Psychometric Properties of the Portuguese Language Version of the Sport Motivation Scale-II among Brazilian Youth Team Sports Participants

Propiedades psicométricas de la versión en portugués de la Escala de Motivación Deportiva II entre jóvenes brasileños participantes de deportes de equipo

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Abstract

This research analyzed the psychometric properties of the Portuguese language version of the Sport Motivation Scale-II (SMS-II) among Brazilian youth team sport participants. Phase 1 included 590 sport participants (M_{age} = 14.92 years; SD = 1.68). Within this study, of the six models tested, only the six-factor and five-factor models (without the introjected regulation subscale) showed acceptable fit indices. Further, the intercorrelations between subscales supported the idea of a simplex-like pattern within the SMS-II. Phase 2 included 173 sport participants (M_{age} = 12.96; SD = 0.91) who completed the SMS-II and Passion Scale. This study provided validity evidence based on the relationship with external measures, showing higher correlations between more self-determined forms of motivation and harmonious passion and between less self-determined forms of motivation and obsessive passion. Across Phases 1 and 2, some issues with the internal reliability of the SMS-II subscales were identified. Overall, our findings indicated the further refinement of the SMS-II.

Keywords
motivation; psychometrics; sport

Resumen

Esta investigación analizó las propiedades psicométricas de la versión en portugués de la Escala de Motivación Deportiva II (SMS-II) entre participantes juveniles brasileños de deportes de equipo. El estudio 1 incluyó a 590 participantes deportivos (M_{edad} = 14.92 años; *DE* = 1.68). Dentro de este estudio, de los seis modelos probados, solo los modelos de seis y cinco factores (sin la subescala de regulación introyectada) mostraron índices de ajuste aceptables. Además, las intercorrelaciones entre las subescalas sustentaron la idea de un simplex similar dentro del SMS-II. El estudio 2 incluyó a 173 participantes deportivos (M_{edad} = 12.96; *DE* = 0.91) que completaron el SMS-II y la Escala de Pasión. Este estudio proporcionó evidencia de validez con base en la relación con medidas externas, mostrando correlaciones más altas entre formas de motivación más autodeterminadas y pasión armoniosa y entre formas de motivación menos autodeterminadas con pasión obsesiva. En los estudios 1 y 2, se identificaron algunos problemas con la confiabilidad interna de las subescalas del SMS-II. En general, se descubrió que el SMS-II requiere un mayor refinamiento.

Palabras clave

motivación; psicometría; deporte

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Introduction

Participation in youth sports is important for young people for several reasons. To begin with, youth sport participation is associated with greater levels of physical activity and maintaining a healthy weight status (Drake et al., 2012). In terms of psychosocial outcomes, a systematic review by Eime et al. (2013) highlighted that taking part in sport is associated with improved self-esteem, increased social interaction, and reduced depressive symptoms in young people. Similarly, a review by Opstoel et al. (2019) illustrated that sports participation is related to the personal and social development of adolescents (e.g., the development of prosocial behaviors and work ethic). Finally, several review articles have demonstrated that sports participation is particularly important for the development of life skills in young people, including teamwork, leadership, problem-solving, time management, and communication (e.g., Holt et al., 2017; Johnston et al., 2013).

The importance of sport for young people means that researchers and practitioners need to understand the motivation behind young people's participation in sport. To examine motivation in sport, Self-Determination Theory (SDT; Ryan & Deci, 2017) has been identified as one of the most used theoretical approaches in sport psychology (Hagger & Chatzisarantis, 2007). Within SDT, Ryan and Deci (2017) highlight that motivation is viewed as a psychological attribute that can be situated along a continuum, ranging from amotivation (a lack of motivation) to extrinsic motivation, and ultimately to intrinsic motivation (Deci & Ryan, 2012; Ryan & Deci, 2017). Specifically, the continuum is composed of six motivation subtypes (amotivation, external regulation, introjected regulation, identified regulation, integrated regulation, and intrinsic motivation). According to Ryan and Deci (2017), amotivation is characterized by the complete lack of motivation. External regulation occurs when an individual's actions are aimed at obtaining external rewards or avoiding punishment. Introjected regulation is behavior controlled by internal pressures, such as guilt or shame avoidance. Identified regulation is the perception that the behavior is personally important to one's life. Integrated regulation is the most comprehensive form of internalization, as it aligns the behavior with the person's own goals, objectives, and needs. Lastly, intrinsic motivation refers to behaviors being performed simply for the pleasure or enjoyment that the behavior provides.

According to Standage (2023), the six motivation subtypes outlined above form a quasi-simplex pattern, with adjacent subtypes having higher positive correlations than subtypes that are further apart. The motivation subtypes can be divided into intrinsic motivation, extrinsic motivation (including integrated regulation, identified regulation, introjected regulation, and external regulation), and amotivation (Ryan & Reeve, 2024). Other researchers (e.g., Pelletier et al. 2019) have split the motivation subtypes into self-determined motivation (intrinsic motivation, integrated regulation, and identified motivation) and non-self-determined motivation (introjected regulation, external regulation, and amotivation). Finally, it has been suggested that the motivation sub-types may be divided into autonomous motivation (intrinsic regulation, integrated regulation, and identified regulation), controlled motivation (introjected regulation and external regulation), and amotivation (Ryan & Reeve, 2024). Importantly, more autonomous forms of motivation are positively associated with positive outcomes in sport including life skills development (Nascimento-Junior et al., 2019), perceptions of flow (Langan et al., 2016), prosocial behavior (Sheehy & Hodge, 2015), sportspersonship (Ntoumanis & Standage, 2009), effort (Monteiro et al., 2018), engagement (Podlog et al., 2015), subjective vitality (Balaguer et al., 2018), persistence and dropout (Jõesaar et al., 2012; Sarrazin et al., 2002).

To evaluate the various components of motivation, several scales have been used over the last few decades (see Clancy et al., 2017, for a review). Specifically, the main motivation measures used in sport psychology are as follows: the Sport Motivation Scale versions one (SMS; Pelletier et al., 1995) and two (SMS-II; Pelletier et al., 2013), the Sport Motivation Scale 6 (SMS-6; Mallett et al., 2007), the Behavioral Regulation in Sport Questionnaire (BRSQ; Lonsdale et al., 2008), the Intrinsic Motivation Inventory (IMI; McAuley et al., 1989), and the Situational Motivational Scale (SIMS; Guay et al., 2000). Of these scales, the SMS versions one and two have been the most widely used to assess the components of motivation outlined by SDT (Ryan & Deci, 2017).

The SMS was originally developed in France (Brière et al., 1995) to measure the various components of motivation outlined by SDT at the time (Deci & Ryan, 2012). The SMS is composed of 28 items and includes seven

subscales of four items which evaluate three forms of intrinsic motivation (to know, to accomplish things, to experience stimulation), three types of extrinsic motivation (external regulation, introjected regulation, and identified regulation), and amotivation (Pelletier et al., 1995). Studies have supported the psychometric properties of the SMS in several countries, including Bulgaria (Chantal et al., 1996), Greece (Doganis, 2000), Portugal (Serpa et al., 2004), Spain (Núñez et al., 2006), and Germany (Burtscher et al., 2011). In Brazil, two studies have shown acceptable psychometric properties for the scale among athletes from several sports and soccer players (Bara Filho et al., 2011; Costa et al., 2011). Finally, a meta-analysis of 21 published studies by Chatzisarantis et al. (2003) also supported the nomological validity of the SMS.

Although the above studies found good psychometric properties for the SMS, researchers raised several questions about the scale's structure. For instance, Mallett et al. (2007) argued that the scale did not represent all SDT constructs and suggested that it should be modified to include integrated regulation and utilize only one subscale, instead of three, for intrinsic motivation. To address these criticisms and increase the performance of the scale, Pelletier et al. (2013) reevaluated and revised the SMS to create the SMS-II. The SMS-II comprises 18 items, a mix of SMS items and newly developed items, a subscale for integrated regulation, and a single subscale that groups the three types of intrinsic motivation. The validity and reliability of the SMS-II have been supported in several countries such as China (Li et al., 2018), Brazil (Nascimento Junior et al., 2014), Sweden (Stenling et al., 2015), France (Pelletier et al., 2019), Mexico (Pineda-Espejel et al., 2016), Spain (Viciana et al., 2014), Hungary (Paic et al., 2017), Portugal (Rodrigues et al., 2021), and Iran (Manouchehri et al., 2015).

Although the above studies have provided evidence for the psychometric properties of SMS-II, studies have highlighted some limitations of the scale. To begin with, studies have pointed to limitations in the items from the identified and integrated regulation subscales and their relationships with controlled motivation (Lonsdale et al., 2014). Specific problems have also been identified with the factor loadings of some items. For instance, Pelletier et al. (2013) found a lower-than-expected factor loading (.47) for one item ("Because I would not feel worthwhile if I did not") on the introjected regulation subscale.

When used with a sample of Brazilian athletes, the Portuguese version of the SMS-II (Nascimento et al., 2014) also had problems with: (a) item 1 ("Because I would feel bad about myself if I did not take the time to do it," FL = .47) and item 7 ("Because I would not feel worthwhile if I did not," FL = .38) of the introjected regulation subscale; and (b) item 15 of the external regulation subscale ("Because people around me reward me when I do," FL = .52). The Chinese version of the SMS-II (Li et al., 2018) also had low FLs for item 2 of the amotivation subscale ("I used to have good reasons for doing sports, but now I am asking myself if I should continue," FL = .46); and item 1 of the introjected regulation subscale ("Because I would feel bad about myself if I did not take the time to do it," FL = .54). Utilizing the scale with Swedish athletes, Stenling et al. (2015) found low factor loadings for item 13 of the amotivation subscale ("It is not clear to me anymore; I don't really think my place is in sport," FL = .18); and item 8 of the external regulation subscale ("Because I think others would disapprove of me if I did not," FL = .44). Finally, the Spanish version of the SMS-II (Viciana et al., 2014) had problems with item 1 of the introjected regulation subscale ("Because I would feel bad about myself if I did not take the time to do it," FL=.40). According to Comrey and Lee's (1992) criteria, the above factor loadings can be categorized as poor (< .45) or fair (< .55). In terms of internal consistency reliability, lower-than-expected Cronbach's alpha coefficients have been identified for some SMS-II subscales. Using a French version of the SMS-II, Pelletier et al. (2019) found a lower-than-expected Cronbach's alpha coefficient (.67) for the identified regulation subscale. Nascimento et al. (2014) found that the introjected regulation subscale had a low Cronbach's alpha coefficient (.61) with Brazilian athletes. Lastly, using a Spanish version of the scale, Viciana et al. (2014) found low Cronbach's alpha values for the following subscales: identified regulation (.69), introjected regulation (.64), external regulation (.54), and amotivation (.64). Nunnally and Bernstein (1994) have suggested that alpha coefficients above .70 are deemed adequate for the psychological domain. In terms of validity, some studies have highlighted discriminant (i.e., higher-than-expected inter-factor correlations) and factorial validity problems (i.e., poor model fit) with the scale (e.g., Li et al., 2018; Stenling et al., 2015; Viciana et al., 2014). Given both the positive and negative findings for the psychometric properties of the SMS-II, an ongoing assessment of its psychometric properties is warranted. This is particularly the case as DeVellis (2011) has highlighted that the validity and reliability of a measure should be considered an ongoing process, with scale refinement sometimes necessary.

Despite the limitations identified in some studies, the SMS-II remains one of the most comprehensive and widely used instruments grounded in Self-Determination Theory for assessing motivation in sport settings. Its inclusion of the integrated regulation subscale and the consolidation of intrinsic motivation into a single factor reflects recent theoretical developments, offering a more parsimonious structure that aligns with current SDT conceptualizations (Ryan & Deci, 2017). Additionally, the availability of a Portuguese version of the SMS-II, which has demonstrated acceptable internal consistency in Brazilian samples (Nascimento Junior et al., 2014), supports its use in the present study. Compared to alternative instruments, such as the BRSQ or SMS-6, the SMS-II offers broader international validation, more frequent use in the literature, and greater comparability across studies. Furthermore, the choice of SMS-II was informed by the need for a theoretically grounded, parsimonious, and culturally adapted instrument capable of capturing multiple motivational regulations in line with the study's objectives.

Although there is no youth version of the SMS-II, the scale has been used and has adequate internal consistency reliability among youth sport participants (Pelletier et al., 2013; Rottensteiner et al., 2015). Rottensteiner et al. (2015) observed motivation in youth players using the original version of the SMS, which is a completely different instrument from the SMS-II. Pelletier et al. (2013) use a version of the SMS-II; however, this research utilizes a sample of young athletes with extensive sports experience. Given the importance of motivation for youth sport participants (Bruner et al., 2014; Viciana et al., 2014), it is vital that a valid and reliable scale is available to assess the different subtypes of motivation in this domain. Specifically, the scale for youth athletes will help researchers and practitioners to study the phenomenon of motivation among youth sport participants worldwide.

Thus, this research aimed to analyze the psychometric properties of the Portuguese language version of the SMS-II (Nascimento Junior et al., 2014) in a sample of Brazilian youth sports participants, conducted in two phases. The first phase aimed to verify validity evidence based on the internal structure of the instrument. The second phase assessed validity evidence based on the relationship with external measures by assessing whether the SMS-II subscales were associated with a measure of sports passion.

Phase 1: Validity Evidence Based on Internal Structure and Internal Reliability

The purpose of Phase 1 was to assess validity evidence based on internal structure for the Portuguese language version of the SMS-II. Specifically, we adopted a model-testing approach (i.e., several plausible models were tested) to assess the internal structure of the SMS-II using a large sample of Brazilian youth team sport participants. During this study, we also assessed the inter-relationships between the six subscales of the SMS-II and the internal consistency reliability of each subscale.

Methods

Study Design

This study is classified as instrumental research, a category that encompasses investigations aimed at analyzing the psychometric properties of psychological assessment instruments, whether newly developed or existing (Ato et al., 2013).

Participants

A total of 616 youth sport participants from all regions of Brazil were included in the study. Our inclusion criteria for the study required that youth sport participants had to have taken part in sports competitions for at least one year and belong to one of the teams participating in the sports tournament where the data were collected. However, 26 participants were excluded from the final sample because they did not answer the questionnaire adequately (i.e., they failed to respond to numerous items or subscales). The sample size was determined based on recommendations for conducting confirmatory factor analysis and other multivariate statistical techniques, which suggest a minimum of five to ten par-

ticipants per estimated parameter or item (Hair et al., 2019). Considering the number of items and constructs included in the instruments used in this study, the final sample of 590 participants exceeds the recommended thresholds for robust statistical analyses. Moreover, previous validation studies using the same instruments and similar populations have employed comparable or smaller sample sizes (e.g., Monteiro et al., 2018; Nascimento Junior et al., 2014), supporting the adequacy of the current sample for the intended analyses.

Youth sport participants were recreational athletes who participated in sports as part of their leisure-time activities. The participants, aged 11–18 years, were included in the final sample (M_{age}=14.92 years, SD=1.68), comprising both male (n = 360) and female participants (n = 230). The participants reported that they practiced their sport for an average of 42.04 months (SD = 40.87) and took part in the following sports: basketball (n = 40), handball (n = 140), indoor football (n = 234), football (n = 41), and volleyball (n = 135). Only the participants who had the consent form signed by the coaches (responsible for the participants in the sports event) were included in the study.

Measure

Sports motivation. The SMS-II (Pelletier et al., 2013), adapted by Nascimento Junior et al. (2014) for the Portuguese language, was used to assess participants' sports motivation. This scale asks participants to report the extent to which the listed reasons for practicing their sport correspond with their own personal reasons. This 18-item questionnaire has six subscales that correspond to the six motivation subtypes: amotivation (e.g., "I used to have good reasons for doing sports but now I am asking myself if I should continue"), external regulation (e.g., "Because people around me reward me when I do"), introjected regulation (e.g., "Because I would not feel worthwhile if I did not"), identified regulation (e.g., "Because I have chosen this sport as a way to develop myself"), integrated regulation (e.g., "Because practicing sport reflects the essence of who I am"), and intrinsic motivation (e.g., "Because it gives me pleasure to learn more about my sport"). All items are assessed on a 7-point Likert scale ranging from 1 (*does not correspond at all*) to 7 (*corresponds exactly*).

The adaptation of the Portuguese version of the SMS-II to the Brazilian sports context conducted by Nascimento Junior et al. (2014) followed a rigorous translation and validation process. A double back-translation was conducted by four independent translators, and semantic adjustments were made after comparing the back-translated versions with the original. Three experts in sport psychology evaluated item clarity and theoretical relevance, and content validity was assessed using the Content Validity Coefficient (CVC). The final Portuguese version was pilot tested with 20 youth athletes (ten males and ten females) from various sports to ensure linguistic and developmental appropriateness for the target population.

Ethical Aspects

Prior to the data collection, approval was received from the host university's research ethics and integrity office (Protocol No. 3.576.805). Additionally, each participant provided informed consent before completing the survey.

Procedures

Data collection was conducted at the youth sport participants' tournament accommodations and training venues in Brazil. The questionnaires were administered collectively by the researchers in a private room, in the absence of the two trainers.

Data Analysis

To assess the internal structure of scores obtained from the SMS-II, confirmatory factor analysis (CFA) employing maximum likelihood estimation was conducted using Amos Version 25 (IBM Corporation, 2017). Based on the SDT literature (Deci & Ryan, 2012; Ryan & Deci, 2017), the following models were tested: a six-factor model representing each of the six motivation subtypes; a three-factor model including autonomous motivation (i.e., intrinsic motivation, integrated regulation, and identified regulation combined), controlled motivation (i.e., introjected regulation and external regulation combined), and amotivation; a three-factor model including intrinsic motivation, external motivation (i.e., integrated regulation, introjected regulation, and external regulation combined), and amotivation; and a two-factor model representing self-determined motivation (i.e., intrinsic motivation, integrated regulation, and identified regulation combined) and non-self-determined motivation (i.e., introjected regulation, external regulation, and amotivation combined).

Firstly, we assessed outliers using the Mahalanobis squared distance (D2), as the absence of such cases is a prerequisite for CFA. We verified the normality of univariate data using skewness (Sk) and kurtosis (Ku),

while assessing multivariate distributions with the Mardia coefficient for multivariate kurtosis. As our data (items) did not meet normality assumptions (ISKI > 3.0 and IKuI > 10), we performed a Bollen and Stine (1992) bootstrap procedure to obtain a corrected chi-squared value for the estimated coefficients of the maximum likelihood estimator.

The following fit indices were used to assess model fit: chi-square statistic divided by degrees of freedom (χ^2/df), Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Tucker Lewis Index (TLI), and the Standardized Root Mean Square Residual (SRMR). To begin with, a χ^2/df of less than 3.0 was indicative of adequate fit (Tabachnick & Fidell, 2013). In line with Marsh et al.'s (2004) recommendations, an RMSEA value of less than .08 or .05 represented a reasonable or close fit to the data, respectively, whereas CFI and TLI values greater than .90 or .95 indicated an acceptable or excellent fit, respectively. An SRMR value of .08 or below indicated satisfactory fit (Hu & Bentler, 1999). The adequacy of factor loadings was judged according to Comrey and Lee's (1992) criteria: FLs > .71 were considered excellent, .63 very good, .55 good, .45 fair, and .32 poor.

Finally, to assess the internal consistency reliability of the SMS-II subscales, Cronbach's alpha (α) and Composite Reliability (*CR*) were calculated. Values higher than .70 were considered indicators of suitable internal consistency reliability (Nunnally & Bernstein, 1994).

Results

Internal Structure

Table 1 contains the fit indices for the models tested when assessing the factor structure of the SMS-II. Table 2 presents the factor loadings for the models tested. We can see that the six-factor model (Table 1, Model A) displayed a reasonable fit on 3/5 of the fit indices (i.e., *RMSEA*, *CFI*, and *SRMR*). In contrast, the χ^2/df and TLI displayed a less than adequate fit. The factor loadings for the items were 'good' to 'excellent' according to Comrey and Lee's (1992) criteria, with the exception of one introjected regulation item ("Because I feel better about myself when I do"), which had a 'poor' factor loading of .35 (see Table 2). After removing this one item, we retested the model but found no discernible improvement in model fit (see Model B in Table 1). We can see that the three-factor model, including autonomous motivation, controlled motivation, and amotivation, provided a poor fit (see Table 1, Model C). Four items in this model also had 'poor' factor loadings (see Table 2). From Table 1, we can also see that the model including intrinsic motivation, external motivation, and amotivation (Model D) displayed a poor fit. Again, four items in this model displayed 'poor' factor loadings (see Table 2). The two-factor model, including self-determined motivation and non-self-determined motivation, also displayed a poor fit (See Table 1, Model E). Seven items in this model had 'poor' factor loadings (see Table 2). Based on past research studies (e.g., Viciana et al., 2014), we also tested a five-factor model, which excluded the introjected regulation subscale (Model F). With this model, 3/5 fit indices (i.e., RMSEA, CFI, and SRMR) provided an adequate fit; whereas, the χ^2/df and TLI values displayed a less than adequate fit. The factor loadings for this model were 'good' to 'excellent' according to Comrey and Lee's criteria.

Table 1. Indices of Model Fit for the Models Tested

Model	$\chi^2(df)$	χ^2/df	RMSEA (CI 95%)	CFI	TLI	SRMR	FL Range
A. 6-factor	493.92*** (120)	4.12	.07 (.05–.08)	.91	.88	.07	(.35–.75)
B. 6-factor (minus introjected regulation item 2 with poor factor loading)	437.99*** (104)	4.21	.07 (.05–.08)	.91	.89	.07	(.56–.75)
C. 3-factor (autonomous motivation, controlled motivation, & amotivation)	1089.52*** (132)	8.25	.11 (.10–.12)	.76	.72	.11	(.16–.71)

Model	$\chi^2(df)$	χ^2/df	RMSEA (CI 95%)	CFI	TLI	SRMR	FL Range
D. 3-factor (intrinsic motivation, external motivation, & amotivation)	1094.54*** (132)	8.29	.11 (.10–.12)	.75	.72	.12	(.06–.72)
E. 2-factor (self-determined motivation & non-self-determined motivation)	1373.40*** (134)	10.25	.13 (.11–.14)	.68	.64	.13	(-.15–.73)
F. 5-factor CFA (did not include the introjected regulation subscale)	339.47*** (80)	4.24	.07 (.06–.08)	.92	.89	.06	(.58–.75)

Note. *N* = 590. RMSEA = root mean square error of approximation; CFI = comparative fit index; TLI = Tucker-Lewis index; SRMR = standardized root mean square residual.
***$p < .001$.

Table 2. Standardized Factor Loadings for the Models Tested

Item	Model A	Model B	Model C	Model D	Model E	Model F
Intrinsic motivation 1	.56	.56	.61	.58	.61	.58
Intrinsic motivation 2	.59	.58	.64	.60	.64	.60
Intrinsic motivation 3	.70	.70	.70	.68	.70	.69
Integrated regulation 1	.67	.67	.67	.66	.60	.68
Integrated regulation 2	.72	.73	.71	.71	.35	.72
Integrated regulation 3	.64	.64	.63	.62	.73	.63
Identified regulation 1	.65	.65	.67	.67	.66	.66
Identified regulation 2	.69	.68	.71	.70	.71	.69
Identified regulation 3	.66	.66	.68	.68	.63	.65
Introjected regulation 1	.59	.59	.60	.61	.67	–
Introjected regulation 2	.35	–	.38	.36	.71	–
Introjected regulation 3	.71	.71	.70	.75	.68	–
External regulation 1	.73	.73	.23	.15	.12	.74
External regulation 2	.75	.75	.16	.06	.03	.75
External regulation 3	.58	.58	.36	.31	.28	.58
Amotivation 1	.61	.61	.54	.52	-.04	.61
Amotivation 2	.60	.60	.66	.66	-.04	.60
Amotivation 3	.68	.68	.71	.72	-.15	.68

Note. *N* = 590.

Internal Consistency, Reliability, and Correlation between subscales

Table 3 contains *α/CR* coefficients for the SMS-II subscales. The internal reliability coefficients for each of the three-item subscales were as follows: intrinsic motivation (*α* = .66; *CR* = .65), integrated regulation (*α* = .71; *CR* = .72), identified regulation (*α* = .70; *CR* = .71), introjected regulation (*α* =.55; *CR* = .58), external regulation (*α* = .72; *CR* = .73), and amotivation (*α* = .66; *CR* = .67). Three of the six subscales did not meet Nunnally and Bernstein's (1994) criteria of .70 or above to indicate adequate internal consistency reliability.

Table 3. Mean Scores, Standard Deviations, Reliability Coefficients, and Intercorrelations for the SMS-II subscales

	1	2	3	4	5	6
1. Intrinsic motivation	–					
2. Integrated regulation	.70***	–				
3. Identified regulation	.75***	.73***	–			
4. Introjected regulation	.66***	.66***	.64***	–		
5. External regulation	.11**	.19***	.17***	.27***	–	
6. Amotivation	-.13**	-.05	-.08*	.03	.55***	–
Mean score	5.64	5.31	5.57	4.96	3.50	3.02
Standard deviation	1.29	1.42	1.34	1.43	1.76	1.71
Alpha values	.66	.71	.70	.55	.72	.66
Composite reliability	.65	.72	.71	.58	.73	.67

Note. *N* = 590.

Table 3 also presents the intercorrelations between the six subscales of the SMS-II, allowing us to assess whether a simplex-like pattern exists within the scale. The majority of results demonstrated that the correlations were stronger for subscales situated closer to one another on the continuum, as compared to subscales that were further apart. However, a few discrepancies in the simplex-like pattern were noted. The correlation between intrinsic motivation and identified regulation was higher than between intrinsic motivation and integrated regulation. Additionally, external regulation had a higher correlation with integrated regulation as compared to identified regulation.

Phase 2: Validity Evidence Based on the Relationship with External Measures

The purpose of this phase was to assess validity evidence based on the relationship with external measures by testing whether the six SMS-II subscale scores correlated with theoretically relevant outcomes. According to SDT (Ryan & Deci, 2017), intrinsic motivation (i.e., the most self-determined form of motivation) has been found to be positively related to adaptive outcomes in several domains, including sport (Nascimento Junior et al., 2017). Another outcome that the SMS-II subscales ought to be related to is participants' passion for their sport. The concept of passion refers to a person's inclination to carry out an activity that they like, deem important, and are willing to invest a considerable amount of time and energy in (Vallerand et al., 2003). Considering the Dualistic Model of Passion (DMP), Vallerand et al. (2003) proposed the existence of two types of passion:

harmonious and obsessive passion. In line with this proposition, past research by Curran et al. (2011) verified the positive associations between harmonious passion and self-determined motivation in young soccer players; whereas, there was no significant association between obsessive passion and self-determined motivation. Similarly, Amemiya and Sakairi (2019) found positive associations between both harmonious and obsessive passion and intrinsic motivation in Japanese athletes. Other studies have shown that self-determined motivation is positively associated with both harmonious and obsessive passion among youth sport participants (Curran et al., 2011; Peixoto et al., 2019; Vallerand & Miquelon, 2007). Based on the tenets of SDT (Ryan & Deci, 2017) and the aforementioned studies, we hypothesized that all types of motivation (i.e., intrinsic motivation, integrated regulation, identified regulation, introjected regulation, external regulation, and amotivation) would be positively related to the two types of passion. Specifically, we hypothesized that more self-determined forms of motivation would have larger correlations with harmonious passion than less self-determined forms of motivation. We also hypothesized that less self-determined forms of motivation would have larger relationships with obsessive passion, compared to more self-determined forms of motivation.

Methods

Participants

The sample consisted of 173 youth sport participants (male, $n = 128$; female, $n = 45$) between 11 and 17 years of age ($M_{age} = 12.96$; $SD = 0.91$). The participants were selected in a non-probabilistic way and for convenience, and the selection criteria were as follows: 1) having practiced the sport for more than one year; and 2) having participated in some regional/state-level competition during the 2017/2018 seasons. Participants represented the following sports: handball ($n = 80$), volleyball ($n = 2$), indoor football ($n = 30$), basketball ($n = 20$), and football ($n = 41$).

Measures

To assess participants' motivation, the 18-item SMS-II described in Phase 1 was used. With the current sample, the SMS-II subscales displayed Cronbach's alpha coefficients ranging from .66 to .81 (see Table 4). Two of the alpha coefficients were marginally below the .70 criteria, whereas the other alpha coefficients supported the internal consistency reliability of the subscales (Nunnally & Bernstein, 1994).

The Passion Scale (Vallerand et al., 2003) is an instrument developed for assessing the different dimensions of passion: harmonious passion ("This activity is in harmony with the other activities in my life") and obsessive passion ("I have difficulties controlling my urge to do my activity"). Participants were asked to think of their favorite sport and indicate their level of agreement with each item on a scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Studies on the adaptation of the instrument to Portuguese and an evaluation of its psychometric properties have supported the validity and reliability of the scale (Peixoto et al., 2019). In the present study, Cronbach's alpha coefficients supported the internal consistency reliability of the subscales: harmonious passion (.79) and obsessive passion (.81).

Ethical Aspects

Only the participants who had the consent form signed by the coaches (responsible for the participants in the sports event) were included in the study.

Data Analysis

Data normality was assessed using the Kolmogorov-Smirnov test. Bootstrapping procedures (1,000 resamplings; 95% CI BCa) were performed to enhance the reliability of the results, correct deviations from normality in the sample distribution and differences in group sizes, and also to present a 95% confidence interval for the differences between the means (Haukoos & Lewis, 2005). Pearson's product-moment correlation coefficients were used to assess the relationships between participants' perceptions of the various motivation subtypes and the two aspects of passion. A p-value of less than .05 was required to indicate a statistically significant relationship between variables. Correlations were judged as small ($r = \pm .10$ to $\pm .29$), medium ($r = \pm .30$ to $\pm .49$), or large ($r > \pm .50$) based on Cohen's (1988) criteria.

Results

From Table 4, we can see that the six components of motivation displayed significant and positive correlations with the passion subscales. These significant positive correlations ranged in size from .15 to .38. We must also highlight that more self-determined forms of motivation (intrinsic motivation, integrated regulation, and identified regulation) showed higher correlations with harmonious passion, whereas less self-determined forms of motivation (amotivation and external regulation) showed higher correlations with obsessive passion. Further, it is important to highlight the positive correlation between introjected regulation (controlled motivation) and both harmonious and obsessive passion. Furthermore, external regulation did not show a significant association with harmonious passion, while intrinsic motivation did not show a significant association with obsessive passion. All of the significant positive correlations were small in size, apart from the medium-sized positive correlations between obsessive passion and amotivation ($r = .36$) and external regulation ($r = .38$). Overall, the above findings supported our hypotheses in relation to the two forms of passion in sport.

Table 4. Correlation Between the Components of Motivation and Sports Passion

	Components of motivation						Passion	
	1	2	3	4	5	6	7	8
1. Amotivation	(.70)	.69***	.32**	.26**	.30**	.18*	.18*	.36**
2. External regulation		(.75)	.53**	.41**	.49**	.37**	.12	.38**
3. Introjected regulation			(.68)	.62**	.73***	.68***	.26**	.22**
4. Identified regulation				(.66)	.67***	.72***	.24**	.19*
5. Integrated regulation					(.71)	.66***	.16*	.15*
6. Intrinsic motivation						(.77)	.19*	.12
7. Harmonious passion							(.79)	.65***
8. Obsessive passion								(.81)

Note. $N = 173$. Correlations were Pearson's product-moment correlation coefficients. Alpha coefficients for each subscale are contained within the parentheses.
*$p < .05$, **$p < .01$, *** $p < .001$

General Discussion

The overall purpose of the present study was to revisit the psychometric properties of the Portuguese language version of the SMS-II (Nascimento Junior et al., 2014) with a sample of Brazilian youth sport participants. It is important to consider developmental differences when adapting motivation measures for youth sport contexts. Compared to adult athletes, youth athletes are still undergoing physical, cognitive, and emotional maturation, which can influence how they interpret and respond to motivational constructs. For example, younger athletes may rely more on external forms of regulation due to their dependence on coaches, parents, and social approval, whereas adults tend to exhibit more autonomous forms of motivation. These developmental distinctions may impact the factorial structure and psychometric properties of instruments like the SMS-II. Previous research in other cultural contexts (e.g., Chinese, Spanish, and Canadian samples) has shown variation in factor loadings and model fit when the scale is applied to youth populations, suggesting

that age and experience should be carefully considered during validation procedures. Therefore, psychometric evaluations for youth samples are crucial to ensure the theoretical and developmental alignment of the instrument.

The primary objective of Phase 1 was to assess the validity evidence of the scale based on its internal structure. Overall, none of the six models we tested provided an acceptable fit according to the criteria for fit we adopted (Hu & Bentler, 1999; Marsh et al., 2004; Tabachnick & Fidell, 2013). To begin with, the six-factor model we tested (see Model A in Table 1) did not support the six-factor structure of the scale. This result contrasts with past research findings (e.g., Li et al., 2018; Paic et al., 2017; Pelletier et al., 2013, 2019; Viciana et al., 2014), which have supported the six-factor structure of the scale among athletes from Chinese, English, French, Hungarian, and Spanish backgrounds. Similar to our study, a study with Swedish athletes did not support the six-factor structure of the scale using confirmatory factor analysis. In terms of factor loadings, item 2 of the introjected regulation scale ("Because I feel better about myself when I train") had a 'poor' factor loading (.35) in the current study. A low factor loading for this item was also found by Pineda-Espejel et al. (2016) in their SMS-II validation study with Mexican athletes. After removing this item, these researchers were able to provide support for a six-factor model of the SMS-II (Pineda-Espejel et al., 2016). However, after removing the same low-factor-loading item, we did not find any considerable improvement in model fit (see Model B in Table 1).

One possible explanation for the persistent psychometric problems related to the introjected regulation subscale is the conceptual and developmental complexity of this motivational type for youth athletes. Introjected regulation, by definition, involves partially internalized motives that are driven by internal pressures, such as guilt or shame (Deci & Ryan, 2012). These nuances may be difficult for younger athletes to fully grasp. Additionally, the language used in the items may be too abstract or emotionally subtle for youth participants, reducing item clarity and discriminability. As a result, youth may respond inconsistently to such items, which would weaken the subscale's reliability and internal structure. These findings suggest the need for age-appropriate item wording and possibly the development of new items that better capture the essence of introjected regulation in youth sport settings.

Secondly, we tested two different three-factor models (see Models C and D in Table 1). The first of these models included autonomous motivation (intrinsic regulation, integrated regulation, and identified regulation), controlled motivation (introjected regulation and external regulation), and amotivation (Deci & Ryan, 2012). The second model included intrinsic motivation, extrinsic motivation (integrated regulation, identified regulation, introjected regulation, and external regulation), and amotivation (Deci & Ryan, 2012). However, these three-factor models displayed a poor fit. Additionally, item two of the introjected regulation subscale ("Because I feel better about myself when I train") and all three items from the external regulation subscale had 'poor' factor loadings. Similar three-factor models were tested with the Mexican (Pineda-Espejel et al., 2016) and Spanish (Viciana et al., 2014) versions of the SMS-II. Pineda-Espejel et al. (2016) observed that the model fit indices supported the validity of a three-factor model with Mexican athletes. In contrast, Viciana et al. (2014) corroborated our findings by demonstrating that a three-factor model, including autonomous motivation, controlled motivation, and amotivation, displayed poor model fit.

Thirdly, we tested a two-factor model (Pelletier et al., 2019) that was comprised of self-determined motivation (intrinsic motivation, integrated regulation, and identified motivation) and non-self-determined motivation (introjected regulation, external regulation, and amotivation). However, this model displayed very poor fit (see Model E in Table 1). Furthermore, seven items displayed 'poor' factor loadings in this model: item 2 of the integrated regulation subscale ("Because participating in sport is an integral part of my life"), the three external regulation items, and all three amotivation items. Similar to the current study, Viciana et al. (2014) also failed to provide support for a two-factor model with Spanish athletes.

Based on past research by Viciana et al. (2014), we also tested a five-factor model, which excluded the introjected regulation items (see Model F in Table 1). Although the factor loadings of items in this model were satisfactory, the model fit indices did not support the model. This finding contrasts with Viciana et al.'s (2014) support for a five-factor model among Spanish athletes. In terms of testing the SMS-II without the introjected regulation items, it is important to note that the present study and past studies have identified several problems with items in the introjected regulation subscale (e.g.,

Nascimento Junior et al., 2014; Pelletier et al., 2013; Stenling et al., 2015; Viciana et al., 2014).

Another aim of Phase 1 was to assess the intercorrelations between the six subscales of the SMS-II for a simplex-like pattern within the scale. The majority of results supported the idea of a simplex-like pattern within the scale (see Table 3). However, two discrepancies were noted in the simplex-like pattern. The correlation between intrinsic motivation and identified regulation was higher than between intrinsic motivation and integrated regulation, and external regulation had a higher correlation with integrated regulation as compared to identified regulation. This finding contrasted with other studies whose intercorrelations between the subscales provided clear support for the simplex-like pattern (e.g., Pelletier et al., 2019; Stenling et al., 2015). However, like the present study, numerous studies have found slight discrepancies in the simplex-like pattern of the SMS-II (e.g., Li et al., 2018; Nascimento Junior et al., 2014; Pelletier et al., 2013; Viciana et al., 2014).

Phase 2 investigated evidence for the validity evidence based on the relationship with external measures by assessing whether the SMS-II subscales were associated with a measure of sports passion. Overall, these results supported our hypotheses that all forms of motivation would show positive associations with the two types of passion. Our findings also demonstrated that more self-determined forms of motivation (intrinsic motivation, integrated regulation, and identified regulation) showed higher correlations with harmonious passion, while less self-determined forms of motivation (amotivation and external regulation) showed higher correlations with obsessive passion (see Table 4). Such findings supported Curran et al.'s (2011) study, which found that self-determined motivation and harmonious passion are positively associated. However, other studies have shown that self-determined motivation is positively associated with both harmonious and obsessive passion in youth sport participants (Peixoto et al., 2019; Vallerand & Miquelon, 2007). For this reason, the results of this study could imply that passion is a psychological factor related to athletes' motivation, regardless of the type of passion involved (Amemiya & Sakairi, 2019; Ruffault et al., 2016). Amemiya and Sakairi (2019) showed that university athletes with high levels of harmonious or obsessive passion reported high rates of intrinsic motivation toward sport activities. Specifically, the results of this study could imply that harmonious passion leads to more spontaneous engagement in competition and has stronger relationships with self-determined forms of motivation, while obsessive passion can also be caused by external influences, such as pressure and expectations from others that can also be related to less self-determined forms of motivation (Donahue et al., 2009; Ruffault et al., 2016).

Although introjected regulation is traditionally characterized as a form of controlled motivation—driven by internal pressures such as guilt, shame, or the desire for approval—the results of the present study indicate its association with both obsessive passion and harmonious passion. This apparent duality can be understood through two main perspectives. First, in the case of obsessive passion, the association with introjected regulation is expected and well documented in the literature (Vallerand et al., 2003). Individuals with obsessive passion tend to internalize their engagement in sport in a controlling manner, feeling compelled to participate to avoid negative emotions, which is consistent with the nature of introjected regulation.

However, the association between introjected regulation and harmonious passion may reflect an intermediate stage in the internalization process, as proposed by SDT (Deci & Ryan, 2012). While harmonious passion is typically associated with more autonomous forms of motivation (e.g., identified or integrated regulation), it is possible that some athletes experience a sense of internal obligation or personal responsibility that motivates their continued engagement in sport. In such cases, introjected regulation may not necessarily be dysfunctional, but rather part of a more complex motivational profile that blends both autonomous and controlled elements.

Furthermore, the sport context may facilitate the coexistence of different motivational regulations. The pursuit of performance, recognition, or personal growth may generate internal pressures compatible with introjected regulation, without undermining the balance and positive experience associated with harmonious passion. These findings suggest that, although introjected regulation is considered a less self-determined form of motivation, it may coexist with adaptive experiences in sport depending on how it is subjectively interpreted and integrated by the individual.

A secondary aim of both Phases 1 and 2 was to assess the internal consistency and reliability of the SMS-II subscales. Phase 1 found lower than expected Cronbach's alpha coefficients for the intrinsic motivation, introjected

motivation, and amotivation subscales; whereas Phase 2 found lower than expected alpha coefficients for the introjected and identified regulation subscales. These values were below those recommended by Nunnally and Bernstein (1994) to demonstrate adequate internal consistency reliability (i.e., >.70). Other researchers have also identified problems with the internal consistency reliability of the SMS-II subscales. To begin with, Pelletier et al. (2019) found that the identified regulation subscale had a reliability coefficient lower than the .70 criteria (Nunnally & Bernstein, 1994). With Spanish athletes, Viciana et al. (2014) found lower-than-acceptable reliability coefficients for the external and introjected regulation subscales. Similarly, Pineda-Espejel et al. (2016) found a lower-than-acceptable reliability coefficient for the introjected regulation subscale. Finally, Manouchehri et al. (2015) found lower-than-acceptable reliability coefficients for the identified regulation and amotivation subscales among Iranian athletes.

Overall, after conducting these two studies, it is evident that the SMS-II requires refinement for use with Portuguese-speaking youth sports participants. Of the models we tested, the six-factor model provided the best fit indices. However, as two of the fit indices for this model did not reach the criteria for adequate fit, we adopted this model for refinement. As highlighted earlier, within the six-factor model, one of the introjected regulation items had a poor factor loading. A probable explanation for the problems with this item/subscale is that two items ("Because I would feel bad about myself if I did not take the time to do it" and "Because I would not feel worthwhile if I did not") are negatively worded, whereas the other item is positively worded ("Because I feel better about myself when I do"). In this regard, Roszkowki and Soven (2010) have suggested that negatively worded items perform poorly with athletic samples.

Furthermore, Eys et al. (2007) suggest that a mixture of positively and negatively worded items can undermine the psychometric properties of scales used with youth sport participants. As such, future studies should aim to rectify this issue by developing and utilizing either positively or negatively worded items, rather than combining both types of items. In terms of the lower-than-expected Cronbach's alpha coefficients for some subscales across Phases 1 and 2, a solution to this problem could be to create and test extra items in each subscale. This might rectify the problem, as it is known that more items help improve the internal consistency reliability of a subscale. For example, several researchers have recommended that at least four items are needed to describe a construct and ensure adequate internal consistency (Jackson & Marsh, 1996; Watson & Clark, 1997). When developing and testing new items (as well as old ones), it would be worthwhile to assess the reading level of these items using the Flesch-Kincaid readability assessment. This would ensure that the items are at the appropriate reading level for the target population and are comprehended correctly by youth sport participants. Additionally, this approach should help ensure an improvement in the psychometric properties of the scale with youth sport participants. In summary, the refinements to the scale recommended above are necessary as part of the ongoing process of enhancing the validity and reliability of the scale among Portuguese-speaking youth sport participants. In this regard, DeVellis (2011) suggested that validity and reliability should be viewed as ongoing processes, with scale refinement being an integral part of them.

Limitations and Future Research

The two studies in this research have some limitations that should be taken into consideration. To begin with, only five team sports were included in the research, and some of these sports featured a small number of participants (e.g., football and basketball). Therefore, future investigations should increase the number of sports (including individual sports) when assessing the SMS-II with youth sport participants. Secondly, it is worth noting that the number of females was smaller in both studies, highlighting the need for future studies to achieve a better balance between the sexes when evaluating the psychometric properties of the scale. A third limitation was that we only assessed the structural and external aspects of construct validity, along with internal consistency reliability, in the present research. Therefore, future studies should seek to assess additional aspects of the validity evidence.

Conclusion

In summary, the present research was the first attempt to test and assess the psychometric properties of the SMS-II with Portuguese-speaking youth sport participants. Despite some positive findings, we must conclude that the scale requires further refinement to improve its validity and reliability with this population. As such, future studies should seek to further refine the SMS-II for use with Portuguese-speaking youth sport participants. This refinement process should help ensure that the validity and reliability of the scale are clearly evidenced for this population.

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