017; Laborde et al., 2016; Lane et al., 2009). Laborde et al. (2016) presented, in a systematic review, that EI has a significant impact over emotions, physiological responses to stress, successful use of psychological abilities and better sports performance. However, Castro-Sánchez et al. (2018) revealed that this management occurs in different forms in group and individual sports, considering that individual sports' athletes usually present higher levels of state-anxiety when compared to group sports' athletes.

A study with fighters with different competitive levels showed that men of the amateur category are more anxious than women, while high performance female fighters presented higher ability of comprehension and perception of emotions (Fernández et al., 2019). Such investigations highlight that EI helps the athlete to extract information from situations in competitions and training, with the purpose of noticing, managing and using these information to maximize personal performance (Laborde et al., 2018). Therefore, it is important to evaluate, comprehend and organize the management and the use of emotions in the context of training and competitions, since this control can directly influence in the cognitive performance of the athletes (Laborde et al., 2014; Niven et al., 2011; Tamminen et al., 2019).

In order to do so, EI has been evaluated through several instruments and diverse contexts. Specifically in the sports context, the most used instruments are the Bar-On Emotional Quotient Inventory – Youth Version (EQ-i:YV) (Bar-On & Parker, 2000), the Mayer-Salovev-Caruso Emotional Intelligence Test (MSCEIT) (Mayer, 2002), and the Self Report Emotional Intelligence Test (SSEIT) (Schutte et al., 1998), which has been the most used instruments by researchers within (Vieira-Santos et al., 2018) and outside the sports context (Aniemeka et al., 2020; Toledo et al., 2018). SSEIT is composed of 33 items that assess the perception of emotions, the management of one's emotions, the management of others' emotions and the use of emotions (Schutte et al., 1998). In general, the scale is one of the main scales used in the world in different contexts (Aniemeka et al., 2020; Toledo Júnior et al., 2018) and it presents clear evidence of reliability, adequate validity. In populations of other languages, several studies have provided evidence of the validity (ie content and factorial validity) and reliability (ie, internal consistency reliability and test-retest reliability) of scores obtained on the SSEIT in sport context across various data collections in Spain (García-Coll et al., 2013), North America (Lane et al., 2009) and the United Kingdom (Vaughan & Laborde, 2018).

Despite the advances of research regarding EI, and more specifically about the SSEIT in the sports context, the one-factor model with 33 items proposed by Schutte et al. (1998) has found inconsistencies in items and/or dimensions in validation studies (cited above) with athletes. These aspects evidence the need of several adjustments, such as the reduction of the number of items, fragmentation of dimensions and/or maintenance of a one-factor model like the original scale. Specifically, the study performed by Petrides and Furnham (2003) failed in pointing the one-factor structure proposed by Schutte et al. (1998), in a way that the authors proposed an alternative conceptualization with a solution of four factors (optimism/mood regulation, evaluation of emotions, social abilities and use of emotions), however, such study was not specific for athletes.

Lane et al. (2009) verified, in North American athletes, that a model with six factors of the SSEIT, with 33 items, presented an acceptable adjustment. However, the authors identified several inconsistencies in 14 items of the instrument, verifying that a one-factor and a multidimensional model with 6 factors and 19 items presented satisfactory adjustment. García-Coll et al. (2013) analyzed the psychometric properties of SSEIT in Spanish athletes and observed problems in the items 5, 28 and 33, which are described as a negative sentence and, according to the authors, created a type of response factor that interfered in the statistical analysis. The authors verified a satisfactory adjustment with the remaining 30 items in a one-factor and multidimensional structure with four factors (emotional perception, self-emotional management, hetero-emotional management and emotional utilization).

In a more recent study conducted by Vaughan and Laborde (2017), with British athletes, the authors tested the following models: one-factor model with 33 items (Schutte et al., 1998); four-factor model with 33 items (Petrides & Furnham, 2003); six-factor model with 33 items (Lane et al., 2009); and a one-factor and five-factor models with 19 items (Lane et al., 2009). Of the five models tested, the authors found that the model with 6 factors and 33 items was the only one with acceptable adjustment, even though several items presented factorial load below 0.50 (items 4, 8, 11, 27 and 28). The model with five factors also presented acceptable adjustment, although it was considered inadequate based on the cut-points recommended by literature (Hu & Bentler, 1999). Lastly, the six-factor model based on the model of Salovey and Mayer (1990) did not provide support due to its very low factorial load. The authors stated that these inconsistencies could be due to incorrect statistical analysis, revealing the need of investigating several models found in previous studies, with the purpose of verifying the factorial structure with the best adjustment for the context to be used. Thus, the authors reiterated the importance of conducting future research regarding the psychometric properties of SSEIT with athlete and non-athlete samples in different countries, so that such inconsistencies could be overcome.

One of the difficulties of investigating this psychological attribute in the Brazilian sports context is the absence of an instrument that has passed all stages of transcultural adaptation and that presents adequate psychometric properties, being this considered a gap in scientific knowledge regarding the topic in Brazil. SSEIT has been translated and adapted to the Portuguese language, in the scope of Brazilian medicine students, by Toledo Júnior et al. (2018). However, the authors did not analyze the psychometric properties of the instrument. Therefore, the present study aims to fill this gap by using the translated and adapted version by Toledo Júnior et al. (2018) to analyze the psychometric properties of the instrument with a Brazilian sample of youth and adult athletes. This instrument could help scientific investigations in the country regarding the construct and effectively contribute to the work of sports professionals, in the better comprehension and use of this psychological attribute to optimize cognitive performance of athletes (Ribeiro et al., 2018).

However, because the SSEIT is only available in English or Spanish, the reach of the SSEIT does not currently extend to non- English or Spanish speaking populations. This is a common issue with the EI development through sport literature, which is dominated by research within European countries, such as United Kingdom and Spain (García-Coll et al., 2013; Lane et al., 2009; Vaughan & Laborde, 2018). In order to address this issue, instruments like the SSEIT needs to be adapted and tested psychometrically in several widely spoken languages. One of these languages is Portuguese, which is estimated to be the sixth most spoken language worldwide, with more than 200 million speakers in countries, such as Portugal, Brazil, Mozambique and Angola (Parkinson, 2017).

The present study is relevant since it aims to examine the validity evidence based on internal structure and on relationship with external measures, as well as the factor invariance of the SSEIT with a sample of Brazilian athletes. The main objective is to analyze the psychometric properties through an exploratory and confirmatory approach, with the purpose of determining the utility of the scale in sports and to compare with other domains. Specifically, in addition to the factorial structure obtained in the exploratory analysis, the confirmatory analysis of the one-factor and multidimensional models with four and six factors, proposed in literature, was tested. Moreover, the reduced model proposed by Lane et al. (2009) was replicated.

Methods

Study Desing and Procedures

This is a descriptive study with transversal delineation and methodological research (Ato et al., 2013). Initially, contact was made with the people responsible for the competitions in order to obtain consent to perform the research. Afterwards, the local Research and Ethics Committee approved the study (protocol n. 3.576.805). Data was collected in the hotels and/or hosting locations of the teams/athletes in the cities where the competitions took place, during the second semester of 2019. Questionnaires were answered collectively, in a private room, without the presence of the coaches. Only the participants who had the consent form signed by their parents and coaches (responsible for the adolescents) were selected to the study. We asked the contact (e-mail and phone number) of the parents at the schools before the competition to obtain the permission to conduct the research with the athletes under the age of 18 years. The total time to answer the questionnaires was of approximately 30 minutes. Questionnaires were randomized between participants.

Participants

In total, 519 youth and adult athletes were invited to participate in the study. They competed in the School Games of Arapiraca, a city in the state of Alagoas, in Brazil, and in the Brazilian College Games of 2019. However, 11 athletes were excluded from the study for not correctly answering the questionnaires (leaving several items blank). As a result, 508 athletes aged between 11 and 42 years were included in the final sample (295 male, 213 female; mean age = 18.55 ± 4.68 years). Athletes reported a mean time of sports practice of 72.26 ± 66.88 months, with a weekly training duration of 5.68 ± 4.86 hours. The participants played the following sports: futsal (n=218), handball (n=113), basketball (n=45), judo (n=34), volleyball (n=32), swimming (n=25), chess (n=12), e-sports (n=11), karate (n=8), beach volleyball (n=5) and track and field (n=5).

Athletes were selected by convenience, in a non-probabilistic way, according to the following inclusion criteria: 1) practicing the sport for at least three months; and 2) having participated in any official competition in the year of 2018/2019. Participants were only enrolled after signing a free informed consent term (if 18 years or older) or a free informed assent term (if under 18 years of age), and verbally manifesting their desire to participate in the research. Parents and/or guardians of the participants under 18 years also signed a free informed consent term.

Instruments

Sociodemographic data

Sociodemographic information was collected to describe the sample (age, gender, sport practiced, time of practice per week, and years of practice).

Schutte Self-Report Emotional Intelligence Test (SSEIT)

SSEIT is a self-applicable scale with 33 questions developed for the general population by Schutte et al. (1998). Its validation pointed to a unifactorial solution, with a satisfactory internal consistency index of 0.87. The items use a likert type scale with five answer options, being: (1) *I totally disagree*, (2) *I partially disagree*, (3) *I do not agree, nor disagree*, (4) *I partially agree* and (5) *I totally agree*. To calculate the final score, values of the item 5, 28 and 33 must be inverted. Afterwards, all values of the answers must be summed. The scores range from 33 to 165 and higher scores indicate higher levels of EI. The present study used the translated and adapted version to the Portuguese language created by Toledo Júnior et al. (2018).

Other studies point that the 33 items can also be grouped in four factors (perception of emotions: items 5, 9, 15, 18, 19, 22, 25, 29, 32, 33; management of self-emotions: items 2, 3, 10, 12, 14, 21, 23, 28, 31; management of others' emotions: items 1, 4, 11, 13, 16, 24, 26, 30; and use of emotions: items 6, 7, 8, 17, 20, 27), or six factors (management of others' emotions: items 5, 18, 25, 26, 29, 32, 33; management of self-emotions: items 2, 9, 15, 19, 22; regulation of emotions: items 1, 6, 14, 21, 23; social skills: items 4, 11, 13, 24, 30; use of emotions: items 7, 12, 16, 17, 20, 27, 31); and optimism: items 3, 8, 10, 28). In addition to structures with one and five factors with 19 items (García-Coll et al., 2013; Petrides & Furnham, 2003; Vaughan & Laborde, 2018).

Competitive State Anxiety Inventory-2R (CSAI-2R)

The frequency dimension of the CSAI-2R, originally developed by Martens et al. (1990), and validated for the Brazilian context by Fernandes et al. (2012), was used. This instrument is composed of 16 items distributed in three subscales, being: cognitive anxiety ("*I am worried because I can perform not as well as I could in this competition*"), somatic anxiety ("*I feel my body tense*") and self-confidence ("*I feel self-confident*"). The items are answered in a likert type scale in a continuum that ranges from "*nothing*" (1) to "*very*" (4). The results of the validation for the Brazilian context revealed a satisfactory reliability (α>.70) and satisfactory adjustment indexes (CFI=.959; GFI=.942; RMSEA = .044) for the reduced 16-item model.

Data analysis

Data were evaluated using SPSS version 23.0 and Amos version 23.0. The data regarding sample characterization were analyzed using descriptive statistics for the continuous (mean and standard deviation) and categorical data (absolute and relative frequency).

In order to examine the validity evidence based on internal structure of SSEIT, different structural models were tested following an analytical sequential procedure. First, an Exploratory Factor Analysis (EFA) was performed to establish the hypothetical dimensional models of EI. Afterwards, different models were tested through Confirmatory Factor Analysis (CFA). Lastly, the best-adjusted model was selected. The sample size for EFA and CFA was determined based on the recommendation of at least 10 participants by item and parameter estimated of the model, respectively (Hair et al., 2019). To guarantee the adequacy of the sample, Monte Carlo's bootstrapping technique was applied and the power of the analysis was calculated (MacCallum et al., 1996).

Although it is not recommended by some psychometric researchers to use the same sample to conduct EFA and CFA, Van Prooijen and van der Kloot (2001) state that it is possible to test whether the items of an instrument whose structure has more than one factor can be assumed to be one-dimensional, that is, that each of them evaluates exclusively one factor only, which is the case of the present study. The authors argue that CFA can be used to test slightly more restricted versions of an unrestricted model derived via EFA, in the same dataset. More specifically, the authors suggest that they can be set at zero factor loadings (or correlations between factors) that have been identified, in EFA, as having values below .20. This specification tends not to penalize the model fit much, being a viable strategy for replication, via CFA, of multidimensional structures identified via EFA.

EFA was performed using the method of extraction of the Unweighted Least Squares with Promax Rotation, which is an oblique method of rotation that allows corelated factors and is recommended for large samples. Initially the Kaiser-Meyer-Olkin Test (KMO) and Bartlett's indexes were tested. Moreover, an analysis of self-values was performed using Kaiser's Criterion (>1), Cattell's Criterion (scree plot) and parallel analysis, which suggest the number of factors to be retained. The theoretical definitions regarding the constructs and semantic contexts of SSEIT were considered to determine the most satisfactory factorial solution. The sample's measure of adequacy of each item was performed using the anti-image matrix (AIM>0.7/r<0.09). Considering the representative sample of the present study, items with factorial loads above 0.30 were maintained in the model, since it is considered an acceptable measure for large samples (Hair et al., 2019).

Regarding the CFA, the verification of existence of outliers was evaluated using the square distance of Mahalanobis (D^2), since the inexistence of outliers is an assumption for this analysis (Byrne, 2010). Normality was verified, since it also is an assumption for performing CFA, by studying the univariate distribution through skewness and kurtosis (ISkI<3.0 and IKuI<10), and multivariate distribution through Mardia's Coefficient for multivariate kurtosis (Kline, 2012).

The algorithm of maximum likelihood for the estimations of the parameters was used (Kline, 2012). The standardized factorial loads were interpreted using the recommendations by Comrey and Lee (1992) (for example: >0.71 = excellent; >0.63 = very good; >0.55 = good; >0.35 = reasonable/acceptable; <0.35 = weak). In addition, the bootstrapping technique was performed to verify the significance of the factorial load in each item with its respective factor (MacCallum et al., 1996). The confirmatory models were tested using the most recommended adjustment indexes in literature: Chi-Square (χ^2 and p=value), Root of the Mean Square Error of Approximation (RMSEA; C.I. 90%), Tucker-Lewis Index (TLI), Normalized Chi-Square (χ^2/degrees of freedom, recommended between 1.0 and 3.0) and Comparative Fit Index (CFI) (Byrne, 2010; Hair et al., 2019). An excellent fit is .95 for CFI/TLI and .06 for RMSEA, while an "adequate fit" is .90 for CFI/TLI and RMSEA is .08 (Hu & Bentler, 1999).

Moreover, the composite reliability (CR) and Cronbach's alpha (α) were calculated to evaluate the internal consistency of SSEIT adopting values ≥ 0.70 as cut-point (Hair et al., 2019).

To identify the factorial invariance of the instrument, an appropriate model fit for gender and age group was initially defined. After obtaining the factors, these were simultaneously submitted to a multi-group analysis (with Emilisrel6 correction) which aimed to perform a progressive set of restrictions (factorial loads, variance and covariance) to analyze the equivalence of the instrument in different subgroups (men *vs* women; up to 18 years *vs* older than 18 years).

Lastly, to verify the assumptions of validity evidence based on relationship with external measures, we conducted a preliminary analysis of the data through Kolmogorov-Smirnov normality test. After the normality test, the Pearson's Correlation (r) was performed to verify the association between EI and the dimensions of pre-competitive anxiety. The influence of the indicators in global levels of EI follows the same tendency in-group and individual sports, and pre-competitive anxiety is directly linked to these unbalances. Recent studies point that EI is a skill that can be improved and taught with the purpose of restraining essential emotions in the sports contexts, such as stress, aggressiveness or anxiety, being this last one a disturbing element that deteriorates sports performance (Castro-Sánchez et al., 2018; Laborde et al., 2016; Laborde et al., 2014).

Results

Exploratory Factorial Analysis

The EFA was performed with the purpose of establishing hypothetical dimensional models of emotional intelligence. Even though the original version by Schutte et al. (1998) adopted a one-factor model with 33 items, recent studies found different dimensional structures of the scale for the sports context (García-Coll et al., 2013; Lane et al., 2009; Petrides & Furnham, 2003; Vaughan & Laborde, 2018). Thus, a model with an extraction free of factors was first tested in order to verify if the items were distributed throughout the possible latent factors.

The analysis of EFA with 33 items showed and adequate KMO (0.86) and a significant Bartlett's test (p=.001). Kaiser's criterion suggested 10 factors to retain, while Catell's criterion and the parallel analysis pointed to four factors, but with the highest percentage of variance explained by factor 1. In this scenario, solutions ranging from 2 to 10 factors were tested, in addition to the unifactorial structure. However, the solutions with 4, 5, 6, 7, 8, 9 and 10 factors were discarded due to the bad distribution of items among the latent factors, with factors containing only one or two items and items with cross factorial loads. In all solutions tested (2, 3, 4, 5, 6, 7, 8, 9 and 10 factors), the majority of the 33 items saturated with high factorial load in factor 1, revealing the existence of a unifactorial model.

The solution with one factor revealed communalities that ranged from 0.02 to 0.38, and factorial loads between 0.32 and 0.61, with exception of the items 5, 6, 13, 28, 29, 32 and 33, which presented poor communalities and factorial loads in the unifactorial model. It is worth highlighting that items item 5 ("*I find it hard to understand the non-verbal messages of other people*"), item 28 ("*When I am faced with a challenge, I give up because I believe I will fail*") and item 33 ("*It is difficult for me to understand why people feel the way they do*") have inverted scores. Regarding the identification of tendencies to explain items with weak loads, the most plausible observation includes items with inverted scores (for instance, items written as negative sentences). Previous researches have evidence that suggests that items with inverted scores present low performance in models with one factor (Woods, 2006).

Based on these exploratory results, a second model without the three items with inverted scores (5, 28 and 33) was tested in order to check if only those items were interfering in the model. This model presented adequate adjustment (KMO=0.87 / Bartlett $p < .001$). However, items 6, 13, 29 and 33 kept presenting factorial loads below 0.30. In this scenario, these items were excluded, and a third model was tested. The unifactorial model with 26 items presented better adjustment (KMO=0.89 / Bartlett $p < .001$) and all indicators regarding the number of factors to be extracted agreed in one factor, explaining approximately 30% of the total variance of the data. The factorial loads ranged from .33 to.62 (Table 1).

Confirmatory Factorial Analysis

Even though the results of the EFA indicate a one-factor model with 26 items, partially agreeing with the original version by Schutte et al. (1998), the initial analysis tested the unidimensional models of 33 items (Schutte et al., 1998), 30 items (García-Coll et al., 2013) and 26 items (solution presented by the EFA of the present study). Further, the four-factor model with 33 items (Petrides & Furnham, 2000), 6 factors with 33 items (Lane et al., 2009), and to the unidimensional model and 5-factor model with 19 items (Lane et al., 2009). Vaughan and Laborde (2017), to verify the models with best adjustment in European athletes and non-athletes, also performed this same procedure.

Preliminary analysis of the CFA

A preliminary analysis of the data revealed 43 multivariate outliers (D^2 = p1 < 0.01; p2 < 0.01). These participants were removed due to the possibility of compromising the internal consistency of the scale and the due to the fact that the inexistence of outliers is a basic assumption of CFA (Hair et al., 2009). The descriptive statistics of the items did not indicate deviations of univariate normality, since skewness values ranged from -1.63 to -0.02 and kurtosis values varied from -0.82 to 2.40 (Hair et al., 2009). However, the Mardia's normalized coefficient of multivariate kurtosis (1970), was above 5.00 (2148.95; $p < .001$), which Bentler (2007) suggests as an indicator of deviation of multivariate normality. Thus, the Bollen-Stine Bootstrap procedure was performed to obtain a corrected Chi-Square value of the estimated coefficients for the maximum likelihood estimator (Marôco, 2010).

Main analysis of CFA

The first model evaluated the unidimensional structure proposed by Schutte et al. (1998), with 33 items, and indicated an inadequate adjustment of the data (Table 1). It is worth highlighting that the factorial loads ranged from 0.03 to 0.70, with lower values being found in items 5 (0.03), 6 (0.31), 13 (0.17), 28 (0.31), 29 (0.24), 32 (0.32) and 33 (0.10), which also presented problems in the EFA. This result points to a unifactorial model with 26 items, which was found in the EFA. However, a unifactorial model with 30 items (without the items with inverted scores) was tested first, also presenting an unsatisfactory adjustment and with factorial load problems in items 6, 13, 29 and 32 (Table 2).

The unifactorial model with 26 items, which presented the best factorial structure in the EFA, presented satisfactory adjustment in all indexes (Table 2). Regarding the standarized factorial loads of the items, it is worth highlighting that all items presented statistically significant factorial loads for $p < .05$. In addition, all 26 items presented factorial loads above 0.35 (reasonable). Bootstrap replications ($p < .001$) and confidence interval (C.I. 95%) indicated the stability of the factorial estimations and, consequently, the acceptable adjustment of the model for the data. Power analysis of the unifactorial model with 26 items was conducted to test our sample adequacy. Based on RMSEA estimation, considering a RMSEA ranging from .04 to .05 with 5% significance, our sample showed 99% power (MacCallum et al., 1996).

Table 1.
EFA of the unifactorial model with 26 items of the Brazilian version of SSEIT for the sports context

Items of SSEIT	One-factor model with 26 items
1. I know when to speak about my personal problems to other	0.42
2. When I am faced with obstacles, I remember times I faced similar obstacles and overcame them.	0.45
3. I expect that I will do well on most things I try.	0.50
4. Other people find it easy to confide in me	0.50
7. When my mood changes, I see new possibilities.	0.33
8. Emotions are one of the things that make my life worth living.	0.44
9. I am aware of my emotions as I experience them	0.48
10. I expect good things to happen	0.56
11. I like to share my emotions with others.	0.38
12. When I experience a positive emotion, I know how to make it last.	0.55
14. I seek out activities that make me happy	0.57
15. I am aware of the non-verbal messages I send to others	0.47
16. I present myself in a way that makes a good impression on others	0.57
17. When I am in a positive mood, solving problems is easy for me	0.49
18. By looking at their facial expressions, I recognize the emotions people are experiencing.	0.39
19. I know why my emotions change.	0.34
20. When I am in a positive mood, I am able to come up with new ideas	0.55
21. I have control over my emotions	0.34
22. I easily recognize my emotions as I experience them	0.50
23. I motivate myself by imagining a good outcome to tasks I take on	0.62
24. I compliment others when they have done something well.	0.49
25. I am aware of the non-verbal messages other people send	0.38
26. When another person tells me about an important event in his or her life, I almost feel as though I experienced this event myself	0.35
27. When I feel a change in emotions, I tend to come up with new ideas.	0.42
30. I help other people feel better when they are down	0.42
31. I use good moods to help myself keep trying in the face of obstacles	0.56
Eigenvalue	6.342
Percentage of variance explained.	28.39

Note: Method of Extraction of the Unweighted Least Squares.

In order to determine if a more parsimonious adjustment could be reached, the model with 6 factors and 33 items created by Lane et al. (2009) was also tested. It presented an unsatisfactory adjustment (Table 2). This also happened with the model with 4 factors and 33 items proposed by Petrides and Furnham (2000). In both models, several items saturated in their respective factors with poor factorial loads (<0.35).

The data of the 19 items proposed by Lane et al. (2009) was also re-analyzed, examining the unidimensional model and the one with 5 factors. It was possible to note that the model with 5 factors proposed by Lane et al. (2009) also presented adjustment levels below cut point (Table 2), while the unifactorial model presented partially acceptable adjustment with the sample of Brazilian athletes, but lower than the unifactorial model with 26 items obtained in the present study (Table 2).

Internal consistency. The unifactorial model with 26 items presented satisfactory values for the evaluation of the internal consistency (composite reliability = .75; Cronbach's alpha = .87). It is worth highlighting that all the other tested models presented similar or lower values for both composite reliability and Cronbach's alpha.

Factorial invariance. The invariance of the Brazilian version of SSEIT, according to gender and age group, was investigated using a multi-group analysis (Table 3), allowing

Table 2

Indexes of adjustment of the models with one, four, five and six factors of the Brazilian version of the SSEIT for the sports context

Model	χ^2	*df*	χ^2 / df	RMSEA (C.I. 95%)	CFI	TLI	AIC	BIC	λij
1 factor (33 items)	1354.65*	487	2.78	0.06 (0.06-0.07)	0.77	0.75	1502.65	1809.16	0.03-0.70
1 factor (30 items)	905.06*	385	2.35	0.05 (0.05-0.06)	0.85	0.83	1065.06	1396.43	0.23-0.70
1 factor (26 items)	592.20*	279	2.12	0.05 (0.04-0.05)	0.91	0.90	736.20	1034.43	0.35-0.70
4 factors (33 items)	1255.33*	478	2.63	0.06 (0.05-0.06)	0.80	0.77	1421.33	1765.12	0.10-0.72
6 factors (33 items)	1296.36*	473	2.74	0.06 (0.06-0.07)	0.77	0.75	1472.36	1836.86	0.10-0.69
1 factor (19 items)	310.16*	137	2.26	0.05 (0.04-0.06)	0.91	0.88	416.16	635.68	0.30-0.58
5 factors (19 items)	385.27*	140	2.75	0.06 (0.05-0.07)	0.85	0.82	485.27	692.37	0.33-0.73

Note. N = 465. Number of items for each analysis indicated in the brackets.

RMSEA = Root mean square error of approximation; CFI = Comparative fit index; TLI = Tucker-Lewis index; AIC = Akaike Information Criteria; BIC = Bayes Information Criterion; λij = Standardized factorial loads. **p* < .001.

confirming if the psychometric properties of the instrument did not vary for both genders and age groups. The factorial loadings were statistically significant ($p < .001$) for both genders and age groups.

Regarding gender, the configurational model indicated acceptable absolute adjustment (RMSEA=0.047; C.I. 95% [0.044 – 0.051]). However, with unsatisfactory incremental adjustment values (CFI=0.860). The model of metric invariance ($\Delta\chi^2$ (25) = 44.940, p = .008) and the model of scale invariance ($\Delta\chi^2$ (26) = 45.088, p = .012) produced significantly poorer adjustments, suggesting that the measure of the unidimensional model with 26 items differs between men and women (for example, the interpretation of the participants of SSEIT differed among items). The AIC and BIC produced lower values for the structural model, indicating more parsimony of the structural model.

Regarding age, the configurational model also indicated acceptable absolute adjustment (RMSEA = 0.047, C.I. 95% [0.042 – 0.052]). However, with unsatisfactory incremental adjustment (CFI=0.810). The model of metric invariance ($\Delta\chi^2$ (25) = 37.08, p = .057) and the model of scale invariance ($\Delta\chi^2$ (26) = 37.47, p = .010) also produced a significantly poorer adjustment, suggesting that the measure of the unidimensional model with 26 items differs between youth and adults. The AIC and BIC produced lower values for the structural model, indicating higher parsimony of the structural model.

Even though the models (gender and age group) produced unacceptable incremental adjustments in the data, it is worth highlighting that there were no significant changes in ΔCFI < 0.01 (Wang et al., 2018). Additional invariance tests (for instance, invariance exclusivity) were not explored, since the objective was to test the invariance at group level (for example, compare the medium latent structures).

Validity evidence based on relationship with external measures. The global score of EI presented a negative statistically significant correlation ($p < .05$) with the dimension of cognitive anxiety (r = -.13), and a positive correlation with self-confidence (r = .33). It is worth highlighting that the correlations indicate an inverse association between EI and cognitive anxiety, and a linear association with self-confidence. The correlation between EI and somatic anxiety was not significant (r = -.02; p = .784). Nevertheless, it is important to highlight that all correlations were weak ($r < .40$).

Discussion

The present study was the first to analyze the psychometric properties of SSEIT (Schutte et al., 1998) in the Brazilian context, with a sample of youth and adult athletes, testing different uni and multidimensional models, following the recommendations and propositions

Table 3

Indexes of adjustment for factorial invariance of the unidimensional model with 26 items of the Brazilian version of SSEIT

	χ^2	*df*	$\Delta\chi^2$	Δdf	P	CFI	ΔCFI
Men vs Women							
Configurational invariance	1181.42	124	-	-	-	0.860	-
Metric invariance	1226.36	99	44.94	25	0.008	0.863	0.003
Scale invariance	1226.51	98	45.09	26	0.012	0.864	0.004
Residual invariance	1301.88	62	120.45	62	0.001	0.859	0.001
Up to 18 years vs 18 years or older							
Configurational invariance	1181.22	580	-	-	-	0.816	-
Metric invariance	1218.30	605	37.08	25	0.001	0.812	0.004
Scale invariance	1218.69	606	37.47	26	0.001	0.812	0.004
Residual invariance	1307.89	641	126.67	61	0.001	0.795	0.021

χ^2 = Chi-Square; df = degrees of freedom; $\Delta\chi^2$ = differences in Chi-Square values; Δdf = differences in degrees of freedom; CFI = Comparative Fit Index; ΔCFI = differences in Comparative Fit Index values.

of Vaughan and Laborde (2017) in a study with athletes and non-athletes. The results evidenced a satisfactory validity of the construct, internal consistency and external validity of SSEIT, suggesting that the evaluation of EI in the Brazilian context, for youth and adult athletes, can be performed using this scale. It is necessary to highlight that the final structure of the model adopted in the present study consisted of one dimension with 26 items, directed to globally measure the construct of EI, converging with the original model of the scale proposed by Schutte et al. (1998), composed of 33 items.

The present study was based on the results obtained in previous studies (García-Coll et al., 2013; Lane et al., 2009; Petrides & Furnham, 2003; Vaughan & Laborde, 2018), which verified several inconsistencies in the factorial structure of SSEIT, such as: poor factorial loads, crossed factorial loads, bad distribution of items among latent factors and unsatisfactory adjustment. Revealing the need of testing different models of the factorial structure of the scale in athletes and non-athletes of different cultures. Among the several structures found for SSEIT in sport, the model with 6 factors and 33 items by Lane et al. (2009), the structure with four factors and 33 items suggested by Petrides and Furnham (2000), the reduced model with 19 items created by Lane et al. (2009), the unifactorial and multifactorial model with 30 items and four dimensions by García-Coll et al. (2013), and the unifactorial structure found in all studies are highlighted.

It is worth pointing out that the factorial structure of SSEIT does not represent a consensus in previous research, with divergences being observed regarding the methodological approaches used in the analysis of the psychometric properties of the scale (Laborde et al., 2016; Mayer, 2002; Vaughan & Laborde, 2018). Even though several studies have pointed to a multidimensional structure (García-Coll et al., 2013; Lane et al., 2009; Petrides & Furnham, 2000; Vaughan & Laborde, 2017), the model proposed by Schutte et al. (1998) postulates EI as a unidimensional construct due to the unique ability of one's knowledge of one's own emotions, and to the interpersonal intelligence of understanding the emotions and intentions of others.

In the present study, it was possible to verify that beyond the dimensionality of the scale, some items caused confusion in the interpretation of the participants, making it difficult to analyze data and find an ideal model to the studied context. Such inconsistencies justify the use of an EFA, followed by a CFA, in order to verify the best factorial structure of the data in a sample of Brazilian athletes.

According to the data analyzed, it was verified that of the 33 items initially included in the model of the EFA, seven items showed inconsistencies (5, 6, 13, 18, 29, 32 and 33) regarding their factorial loads. Among the seven problematic items, three had similar problems to the ones detected by Lane et al. (2009) and García-Coll et al (2013), being: item 5 ("*I find it hard to understand the non-verbal* *messages of other people*"), item 28 ("*When I am faced with a challenge, I give up because I believe I will fail*") and item 33 ("*It is difficult for me to understand why people feel the way they do*"), which have inverted scores. Evidence suggests that items with inverted scores present low performance in models with only one factor (Woods, 2006). Thus, as verified in the present study, Vaughan and Laborde (2018) also noticed inconsistencies in items of low and crossed factorial loads when testing the model with six factors in the items 13 and 28. The authors argued that the latent factors of these items can make both elite and amateur athletes interpret these items differently.

Even though some studies point to the existence of multidimensional models (Laborde et al., 2016; Lane et al., 2009; Vaughan & Laborde, 2017), the EFA revealed that the most adequate model was the unidimensional, after the exclusion of the seven problematic items (5, 6, 13, 28, 29, 32 and 33), since all items saturated with a higher magnitude in a single factor. This result partially agrees with the original version by Schutte et al. (1998), confirming one unidimensional structure, but with only 26 items. Such findings demonstrate that the use of techniques to reduce the number of items in order to condense the number of items, instead of counting the variance of the correlations among the observed values, seems to be a good alternative to create a consensus regarding the model for EI (Jöreskog et al., 1996). Although Jöreskog et al. (1996) justifies that, for the specificity of the sample, using the same pattern of tests and factors would be interesting so that each test could follow the same path, or at least have comparable contexts.

In the confirmatory analysis (CFA), the models tested were the unidimensional with 33 items (Schutte et al., 1998), 30 items (García-Coll et al., 2013) and 26 items (proposed by the present study). In addition to the multidimensional models with 4 factors and 33 items (Petrides & Furnham, 2000), 6 factors with 33 items (Lane et al., 2009), and the unidimensional and multidimensional with 5 factors and 19 items by Lane et al. (2009). Vaughan & Laborde (2017) also performed this procedure in order to verify models with the best adjustment in European athletes and non-athletes. Thus, the present study replicated the analysis with the purpose of testing the most parsimonious model for the sample.

The first model of the present study performed an analysis of the unifactorial structure proposed by Schutte et al. (1998), with 33 items, and indicated an inadequate adjustment of the data. This agrees with the findings of the first stage of Vaughan and Laborde's (2017) study. Afterwards, a unifactorial model with 30 items (without the items with inverted scores) was unsuccessfully tested and presented unsatisfactory adjustment. García-Coll et al. (2013) tested this model among Spanish athletes. The authors also performed an EFA and CFA, finding unsatisfactory results for a unifactorial model with 30 items, which obtained factorial loads below 0.40 in most of the items. In addition, the authors tested a model with 4 factors and 30 items, finding better adjustment. However, problems with poor factorial loads were verified in the model.

The indexes of adjustment of the one-factor model with 26 items (without the seven problematic items) confirmed the validity of the construct of SSEIT for the Brazilian sports context, partially agreeing with the original model with 33 items by Schutte et al. (1998). These findings indicate that Brazilian youth and adult athletes perceive EI as a unique ability of one knowing one's own emotions and having the interpersonal intelligence to understand the emotions and intentions of others (Schutte et al., 1998). However, the previous studies that analyzed the factorial structure of SSEIT in the sports context (García-Coll et al., 2013; Lane et al., 2009; Petrides & Furnham, 2000; Vaughan & Laborde, 2017) did not find a satisfactory adjustment for a unidimensional structure due to lack of evidence regarding the sports context.

The reduced models (19 items) with one and five factors, proposed by Lane et al. (2009) were also tested in the present study. Even though the unifactorial model presented a similar and partially acceptable adjustment to the one obtained by Lane et al. (2009), factorial loads under 0.35 were found. Which, according to Comrey and Lee (1992), represent weak factorial loads and could compromise the structure of the instrument. The model with five factors, on the other hand, presented an unsatisfactory adjustment in all indexes analyzed, in addition to similar problems with the factorial loads. Vaughan and Laborde (2017), when testing the psychometric properties of the unifactorial and five-factor models with 19 items, proposed by Lane et al. (2009), obtained unsatisfactory results regarding adjustment and factorial loads. The evidence presented by the authors demonstrate two main preoccupations. The first is related to the inability of adjustment of the theoretical model proposed by Schutte et al. (1998) and the second regards the inconsistency in the factorial structures among elite, amateur and non-athletes (Lane et al., 2009; Vaughan & Laborde, 2017).

The unifactorial model with 26 items, created in the present study, presented satisfactory values for the evaluation of the internal consistency (composite reliability = .75; Cronbach's alpha = .87). These values are considered adequate for psychometric analysis in the field of Sports Psychology (Devellis, 2012). The study of translation and adaptation of SSEIT for the Portuguese language conducted by Toledo Júnior et al. (2018) with medical school students, obtained adequate internal consistency (Cronbach's alpha = .78), but lower than the one found in the present study. The study performed by García-Coll et al. (2013) also evidenced adequate internal consistency of the scale in Spanish athletes, both for the unifactorial model (Cronbach's alpha = .91) and the model with 4 factors and 30 items (>.70). Vaughan and Laborde (2017) tested the internal consistency of several models of SSEIT, verifying that all multidimensional models presented values below recommended by literature (< .70). The same authors only observed adequate reliability (> .70) in the unidimensional models with 33 and 19 items.

When testing the invariance between gender and age group in the unifactorial model with 26 items, according to the procedures proposed by Muthén and Muthén (2014), it was possible to evaluate the adjustment between a freely estimated model and a subsequent more restricted model after establishing a well-adjusted baseline model. The configurational model indicated better adjustment for the data indicating invariance in the measure. However, all subsequent models of invariance produced an unsatisfactory adjustment to the data. Thus, it is possible to infer that the interpretation of the items of SSEIT differed between gender and between youth and adult athletes. This is an important limitation of SSEIT, and must be explored in future studies, in order to show more consistent evidence that confirms the invariance of SSEIT between gender and age groups. Vaughan and Laborde (2017) analyzed the invariance of the six factors model with 33 items, which obtained the best adjustment in that study, and verified similar results to the ones described in the present study, despite having compared a factorial structure between athletes and non-athletes. As stated by the authors, there are only few studies that evaluate the factorial invariance of SSEIT, which can be a possible argument for the inconsistencies found in literature regarding the differences between groups (for example: athletes *vs* non-athletes, men *vs* women, youth *vs* adults).

The external validity of SSEIT was analyzed through the association with pre-competitive anxiety. Consistent evidence in literature points out that EI has a positive effect over the regulation of emotions in the sports context (Kotsou et al., 2011; Laborde et al., 2011; Laborde et al., 2014). The results of the present study show that the global score of EI presented an inverse association with cognitive anxiety, indicating that the perception, control and management of emotions seem to act as a protective factor against negative thoughts, nervousness and preoccupations in pre-competitive moments (Castro-Sánchez et al., 2018). The positive association between self-confidence and EI, on the other hand, seems to confirm the enhancing role of EI over the conviction of the athlete regarding his/her ability to execute the proposed task. Although our results indicate new evidence about the external validity of the instrument with a correlate measure (competitive anxiety), it is important to highlight that all correlations were weak (r< .40) (Bienneman & Figueiredo, 2017). However, correlations weak its relevant in psychology variables. Laborde et al. (2014) verified that EI acted as a predictor of the levels of stress and pre-competitive anxiety in youth tennis players. Laborde et al. (2011) found that German adult handball athletes with high EI scores experienced a lower increase of stress when compared to athletes with low EI scores. Other recent studies also confirmed the positive association with EI and the regulation of emotions, especially with pre-competitive anxiety in youth and adult athletes (Castro-Sánchez et al., 2018; Lane et al., 2009; Lu et al., 2010).

Even though SSEIT presented acceptable psychometric properties in the sample with Brazilian youth and adult athletes, the present study has some limitations. The first limitation regards the number of participants by sports modality, suggesting that other studies approach the specific context of each sport. However, all athletes in the sample were active competitors at a local, state, national and/or international level and derived from different parts of the country. Future studies should also explore the invariance across individual and team sports athletes. The second point is that the present study used the same sample for EFA and CFA, which is not recommended by some psychometric researchers, although Van Prooijen and van der Kloot (2001) argue that it is possible to test whether the items of an instrument whose structure has more than one factor can be assumed to be one-dimensional, which is the case of the present study.

One more limitation is that we included various ages and sports at the sample and have not previously tested the items' facial validity. Thus, future research should analyze also facial validity among Brazilian athletes and replicate the study in independent samples to establish new psychometric evidence about the instrument. Other studies should also encompass questions regarding the validation with other types of investigations not verified in the present study, such as temporal stability and predictive validity, so that the results can aid in the applicability of the instrument.

In this scenario, the results presented point to acceptable psychometric properties of SSEIT in Brazilian athletes of different age groups, in the evaluation of EI in sport. The psychometric properties of SSEIT, for the Brazilian sports context, agreed with the original version of the instrument, regarding the unifactorial model, and disagreed with other transcultural validation studies, and despite the inconsistencies of the items already mentioned, the findings indicate a satisfactory validity of the construct, internal consistency and external validation of SSEIT. Thus, new studies should be conducted in order to verify the consistency of the structure suggested by these results, and to better detail the problems with the removed items.

The findings of the present study can provide relevant information for professionals involved in sports, researchers and Sports Psychology professionals, guiding them about the attributes of EI and the use of SSEIT to facilitate the interpretation of emotions, and aid athletes in their physical and cognitive development, which are essential attributes in the competitive sports context.

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