



Passion Scale: Psychometric Properties and Factorial Invariance via Exploratory Structural Equation Modeling (ESEM)¹

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Abstract: Passion is an important element among the psychological processes involved in the performance of any activity, including sports practice. Given the scarcity of nationally valid and reliable instruments, this study has the purpose of presenting the adaptation processes of the Passion Scale to the Brazilian context. A total of 789 Brazilian athletes (age: 16.62±3.20; 58.4% men) participated in the study. To evaluate their psychometric properties, the scale dimensionality was estimated through the Hull method and Exploratory Structural Equation Modeling, and the accuracy by composite reliability. The factorial invariance model was estimated between men and women, and between participants of different competitive levels. Results showed the two-factor structure of the scale, according to the theoretical hypothesis, with desirable accuracy indicators. Equivalence of the measurement model was demonstrated when evaluating participants of different sexes and different competitive levels. Results suggest adequacy of the Brazilian version for the evaluation of this construct.

Keywords: passion, sport psychology, athletes, scales, positive psychology

Escala de Paixão: Propriedades Psicométricas e Invariância Fatorial via Exploratory Structural Equation Modeling (ESEM)

Resumo: A paixão é um importante elemento dentre os processos psicológicos envolvidos na realização de qualquer atividade, inclusive na prática esportiva. Dada a escassez de instrumentos válidos e fidedignos nacionalmente, esse estudo objetivou apresentar os processos de adaptação da Escala de Paixão para o contexto brasileiro. Participaram da pesquisa 789 atletas brasileiros (idade: 16,62 ± 3,20; 58,4% homens). Visando a avaliação de suas propriedades psicométricas, a dimensionalidade da escala foi estimada através do método Hull e Exploratory Structural Equation Modeling, e a precisão pela fiabilidade composta. Também se estimou a invariância do modelo fatorial entre homens e mulheres, e entre os participantes de diferentes níveis competitivos. Os resultados revelaram a estrutura bifatorial da escala, conforme hipótese teórica, com indicadores desejáveis de precisão. Também foi demonstrada a equivalência do modelo de medida ao avaliar participantes dos diferentes sexos e diferentes níveis competitivos. Os resultados sugerem adequação da versão brasileira para avaliação deste construto.

Palavras-chave: paixão, psicologia do esporte, atletas, escalas, psicologia positiva

Escala de Pasión: Propiedades Psicométricas e Invariancia Factorial Mediante el Exploratory Structural Equation Modeling (ESEM)

Resumen: La pasión es un importante elemento entre los procesos psicológicos involucrados en la realización de cualquier actividad, incluso en la práctica deportiva. Considerando la escasez de instrumentos válidos y fiables en ámbito nacional, este estudio busca presentar los procesos de adaptación de la Escala de Pasión al contexto brasileño. En el estudio participaron 789 atletas brasileños (edad: 16,62 ± 3,20; un 58,4% hombres). Para la evaluación de sus propiedades psicométricas, la dimensionalidad de la escala se estimó por medio del método Hull y Exploratory Structural Equation Modeling; y la precisión, por la fiabilidad compuesta. También se calculó la invariancia del modelo factorial entre los hombres y las mujeres, y entre los participantes de diferentes niveles competitivos. Los resultados revelaron la estructura bifactorial de la escala, que confirma la hipótesis teórica, con indicadores deseables de precisión. También se demostró la equivalencia del modelo de medida en la evaluación de los participantes de ambos sexos y diferentes niveles competitivos. Los resultados sugieren adecuar la versión brasileña para la evaluación en este constructo.

Palabras clave: pasión, psicología del deporte, atletas, escalas, psicología positiva

¹Support: Coordination for the Improvement of Higher Education Personnel (CAPES). Number of processes: PDSE 99999.007298/2014-05, PDSE 99999.000162/2014-00 and BEX 0519/12-0.

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With the advent of Positive Psychology, studies that aim accessing and understanding personal and environmental characteristics that contribute to a more rewarding life experience are continuously increasing. In the Sports and Physical Exercise Psychology (SPEP) scenario this

movement is no different. In this case, investments are directed to the investigation of phenomena, psychological or not, that contribute to a healthy and lasting relationship with sports practices and/or physical exercise, given the benefits of these activities in the daily life of its practitioners.

Among the psychological phenomena associated with adherence and maintenance of sports activity, the concept of passion has become a matter of emphasis for having been shown to be an important psychological phenomenon that contributes to the engagement and maintenance of an activity. In this sense, Marsh, Vallerand, et al. (2013) attribute to the passion the fact that people wake up in the morning with a smile on their face simply “because today is baseball day,” musicians work many hours a day in the production of a new album, or even the fact that people arduously dedicate for a humanitarian cause. Considering high performance sports in specific, Vallerand, Mageau, et al. (2008) highlight the great phenomenon of world basketball Michael Jordan who, even though not accepted in the high school team, remained motivated in training for future attempts, becoming the greatest player in the National Basketball Association (NBA). In NBA he played for 15 seasons and won the Most Valuable Player (MVP) award five times in the regular season and six times in the final season, besides being the only athlete to be named as the MVP and best defensive player of the year in the same season. Also worthy of note is the 1992 Olympic title in Barcelona with the legendary Dream Team.

As hypothesized by Vallerand (2010) and Vallerand, Mageau, et al. (2008), examples such as this demonstrate that passion can act as an important source of motivation and energy for the maintenance of a particular practice for long periods, even when these require facing obstacles and adversities. In this sense, passion can fuel motivation, improve well-being and give meaning to everyday life. However, the authors alert to the negative aspects of this concept, considering that passion can also arouse negative emotions, lead to inflexible persistence to the extent that the achievement of a rewarding life is undermined. In this perspective, the Dualist Model of Passion, which will be used in this research, was developed by Vallerand (2010, 2016) and Vallerand et al. (2003), and will be discussed below.

Dualistic Model of Passion

In this model, passion can be defined as a “strong inclination toward an activity that people like, that they find important, and in which they invest time and energy” (Vallerand et al., 2003, p. 757). This relationship with an activity of preference can occur in two distinct forms, defined as: harmonious passion and obsessive passion, which are distinguished by the way this activity is integrated to the person’s identity. This process is based on an important conception of the Dualist Model of Passion, which proposes that people are naturally inclined to internalize elements of the environment which they consider to be important, making them part of their identity (Vallerand, 2015).

Harmonious passion (HP) results from an autonomous internalization of a given activity to a person’s identity; the activity is experienced with a sense of ownership and free will (Vallerand, 2010, 2016; Vallerand et al., 2003). Having HP as basis, the activity occupies an important place in a person’s identity. However, it does not assume exaggerated proportions to conflict with other domains of life, nor does it pose a risk of losing control due to the need for performing it (Schellenberg, Gunnell, Mosewich, & Bailis, 2014).

In contrast, obsessive passion (OP) results from a controlled internalization of the activity to the person’s identity. This internalization originates from intrapersonal and/or interpersonal pressure. Thus, the engagement in the activity may have as basis the uncontrollable need for social acceptance or self-esteem, obtained through its practice. OP is mainly characterized by the fact that the engagement in the activity is out of the person’s control, eventually taking a disproportionate space in his/her identity, causing conflicts with other life activities (Vallerand, 2010; Vallerand et al., 2003).

Given its relevance, studies held over the last two decades have employed the Passion Scale to measure both forms of passion (Schellenberg et al., 2014). These studies have associated OP and HP with several important consequences in sport such as subjective well-being (Vallerand et al., 2006), deliberate practice and *performance* (Vallerand, Mageau, et al., 2008), behavior of fans (Vallerand, Ntoumanis, et al., 2008) aggression (Danahue, Rip, & Vallerand, 2009), *burnout* (Curran, Appleton, Hill, & Hall, 2013), motivation and dependence on physical exercise (Parastatidou, Doganis, Theodorakis, & Vlachopoulos, 2014), among other studies held in sports context, which can be accessed in the review developed by Vallerand and Miquelon (2007). However, it is worth mentioning that this model has also been used in other areas, such as work and health (Curran, Hill, Appleton, Vallerand, & Standage, 2015; Vallerand, 2010).

Given the importance and applicability of the concept of passion in SPEP, researchers have been working on validity evidence for the Passion Scale in samples composed by different characters that integrate the sports and physical exercise scenario (Jowett, Lafrenière, & Vallerand, 2013; Lafrenière, Jowett, Vallerand, & Carbonneau, 2011). Among them, there are highlighted studies by Vallerand et al. (2003), on the evaluation of psychometric properties of the Passion Scale, such as internal structure, reliability, convergent and discriminant validity in Canadian athletes of basketball, hockey and American football. Marsh, Vallerand, et al. (2013) estimated other evidence of the two-dimensional structure of the Passion Scale in relation to Canadian athletes and practitioners of physical activities, pointing, as a result, the internal structure confirmation and good reliability indexes for each subscale, also verifying the invariance of the factorial model for different types of activities, and different versions of the instrument, French and English. Also, Schellenberg et al. (2014) verified the equivalence of the factorial model among three distant samples: high performance athletes, recreational athletes and fans. In addition, the Spanish version of this instrument was evaluated by Chamorro et al. (2015) who

verified evidence of the two-dimensional model of passion in a sample composed of Spanish athletes and practitioners of physical activity, thus ensuring equivalence of the instrument to the French and Anglo-Canadian versions.

Thus, what can be noticed is that the passion construct has been receiving attention from researchers in the most different areas of Psychology, and in SPEP it is no different, given the efforts expended by international researchers in the development of measures that present validity and accuracy evidence for the evaluation of this construct in this context. However, researchers and practitioners of this area in Brazil still have no instrument whose psychometric properties are known for evaluation of this construct. The lack of such information complicates the development of studies that aim assessing this characteristic in Brazilian athletes and practitioners of physical exercises, especially those that have representative samples of this specific population. It is worth noting that this scenario reflects an important limitation of Brazilian SPEP, which is the lack of measurement instruments available to professionals and researchers in the area (Peixoto & Nakano, 2014; Silva, Foch, Guimarães, & Enumo, 2014).

To contribute to filling these gaps, this research was developed with the following objectives: (a) to describe the process of translation and adaptation of the Passion Scale into Portuguese; (b) to estimate the first evidence based on internal structure and reliability of the instrument; (c) to evaluate the invariance of the factorial model among practitioners of different competitive levels (municipal, state, national and international); and (d) to estimate possible correlation patterns between the different forms of passion, considering the variables “time of experience” and “weekly hours” destined to the sports activity.

Method

Participants

The convenience sample consisted of 789 participants of both sexes (58.4% male), with age ranging from 12 to 36 years (16.86 ± 3.32), representing different sports modalities, such as soccer (16%), volleyball (14.6%), handball (12.3%), basketball (11.5%), futsal (10%), running (7.5%), swimming (5.9%), judo (4.2%), equestrianism (3%), fencing (2.7%), paralympic swimming (2%), and others (10.3%) were involved. As for the competitive level, 30.3% competed at the municipal level, 43% state level, 17.3% national level and 9.3% international level. Regarding the time of experience in the modality, there was a variation between 8 months and 20 years (3.48 ± 3.72 years). In terms of level of education, 60.6% attended high school, 20.9% completed high school, 16.8% attended higher education, and 0.6% indicated a complete upper level.

Instruments

The *Passion Scale* (Vallerand et al., 2003) is an instrument developed to evaluate the different dimensions of

passion, composed of a series of sentences that should be answered through a five-point Likert scale, according to the participant's level of agreement with each of the statements expressed in the items, which ranged from strongly disagree to strongly agree. The scale consists of 12 items (with 6 items referring to Harmonious Passion, and 6 items referring to Obsessive Passion). In addition, it has 5 items, which were not included in the factorial model, which assesses at what extent the activity coincides with the definition of passion.

The researcher can use two different forms to access the activity of interest of respondents. In the first one, commonly used for evaluation of heterogeneous samples, respondents are asked to indicate an activity of interest; in the second one, which is used together with specific groups, the participants engage in a common activity (for example, basketball players) and the evaluation of HP and OP is directed to this activity. Regarding the accuracy indicators of this instrument, the results of the original study showed good accuracy indexes, evaluated by Cronbach's alpha for both subscales: $\alpha = 0.79$ for HP and $\alpha = 0.89$ for OP. Similar results have been observed in the evaluation of other versions, as in the Spanish version, $\alpha = 0.81$ for HP and $\alpha = 0.87$ for OP (Chamarro et al., 2015) and in the Chinese version, $\alpha = 0.86$ and $\alpha = 0.82$, respectively (Zhao, St-Louis, & Vallerand, 2015).

Sociodemographic questionnaire. The questionnaire provided data on the main sociodemographic characteristics of the participants, such as sex, age, sport, competitive level, time of experience in the sport, hours per week dedicated to the activity and level of education.

Procedures

Data collection. Initially, the author of the Passion Scale, Robert J. Vallerand, was contacted. He provided the original version in French and the adapted version in English. Both versions were used in the process of translation and cultural adaptation of the Brazilian version. Thus, the instrument was translated into Brazilian Portuguese by two bilingual people, Portuguese-French and Portuguese-English. Difficulties were found only in relation to one item, reason why native speakers of both languages were consulted. Besides, no difficulties were found to construct a synthesis of translations, since the PS had clearly and objectively drafted items.

In a subsequent step, back-translation, the synthesis version was translated by a professional into French (original language of the instrument). With this version, specialists in psychological assessment (2 doctors and 1 PhD student) evaluated the equivalence between the back-translated versions and the synthesis version. It is worth noting that in the Brazilian version, a five-point Likert scale was chosen as a response system because in the seven-point scale, proposed in the original version, the semantic equivalence of items one and two, and six and seven partially overlapped when translated into Portuguese. Such modifications are in accordance with the guidelines of the International Test Commission (ITC) (2005) for translation and adaptation of instruments, which suggests adapting the response system

of items when it is inappropriate or can be a source of bias for the target population. Finally, the final version was presented to 10 practitioners of physical and sports activities to evaluate the clarity and comprehension of the items. The participants suggested small adjustments, which were made by the researchers.

Data analysis. For estimating the number of factors to be extracted for the Brazilian version of the PS, the Hull method of factorial retention (*Confirmatory Fit Index*) was applied. It is considered one of the main methods currently available to estimate the dimensionality of a set of items (Damásio, 2012; Lorenzo-Seva, Timmerman, & Kiers, 2011). In short, this method is based on the mathematical concept of convex closure, which refers to the smallest polygon that encompasses all the existing variables on a two-dimensional axis. Therefore, the amplitude of factors to be evaluated is determined, estimating the fit indexes for each of these factorial solutions. The suggested factorial solution is the one that presents the best balance between adjustment indexes and degrees of freedom (Lorenzo-Seva et al., 2011). This analysis was conducted using the statistical software Factor 10.3 (Lorenzo-Seva & Ferrando, 2006).

In sequence, the factorial solution was estimated through the Exploratory Structural Equation Modeling (ESEM), with an appropriate estimation method at the ordinal measurement level, common to Likert scales, Weighted Least Squares Mean and Variable-adjusted (WLSMV). According to Marsh, Morin, Parker and Kaur (2013) this method brings together the main aspects of Exploratory Factor Analysis (EFA) and Confirmatory Factorial Analysis (CFA). Based on previous theoretical or empirical information, the researcher establishes the number of factors and a complex structure, in which all items can be correlated with all factors, is estimated. In this perspective, the ESEM is characterized as an important alternative to CFA, a method in which items are intentionally arranged to be correlated with only one factor, resulting in highly restrictive and often not realistic models, leading researchers to failures in the estimation of adjustment evidence of the observed data, to the theoretical models. On the other hand, the ESEM can be considered as an important alternative to the EFA, since it allows the invariance evaluation of factorial models and differential item functioning (DIF) for different groups, as well as the calculation of commonly observed adjustment indexes in traditional CFA models (Tomás, Marsh, González-Romá, Valls, & Nagengast, 2014).

After the internal structure of the PS was estimated, the reliability indicators of the respective factors that compose the scale were verified through composite reliability analysis. As indicated by the specialized literature, indexes equal to or greater than 0.70 were used as reference (Marôco, 2010). The last stage of this research consisted of evaluating the invariance of the factorial model through the ESEM, between groups of female and male athletes and different types of sports. In this way, the proposed theoretical model was evaluated based on the indexes recommended by Muthén and Muthén (2012): WLSMV- χ^2 , df, χ^2 /df, RMSEA, CFI

and TLI. The following reference values were established: χ^2 /df<5, RMSEA<0.08, CFI and TLI>.90.

Ethical Considerations

The PS application occurred after the approval of the project by the Ethics Committee of the *Université du Québec à Trois-Rivières* (UQTR) under the protocol (CER-13-193-07-02.08). For data collection, contacts were held with the sports teams through directors and technicians, who consented formally and, therefore, made possible the contact with athletes, the potential study participants. The instrument was administered collectively in the training centres of the teams, preceded by the signing of the Informed Consent Form. For individuals younger than 18, the participation was conditioned to the responsible person's formal consent and to the participant's assent.

Results

First, the factorability indicators of the available data were calculated. The results were considered good: *KMO*=0.860, Bartlett's χ^2 =(66) 2140.4, p <0.001, ensuring the suitability of data to the intended analyses. The theoretical hypothesis, estimated by the *Hull Comparative Fit Index* (*CFI*), indicated the adequacy of the two-factor solution (*GFI* =0.935; *gl* =35; *Scree* test=6.78). With these results, the data set was submitted to the evaluation through ESEM, a method by which adjustments indexes classified as good were obtained: χ^2 =194,487; *df* = 43; χ^2 /df =4.52, p <0.001; *CFI*=0.961; *TLI*=0.940; *RMSEA*=0.070 (*CI*:90%=0.061-0.081). The factorial model is presented in Table 1, which shows the standardized factor loads presented by the items in each of the factors, as well as the correlations between factors and the composite reliability index.

Results presented in Table 1 show that the items presented factorial loads according to the theoretical perspective described by the dualistic model of passion. Thus, items that composed the HP factor (items: 2, 4, 7, 9, 11 and 17) presented factorial loads in the respective factor, ranging from 0.461 (item 2) to 0.762 (item 4). Also, in relation to the OP factor, these same items had low or negative factor loads, varying between 0.002 (item 12) and -0.045 (item 11). On the other hand, the items theoretically destined to the assessment of the OP factor presented factorial loads, in the respective factor, that varied between 0.427 (item 3) and 0.748 (item 10), presenting similar values to the aforementioned results, low or negative loads in the other factor (ranging from -0.007 in item 10 and 0.255 in item 5). As to the correlation between factors, a moderate correlation index was obtained (r =0.483). These results support the first validity evidence based on the internal structure of the Brazilian version of PS. Still in this analysis, the composite reliability indexes presented by each of the factors were adequate: 0.813 for the HP factor and 0.750 for the OP factor, results that support the reliability of the Brazilian version.

Table 1

Factorial model of the Passion Scale estimated by ESEM (n=789)

Item English/Portuguese	HP	OP
1. This activity is in harmony with the other activities in my life. A prática deste esporte se harmoniza bem com as outras atividades em minha vida.	0.668	-0.200
3. The new things that I discover with this activity allow me to appreciate it even more. As coisas novas que descubro com este esporte me permite apreciá-lo ainda mais.	0.427	0.230
5. This activity reflects the qualities I like about myself. Esse esporte reflete as qualidades que gosto em mim.	0.482	0.255
6. This sport allows me to live a variety of experiences. Esse esporte permite-me vivenciar uma variedade de experiências.	0.448	0.225
8. My activity is well integrated in my life. Este esporte está bem integrado na minha vida.	0.664	0.095
10. My sport is in harmony with other things that are a part of me. Meu esporte está em harmonia com outras coisas que são parte de mim.	0.748	-0.007
2. I have difficulties controlling my urge to do my activity. Tenho dificuldades em controlar meu desejo de praticar meu esporte.	0.010	0.461
4. I have almost an obsessive feeling about this activity. Tenho um sentimento que é quase obsessivo por este esporte.	0.022	0.762
7. This activity is the only thing that really turns me on. Esse esporte é a única coisa que realmente me realiza.	0.014	0.675
9. If I could, I would only do my activity. Se eu pudesse, faria somente este esporte.	-0.047	0.684
11. This activity is so exciting that I sometimes lose control over it. Este esporte é tão excitante que às vezes perco o controle sobre ele.	-0.045	0.711
12. I have the impression that my activity controls me. Eu tenho a impressão que este esporte me controla.	0.002	0.576
Corr.	0.483	
CRI	0.813	0.750

Observation: PH = harmonious passion; PO = obsessive passion; Corr: = correlation index between factors; CRI = composite reliability index.
Items ordered according to factorial structure

After the results that ensured data about the internal structure and reliability of the PS were obtained, the invariance of the factorial model between men and women was obtained, as well as among the participants of different sports, considering their nature: collective and individual. In this way, the configural and scalar invariance of the measurement

model was evaluated, due to the impossibility of measuring metric invariance by the ESEM model based on categorical results. The results of these analyses are presented in Table 2. It is noteworthy that, due to the reduced number of participants from national and international levels, these two sample strata were grouped together for this statistical procedure.

Table 2

Adjustment indexes of Multigroup-ESEM

	No. parameters	WLSMV χ^2 (gl)	p	CFI	TLI	RMSEA (90%CI)
Sex						
(Male)	71	140.181(43)	<0.001	0.949	0.922	0.074 (0.060-0.088)
(Female)	71	141.957(43)	<0.001	0.951	0.925	0.080 (0.064-0.098)
Configural	142	282.876(86)	<0.001	0.950	0.923	0.080 (0.070-0.091)
Scalar	88	336.456(140)	<0.001	0.950	0.953	0.063 (0.054-0.072)
Competitive level						
(Municipal)	71	93.074(43)	<0.001	0.965	0.946	0.074 (0.053-0.075)
(State)	71	113.564(43)	<0.001	0.957	0.933	0.073 (0.057-0.080)
(National/international)	71	97.354(43)	<0.001	0.949	0.926	0.072 (0.054-0.094)
Configural	284	343.875(172)	<0.001	0.954	0.929	0.075 (0.064-0.087)
Scalar	122	549.307(334)	<0.001	0.942	0.954	0.060 (0.051-0.069)

Notably the results obtained in the ESEM-Multigroups can be classified as good, suggesting the equivalence of the measurement model for evaluating groups formed by men and women, as well as among the groups formed by participants of different competitive levels (municipal, state, national/international).

Finally, we verified the correlation indexes between the scores presented in the HP and OP variables with the variables weekly hours dedicated to the activity (WH), time of practice (TP) and passion criterion (Crt), represented by the intensity with which the subjects perceive themselves involved with the activity. The results are shown in Figure 1.

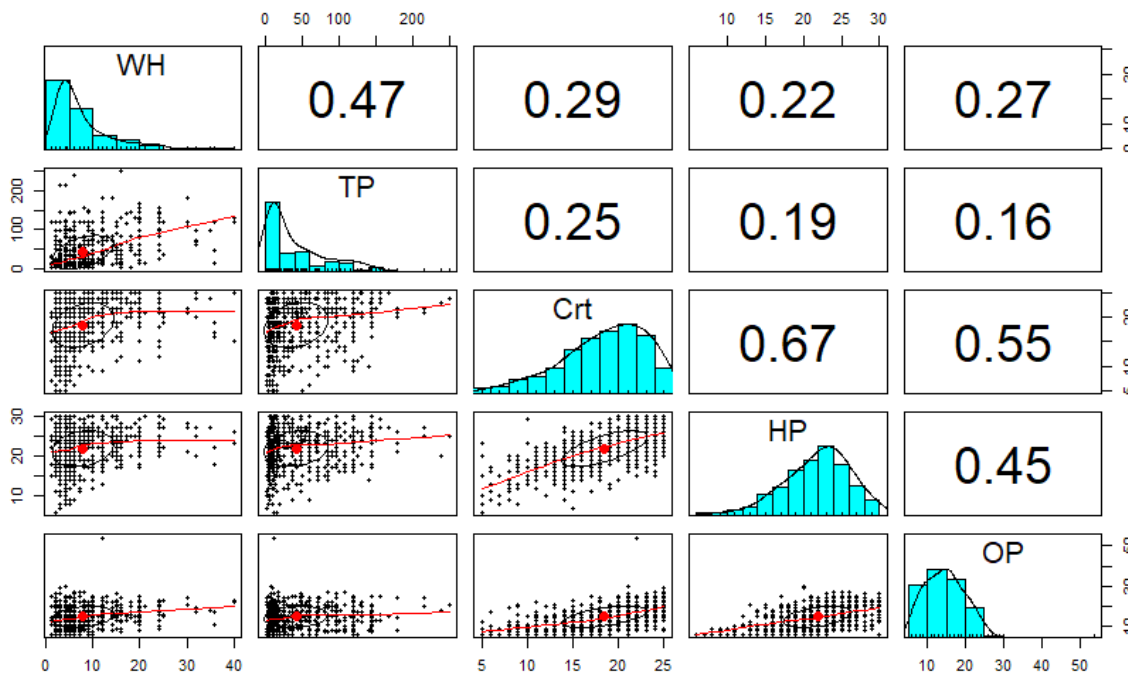


Figure 1. Pearson Correlation. *Observation:* WH = weekly hours dedicated to activity; TP = time of practice; Crt = passion criterion; HP = harmonious passion; OP = obsessive passion.

This figure shows a graphical representation of the Pearson correlation matrix between the aforementioned variables, thus verifying the dispersion graphs of each pair of variables in the lower part of the diagonal, the histogram of each variable in the diagonal and the correlation indexes between the pairs of variable at the top of the diagonal. These analyses were performed through the Psych package (Revelle, 2017) through statistical software R (<http://www.R-project.org>)

As observed in Figure 1, there is the absence of correlations between the variable TP and the factors HP and OP ($r=0.16$ and $r=0.19$, respectively), low magnitude correlations between HP and WH ($r=0.27$) and between OP and WH ($r=0.22$), as well as correlations of moderate magnitude between HP and Crt ($r=0.55$) and strong between OP and Crt ($r=0.67$). These results indicate that the intensity with which people engage in activities is directly associated with the two types of passion, more intensely among those with higher OP levels. Conversely, the number of weekly hours dedicated to practice, as well as the time of practice, showed no differentiation between types of passion.

Discussion

This study aimed to estimate the first validity evidence of the Brazilian version of the PS (Vallerand et al., 2003),

which is based on the dualistic model of passion: HP and OP (Vallerand, 2010, 2016; Vallerand et al., 2003). The results indicated the relevance of the translated and adapted version for evaluating HP and OP in the population of Brazilian athletes.

From the ESEM, the two-factor model originally proposed by Vallerand et al. (2003) could be replicated, as confirmed by other researchers in different Canadian samples (Marsh, Vallerand, et al., 2013, Schellenberg et al., 2014) and also observed in other versions of the PS, such as in the Spanish (Chamarro et al., 2015) and Chinese (Zhao, St-Louis, & Vallerand, 2015) versions. The Brazilian study showed that factorial loads of items similar to those obtained in the studies of these versions can be obtained.

However, for the correlation index between factors, relatively higher results were observed in the present study ($r=0.485$), when compared with those reported by Chamarro et al. (2015) and by Marsh, Vallerand, et al. (2013), $r=0.274$

and $r=0.175$, respectively. Such differences may be associated with the type of estimator and rotational method used in the different studies. Whereas the aforementioned authors used the estimator Robust Maximum Likelihood (MLR) and the Target orthogonal rotational method, the present study used the Robust Weighted Least Squares (WLSMV) and Geomin oblique rotational method, considering the greater indication of using the method selected for estimating non-normal ordinal data (Li, 2014).

Regarding rotational methods, Osborne (2015) when describing the different methods states that the use of orthogonal rotation methods in the evaluation of psychological tests may lead to inadequate factorial solutions when the factors are correlated, as opposed to oblique rotations that can provide adequate solutions even when the factors are not correlated, since this method does not force these correlations, in case they do not exist. Based on these notes, the method used is considered appropriate and, therefore, the results obtained are adequate. Thus, the first objective of this research was satisfactorily achieved: obtaining the first validity evidence based on the internal structure of the PS in its Brazilian version (American Educational Research Association [AERA], American Psychological Association [APA] & National Council on Measurement in Education [NCME], 2014), considering that the factors are structured according to the theoretical proposal that based on the construction of the instrument, the dualistic model of the passion (Vallerand, 2010, 2016; Vallerand et al., 2003) and corroborate the results found internationally (Chamarro et al., 2015; Marsh, Vallerand, et al., 2013).

Considering the reliability indicators of the factors that constituted the Brazilian version of the PS, the composite reliability indexes (0.813 for HP and 0.750 for OP) had values consistent with the other indicators obtained in the evaluation of the different versions: Cronbach's alpha equal to 0.89 and 0.79 (Vallerand et al., 2003) and 0.81 and 0.87, respectively (Chamarro et al., 2015). Thus, the second objective of this research was satisfactorily achieved because this study obtained adequate accuracy indexes (AERA, APA, & NCME, 2014).

Regarding the adequacy indexes of the model adjustments to the available data, one can infer that the values obtained in this research were superior to those found by researchers who estimated validity evidence of the PS via ESEM, such as those reported by Schellenberg et al. (2014), who obtained adjustment indices that can be classified as adequate after inspection of the indices of modification and establishment of correlations between two pairs of observed variables, as well as after the exclusion of two items of the model, namely items 1 and 2. Likewise, Chamarro et al. (2015) verified the adequacy of the respective indexes only after establishing correlation between three pairs of items. Similar strategies were also observed in previous research (Castelda, Mattson, Mackillop, Anderson, & Donovick, 2007; Marsh, Vallerand, et al., 2013), which suggests the adequacy of the statistical methods used in the present research, of the response system (five-point Likert scale) adopted in the Brazilian

version of the instrument, given the absence of needing such adjustments during the analysis.

In addition, the invariance of the measurement model proposed by the PS between the groups formed by men and women was verified, as well as among the participants of different competitive levels. These results, especially those related to the competitive level, corroborate those found by Schellenberg et al. (2014) who verified invariance evidence of the model among groups formed by recreational and competitive athletes and fans, as well as by Marsh et al. (2013) when evaluating the equivalences of the French-Canadian and Anglo-Canadian versions when assessing participants from different activities (leisure, sports, social, professional and educational). Similar results were reported by Chamarro et al. (2015) in samples composed by gamers, sportsmen and practitioners of physical activities.

According to the specialized literature, the knowledge on the scope and limits for the evaluation of different groups is essential for professionals involved in psychological testing, especially that related to the invariance of a measurement model. Considering that the comparison between different groups should be based on empirical evidence that the observed variables (items of a test) relate to latent constructs similarly between the different groups (Borsboom, 2006; Milfont & Fischer, 2010), this requirement was met by the evaluated version.

The last stage of this research consisted of verifying possible patterns of correlation between the variables TP, WH, Crt, HP and OP. The results indicated a lack of correlation between TP and the different forms of passion, suggesting that other variables besides personal involvement may be determinant for the maintenance of sports activity, such as time, social conditions, among others (Weinberg & Gould, 2011), which may be investigated in the future. Correlations between WH, HP and OP, although of low magnitudes, indicate that both forms of passion are positively associated with the number of weekly hours dedicated to physical activity, making it possible to notice that people with higher OP levels perceive themselves to be more inclined to the sport activity of interest. These results corroborate the dualistic theoretical model of passion, since it is theoretically expected that both forms of involvement with the activity lead to longer time of dedication (Vallerand et al., 2003; Vallerand, Mageau et al., 2008). In turn, OP tends to encourage this inclination in a less healthy way, because the person feels controlled by the activity, providing him/her with an impression of greater involvement with such activity, given that, however, such involvement encompasses a practice that can be considered obsessive and not healthy.

As final considerations, this research enabled the confirmation of the PS potential in integrating studies that aim at the HP and OP evaluation among athletes, as well as the indication of the adequacy of the instrument for the Brazilian population. The positive results of these first research studies on the psychometric qualities of the Brazilian version encourage the continuity of research studies of their psychometric qualities until their availability for professional use.

Its use may bring, as a benefit to professionals, especially those interested in developing intervention proposals based on the different types of involvement of athletes with their sports activities of interest. Finally, some limitations of the research are reported. The fact that the analyses are based on a convenience sample, coming from a specific region of the country (Southern region), may have caused some type of bias in the collected information, coming from, for example, cultural origin. In this sense, caution is recommended in the generalization of the data for the Brazilian population; therefore, other studies with amplification and diversification of the sample are recommended, regarding sports modalities and geographical representation. Another aspect to be highlighted refers to the restriction of data collection through the pencil and paper procedure, a fact that ended up restricting and limiting the number of respondents. It is understood that the use of electronic procedures can contribute to overcoming these limitations, being such a tool indicated to allow the representativeness of the sample. Besides, it is suggested that activities of interest, in addition to the sports context, should be explored so that both the evaluation of the measurement model and the assessment of people inserted in different contexts can be conducted.

References

- American Educational Research Association, American Psychological Association, & National Council on Measurement in Education. (2014). *The standards for educational and psychological testing*. Washington, DC: AERA.
- Borsboom, D. (2006). The attack of the psychometricians. *Psychometrika*, 71(3), 425-440. doi:10.1007/s11336-006-1447-6
- Castelda, B. A., Mattson, R. E., MacKillop, J., Anderson, E. J., & Donovan, P. J. (2007). Psychometric validation of the Gambling Passion Scale (GPS) in an English-speaking university sample. *International Gambling Studies*, 7(2), 173-182. doi:10.1080/14459790701387485
- Chamarro, A., Penelo, E., Fornieles, A., Oberst, U., Vallerand, R. J., & Fernández-Castro, J. (2015). Psychometric properties of the Spanish version of the Passion Scale. *Psicothema*, 27(4), 402-409. doi:10.7334/psicothema2015.80
- Curran, T., Appleton, P. R., Hill, A. P., & Hall, H. K. (2013). The mediating role of psychological need satisfaction in relationships between types of passion for sport and athlete burnout. *Journal of Sports Sciences*, 31(6), 597-606. doi:10.1080/02640414.2012.742956
- Curran, T., Hill, A. P., Appleton, P. R., Vallerand, R. J., & Standage, M. (2015). The psychology of passion: A meta-analytical review of a decade of research on intrapersonal outcomes. *Motivation and Emotion*, 39(5), 631-655. doi:10.1007/s11031-015-9503-0
- Damáso, B. F. (2012). Uso da análise fatorial exploratória em psicologia. *Avaliação Psicológica*, 11(2), 213-228. Retrieved from http://pepsic.bvsalud.org/scielo.php?script=sci_arttext&pid=S1677-04712012000200007
- Donahue, E. G., Rip, B., & Vallerand, R. J. (2009). When winning is everything: On passion, identity, and aggression in sport. *Psychology of Sport and Exercise*, 10(5), 526-534. doi:10.1016/j.psychsport.2009.02.002
- International Test Commission. (2005). *International Guidelines on Test Adaptation*. Retrieved from https://www.intestcom.org/files/guideline_test_adaptation.pdf
- Jowett, S., Lafrenière, M.-A. K., & Vallerand, R. J. (2013). Passion for activities and relationship quality: A dyadic approach. *Journal of Social and Personal Relationships*, 30(6), 734-749. doi:10.1177/0265407512467748
- Lafrenière, M.-A. K., Jowett, S., Vallerand, R. J., & Carbonneau, N. (2011). Passion for coaching and the quality of the coach-athlete relationship: The mediating role of coaching behaviors. *Psychology of Sport and Exercise*, 12(2), 144-152. doi:10.1016/j.psychsport.2010.08.002
- Lorenzo-Seva, U., & Ferrando, P. J. (2006). FACTOR: A computer program to fit the exploratory factor analysis model. *Behavior Research Methods*, 38(1), 88-91. doi:10.3758/BF03192753
- Lorenzo-Seva, U., Timmerman, M. E., & Kiers, H. A. L. (2011). The hull method for selecting the number of common factors. *Multivariate Behavioral Research*, 46(2), 340-364. doi:10.1080/00273171.2011.564527
- Li, C.-H. (2014). *The performance of MLR, USLMV, and WLSMV estimation in structural regression models with ordinal variables* (Doctoral dissertation). Retrieved from <https://d.lib.msu.edu/etd/3268/datastream/OBJ/View/>
- Marôco, J. (2010). *Análise de equações estruturais: Fundamentos teóricos, software e aplicações* [Structural equation modeling: Theoretical foundations, software and applications]. Pêro Pinheiro, Portugal: ReportNumber.
- Marsh, H. W., Morin, A. J. S., Parker, P. D., & Kaur, G. (2013). Exploratory structural equation modeling: An integration of the best features of exploratory and confirmatory factor analysis. *Annual Review of Clinical Psychology*, 10, 85-110. doi:10.1146/annurev-clinpsy-032813-153700
- Marsh, H. W., Vallerand, R. J., Lafrenière, M. A. K., Parker, P., Morin, A. J. S., Carbonneau, N., ... Paquet, Y. (2013). Passion: Does one scale fit all? Construct validity of two-factor passion scale and psychometric invariance over different activities and languages. *Psychological Assessment*, 25(3), 796-809. doi:10.1037/a0032573
- Milfont, T. L., & Fischer, R. (2010). Testing measurement invariance across groups: Applications in cross-cultural research. *International Journal of Psychological Research*, 3(1), 111-121. Retrieved from <http://www.redalyc.org/articulo.oa?id=299023509008>

- Muthén, L. K., & Muthén, B. O. (2012). *Mplus user's guide* (7th ed.). Los Angeles, CA: Muthén & Muthén.
- Osborne, J. W. (2015). What is rotating in exploratory factor analysis? *Practical Assessment, Research & Evaluation*, 20(2), 1-8. Retrieved from <http://pareonline.net/pdf/v20n2.pdf>
- Parastatidou, I. S., Doganis, G., Theodorakis, Y., & Vlachopoulos, S. P. (2014). The mediating role of passion in the relationship of exercise motivational regulations with exercise dependence symptoms. *International Journal of Mental Health and Addiction*, 12(4), 406-419. doi:10.1007/s11469-013-9466-x
- Peixoto, E. M., & Nakano, T. C. (2014). Problemas e perspectivas na utilização dos testes psicológicos em psicologia do esporte [Problems and perspectives in the use of psychological tests in sports psychology]. In C. R. Campos, & T. C. Nakano (Orgs.), *Avaliação psicológica direcionada a populações específicas: Técnicas, métodos e estratégias* [Psychological assessment to specific populations: Techniques, methods and strategies] (pp. 201-232). São Paulo, SP: Vetor.
- Revelle, W. (2017). *An overview of the psych package*. Retrieved from <http://personality-project.org/r/overview.pdf>
- Schellenberg, B. J. I., Gunnell, K. E., Mosewich, A. D., & Bailis, D. S. (2014). Measurement invariance of the Passion Scale across three samples: An ESEM approach. *Measurement in Physical Education and Exercise Science*, 18(4), 242-258. doi:10.1080/1091367X.2014.942453
- Silva, A. M. B., Foch, G. F. L., Guimarães, C. A., & Enumo, S. R. F. (2014). Instrumentos aplicados em estudos brasileiros em psicologia do esporte [Testing applied in Brazilian studies in sport psychology]. *Estudos Interdisciplinares em Psicologia*, 5(2), 77-95. doi:10.5433/2236-6407.2014v5n2p77
- Tomás, I., Marsh, H. W., González-Romá, V., Valls, V., & Nagengast, M. (2014). Testing measurement invariance across Spanish and English versions of the physical self-description questionnaire: An application of exploratory structural equation modeling. *Journal of Sport & Exercise Psychology*, 36(2), 179-188. doi:10.1123/jsep.2013-0070
- Vallerand, R. J. (2010). On passion for life activities: The dualistic model of passion. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 42, pp. 97-193). New York, NY: Academic Press.
- Vallerand, R. J. (2015). *The psychology of passion: A dualistic model*. New York, NY: Oxford University Press.
- Vallerand, R. J. (2016). The dualistic model of passion: Theory, research, and implications for the field of education. In W. C. Liu, J. C. K. Wang, & R. M. Ryan (Eds.), *Building autonomous leaders: Perspectives from research and practice using self-determination theory* (pp. 31-58). New York, NY: Springer.
- Vallerand, R. J., Blanchard, C., Mageau, G. A., Koestner, R., Ratelle, C., Léonard, M., ... Marsolais, J. (2003). Les passions de l'âme: On obsessive and harmonious passion. *Journal of Personality and Social Psychology*, 85(4), 756-767. Retrieved from doi:10.1037/0022-3514.85.4.756
- Vallerand, R. J., Mageau, G. A., Elliot, A. J., Dumais, A., Demers, M.-A., & Rousseau, F. (2008). Passion and performance attainment in sport. *Psychology of Sport and Exercise*, 9(3), 373-392. doi:10.1016/j.psychsport.2007.05.003
- Vallerand, R. J., & Miquelon, P. (2007). Passion for sport in athletes. In S. Jowett & D. Lavallee (Eds.), *Social psychology in sport* (pp. 249-264). Champaign, IL: Human Kinetics.
- Vallerand, R. J., Ntoumanis, N., Philippe, F. L., Lavigne, G. L., Carbonneau, N., Bonneville, A., ... Maliha, G. (2008). On passion and sports fans: A look at football. *Journal of Sports Sciences*, 26(12), 1279-1293. doi:10.1080/02640410802123185
- Vallerand, R. J., Rousseau, F. L., Grouzet, F. M. E., Dumais, A., Grenier, S., & Blanchard, C. M. (2006). Passion in sport: A look at determinants and affective experiences. *Journal of Sport & Exercise Psychology*, 28(4), 454-478. doi:10.1123/jsep.28.4.454
- Weinberg, R. S., & Gould, D. (2011). *Foundations of sport and exercise psychology*. Champaign, Human Kinetics.
- Zhao, Y., St-Louis, A., & Vallerand, R. J. (2015). On the validation of the passion scale in Chinese. *Psychology of Well-Being*, 5(3), 1-11. doi:10.1186/s13612-015-0031-1
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Authors' contribution:

All authors made substantial contributions to the conception and design of this study, to data analysis and interpretation, to the manuscript revision, and to the approval of the final version. All authors assume public responsibility for the content of the manuscript.

Received: May. 26, 2016

1st Revision: Oct. 10, 2016

2nd Revision: Apr. 19, 2017

Approved: Apr. 19, 2018

How to cite this article:

Peixoto, E. M., Nakano, T. C., Castillo, R. A., Oliveira, L. P., & Balbinotti, M. A. A. (2019). Passion scale: Psychometric properties and invariance factor through Exploratory Structural Equation Modeling (ESEM). *Paidéia (Ribeirão Preto)*, 29, e2911. doi: <http://dx.doi.org/10.1590/1982-4327e2911>