

Cross-Cultural Validation of the Basic Psychological Needs in Physical Education Scale between Portugal and Brazil Samples

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Abstract. The main propose of this study is the cross-cultural validation of the *Basic Psychological Needs in Physical Education Scale* among Portugal and Brazil samples, through the study of measurement model invariance. Participated in this study, two independent samples, one with 616 Portuguese students, of the 2nd and 3rd basic grade of public school, aged between 9 and 18 years old and another with 450 Brazilian students, from 1st, 2nd and 3rd middle grade of public and private school, aged between 14 and 18 years old. The results support the suitability of the model (three factors, each one with four items), showing an adequate fit to the data in each sample (Portugal: $\chi^2 = 203.8$, $p = .001$, $df = 51$, SRMR = .062, NNFI = .926, CFI = .943, RMSEA = .070, RMSEA 90% IC = .060–.080; Brazil: $\chi^2 = 173.7$, $p = .001$, $df = 51$, SRMR = .052, NNFI = .940, CFI = .954, RMSEA = .073, RMSEA 90% IC = .061–.085), as well valid cross-cultural invariance among Portuguese e Brazilian samples ($\Delta CFI \leq .01$). Those findings allow us to conclude that scale can be used to measure the basic psychological needs in physical education in Portugal and in Brazil.

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In recent years, the Self-Determination Theory (SDT) (Deci & Ryan, 1985) has been used as a motivational theoretical model to support various studies applied to various contexts (e.g., work, health, education, family) (see: Deci & Ryan, 2008), including sports (Gagné, 2003; Reinboth & Duda, 2006), exercise (Edmunds, Ntoumanis, & Duda, 2006; Hagger & Chatzisarantis, 2008) and physical education (Cox & Williams, 2008; Ntoumanis, 2001, 2005; Standage, Duda, & Ntoumanis, 2003, 2005).

According to this model, people's motivation is not directly related with social involvement factors, seeing that their influence (e.g., classroom environment, teacher behavior) is mediated by satisfying three fundamental "nutrients" (Ryan & Deci, 2007), which are the basic psychological needs for autonomy (i.e., the subject's capability to regulate his/her own actions), for competence (i.e., the subject's effectiveness capability for involvement interaction) and relatedness (i.e., the subject's capability of seeking and developing interpersonal connections and relationships). It's these needs that will determine the subject's behavior regulation,

which is based on a motivational *continuum* that oscillates between more autonomous or more controlled forms of behavior regulation.

According to SDT (Self Determination Theory) (Deci & Ryan, 1985; Deci & Ryan, 2008), people tend to participate more in activities they are involved in when they regulate their behavior in an autonomous manner (i.e., intrinsic - for pleasure or entertainment, without the need for reinforcement or rewards; integrated - by assimilation of self behavior, where a high level of congruency with other values and needs of the subject exist; and identified - by the personal importance of certain aspects, such as learning new abilities). In contrast, people tend to participate less in activities they are involved in when they regulate their actions in a controlled manner (i.e., introjected - to avoid feeling of guilt or to obtain external approval; external - to obtain external rewards or avoid punishment) or the regulatory process is simply non-existent (or begins to cease to exist) in people (i.e., lack of motivation and reason to act).

The fact that people who regulate their behavior in a more autonomous manner demonstrate greater persistence, commitment, effort and pleasure in the activities they carry out (Ryan & Deci, 2007), substantiates the application of SDT in the context of Physical Education (PE) and shows it's extreme importance in this field. According to Standage et al. (2003), SDT can provide

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important information regarding the motivational process, namely, the connections between the way in which students regulate their behavior and their commitment during PE class activities and also during sport activities outside of the school environment. Furthermore, if the subjacent SDT principles are promoted within a PE context, the probabilities of students feeling autonomously motivated will increase and may, consequently, enjoy and value the importance of physical activity and sports by adopting a healthy lifestyle (Moreno, González-Cutre, Chillón, & Parras, 2008).

According to Standage et al. (2003, 2005), although SDT has been successfully implemented for over a decade in an educational context, it has not been so successful when applied to the specific context of physical education in schools, seeing that work in this field has not been as frequent. Nevertheless, some studies applied in a PE context (e.g., Ntoumanis, 2001, 2005; Standage et al., 2003, 2005) indicate that the more autonomous forms of behavior regulation are those that are more closely related to positive consequences (e.g., effort, commitment, happiness, concentration in class, better performance in PE classes, greater intention of practicing physical activities or sports outside the school environment) and, on the other hand, the more negative consequences (e.g., boredom, disappointment, shame and unhappiness) are more closely related to controlled forms of behavior regulation, in which the fulfillment of basic psychological needs, especially competence, is the main predictor of the more autonomous forms of motivation. According to Moreno et al. (2008), both autonomy ($\beta = .15$) and competence ($\beta = .40$), present a positive and significant predictive effect on autonomous motivation. On the other hand, studies also reveal that students that perceive a climate of support of their basic psychological needs for their activities, induced by their teacher, are those that present greater levels of satisfaction and, consequently, find it easier to regulate their behavior in an intrinsic, integrated and identified manner (Standage et al., 2005; Cox & Williams, 2008). These results are, in a way, confirmed by the results of some recent experimental studies (Gillison, Standage, & Skevington, 2013; Rosenkranz et al., 2012), in which it was concluded that the autonomy support strategies, used by teachers, lead the students to greater levels of autonomous motivation, enjoyment and physical activity, as well as, greater intention of continuing to practice physical activities.

Nonetheless, with regards to the manner that basic psychological needs are evaluated, only in one of the studies consulted (Ntoumanis, 2005) was a scale, specifically developed to evaluate basic psychological needs, used, the *Basic Psychological Need Satisfaction Scale at Work*

(Deci et al., 2001), which consists of 21 items that evaluate competence (6 items), relatedness (8 items) and autonomy perception (7 items). Even though this scale was modified, adapted and validated for a PE context, resorting to confirmatory factor analysis (CFA), the author considered that the resulting fit indices were not satisfactory ($S-B\chi^2 = 838.6$, $df = 186$, $p = .001$, SRMR = .11, CFI = .70, RMSEA = .10), and only resulted in acceptable fit indices after some of the items were eliminated (3 items in each factor). With regards to reliability, the internal consistence levels were considered to be acceptable by the author ($\alpha_{\text{Competence}} = .70$; $\alpha_{\text{Autonomy}} = .66$; $\alpha_{\text{Relatedness}} = .84$).

Still on the subject of basic psychological needs evaluation, in the other studies consulted (Cox & Williams, 2008; Fernandes, Vasconcelos-Raposo, Lázaro, & Dosil, 2004; Ntoumanis, 2001; Standage et al., 2003, 2005), the strategy used by the authors, to suppress the lack of specific instruments in the PE context, was the use of sub-scales adapted from other questionnaires and/or the development of specific items for this effect. For example, in one of the first studies carried out in Portugal (Fernandes et al., 2004), the evaluation of the basic psychological needs of the students in a PE context, was carried out using the same measuring instruments used in Ntoumanis's (2001) study, in other words: 5 items from the "competence" sub-scale of the Portuguese version of the *Intrinsic Motivation Inventory* (IMIp) and 2 items developed by Ntoumanis (2001) to evaluate autonomy and relatedness perception. The results obtained with regards to the internal consistency values were very similar to the values obtained by Ntoumanis (2001), which were considered unacceptable ($\alpha_{\text{Competence}} = .86$; $\alpha_{\text{Autonomy}} = .38$; $\alpha_{\text{Relatedness}} = .58$).

As such, in order to bridge the existing gap in Portuguese speaking countries regarding the lack of measuring instruments for basic psychological needs, reflected by SDT, Pires, Cid, Borrego, Alves and Silva (2010) preliminarily adapted and validated the Portuguese version of the *Basic Psychological Needs in Exercise Scale* (BPNESp) (Moutão, Cid, Leitão, Alves, & Vlachopoulos, 2012) originally developed by Vlachopoulos and Michailidou (2006) for a Physical Education context, with recourse to exploratory factor analysis (EFA), which was also the strategy used by Moreno et al. (2008), where the authors adapted the Spanish version of the BPNES to physical education. Therefore, after an adaptation of the questionnaire to a PE context, which involved a validation of the content (evaluation of the item content and its level of adjustment to the respective factors), based on the proposed methods used by the various authors (e.g., Ntoumanis & Vazou, 2005), with the contribution of two sets of specialists (PE teachers and Sport Psychologists), the adaptation of the BPNESp to PE, called the Basic Psychological Needs Questionnaire

in Physical Education (BPNQ-PE) was preliminarily validated by means of an exploratory study, where 150 students of both sexes (80 female; 70 male) between the ages of 11 and 16 took part, produced results that allowed the adequacy of the adaptations undertaken to be confirmed. The factorial structure of the BPNQ-PE was later analyzed in another study (Cid, Pires, Silva, & Borrego, 2011), with recourse to CFA, in a sample of 616 students of both sexes (323 female; 293 male) between the ages of 9 and 18, and whose results showed acceptable levels of adjustment (i.e., $S-B\chi^2 = 159.77$, $df = 51$, SRMR = .06, NNFI = .92, CFI = .92, RMSEA = .06, RMSEA 90% CI = .05–.07). These results are consistent with those obtained in the Spanish adaptation of the BPNESp for physical education (Moreno et al., 2008), which also presented a model adjustment that was quite acceptable (i.e., $\chi^2/df = 3.29$, SRMR = .07, NNFI = .92, CFI = .94, IFI = .94, RMSEA = .07).

With regards to the Brazilian sample for BPNQ-PE, which does not contain alterations with regards to the content of the items, Lettnin, Davoglio, Stobäus and Cid (2013), undertook a preliminary study, with recourse to EFA, on a sample of 176 students, of both sexes, with ages between 14 and 18 years. The results showed that the factorial structure of the BPNQ-PE held the same study structure as the Portuguese samples, thus showing promising initial psychometric qualities that allow it to be used in cross-cultural studies that investigate basic psychological needs within a context of Physical Education (Lettnin et al., 2013).

Nevertheless, cross-cultural adaptation is a fundamental process whenever there is an intention of using an instrument, that was developed for a specific type of population, on a different population. Reason for which Vlachopoulos et al. (2013) presented a study regarding the invariance of the model across the various version of the BPNES (i.e., Greece, Portugal, Spain and Turkey), which was the questionnaire on which the current adaptation for physical education was based, and whose conclusions empirically support the invariance of the underlying latent constructs of basic psychological needs.

The application of a new instrument to a different cultural group implies more than its translation, application and comparison of results. Cross-cultural studies should be presented together with all psychometric evaluation stages, which requires a substantial sample, an adequate research design and must demonstrate that the construct, method and obliquity of the items do not differ between version (He & van de Vijver, 2012). Without construct equivalence there is no basis for a cross-cultural comparison. For this reason, researchers should explore the structure of the constructs and the adequacy of the items, making sure they have the same cultural significance (He & van de Vijver, 2012).

As such, considering that the validation of an instrument is a dynamic and continuous process, wherefore, taking into account the importance of basic psychological needs within a school Physical Education context, the objective of the current study is to analyze not only the psychometric qualities of the BPNQ-PE (Lettnin et al., 2013) on a Brazilian sample, with recourse to confirmatory factor analysis, but also a study on the invariance of the measurement model between Brasil and Portugal.

Method

Participants

Portuguese Participants

Participated in this study 616 students of both sexes (323 female; 293 male), attending the 2nd and 3rd basic education grades of public school in Portugal, aged between 9 and 18 years ($M = 13.7$, $SD = 1.6$). With regards to physical and sports activities, aside from the regular attendance of physical education classes (divided into 2 blocks of weekly classes: one with a duration of 45 minutes and another 90 minutes), 310 students stated they practiced extra-curricular sports (e.g., 3 collective and 6 individual types of sports). These students attended an average of 2.9 ($SD = 1.2$) training sessions per week (between 1 and 6), which corresponds to an average of 80.1 minutes ($SD = 26.1$) of weekly practice (between 30 and 150 minutes), in which their experience, in temporal terms, varies between 1 and 120 months ($M = 41.3$, $SD = 31.8$).

Brazilian Participants

450 students of both sexes (228 female; 222 male), attending the 1st, 2nd and 3rd years of secondary education at a public school and private school in Brazil, aged between 14 and 18 years ($M = 15.7$, $SD = 1.0$). With regards to physical and sports activities, aside from the regular attendance of physical education classes (divided into 2 blocks of weekly classes: one with a duration of 65 minutes and another 45 minutes), 241 students stated they practiced extra-curricular sports (e.g., 5 collective and 18 individual types of sports). These students attended an average of 3.1 ($SD = 1.4$) training sessions per week (between 1 and 7), which corresponds to an average of 115.1 ($SD = 60.3$) minutes of weekly practice (between 60 and 180 minutes).

Instruments

Basic Psychological Needs Questionnaire in Physical Education (BPNQ-PE) This instrument consists of 12 items with a 5 level *Likert* type scale, which vary between 1 (“*Strongly Disagree*”) and 5 (“*Strongly Agree*”). The items are grouped posteriorly into 3 factors

(with 4 items each), which reflect the underlying basic psychological needs related to the self-determination theory (Deci & Ryan, 1985): autonomy, competence and relatedness. The BPNQ-PE was validated on a Portuguese sample in an exploratory (Pires et al., 2010) and confirmatory manner (Cid et al., 2011) and in an exploratory manner in a Brazilian sample (Lettnin et al., 2013).

Procedures

Data Collection in Portugal

Once the Executive School Councils were informed regarding the objective of the work and the necessary authorization to undertake the study was obtained, the legal guardians, through the respective form teachers of all the students involved, were contacted in order to obtain their informed consent in writing for participation in the study.

The instrument of evaluation was always applied in similar locations and under similar conditions to all participants, in other words, in a classroom environment to a group of 25 students at maximum, where adequate conditions were provided in order for the individuals not to feel awkward with the situation and, at the same time, they could concentrate during the filling in of the questionnaires. In order to promote honesty during answering, the collection of information was anonymous. As such, confidentiality was guaranteed, assuring that the information would not be transmitted individually to third parties.

Data Collection in Brazil

Once consent had been acquired from the school boards and approval obtained from the scientific commission (research protocol 38/11), the procedures for the research were explained at the schools and the Terms of Free and Informed Consent (TFIC) handed to the students. On a previously established date, the TFIC were collected from the students that were authorized to participate in the research and the questionnaire was applied to all secondary education classes.

In the same way as the Portuguese data collection, the instrument of evaluation was always applied in similar locations and under similar conditions to all participants, in other words, in a classroom environment to a group of 30 students at maximum, where adequate conditions were provided in order for the individuals not to feel awkward with the situation and, at the same time, they could concentrate during the filling in of the questionnaires. In order to promote honesty during answering and the confidentiality of personal information, all data was collected anonymously.

Confirmatory factor analysis (CFA)

To undertake this analysis, the recommendation of a 10:1 ratio (i.e., no. of subjects per parameter being estimated in the model) suggested by various authors was considered (Hair, Black, Babin, & Anderson, 2009; Kline, 2011; Worthington & Whittaker, 2006). Nevertheless, to minimize the problem of non-normal data distribution, in the current study a ratio of 15:1, recommended for these situations (Hair et al., 2009), was applied, seeing that the normalized Mardia coefficient (see Mardia, 1970) pointed to a non-normal multivariate distribution of data (Portuguese sample: 38.1; Brazilian sample: 22.7).

As such, data analysis was undertaken according to the guidance and recommendations of various authors (e.g., Byrne, 2010; Hair et al., 2009; Kline, 2011; Worthington & Whittaker, 2006): as well as according to the method of maximum likelihood (ML), by means of the chi-squared (χ^2) testing of the respective degrees of freedom (*df*) and the level of significance (*p*), furthermore, the following adjustment quality indices were also used: *Standardized Root Mean Square Residual* (SRMR), *Comparative Fit Index* (CFI), *Non-Normed Fit Index* (NNFI), *Root Mean Square Error of Approximation* (RMSEA) and the respective confidence interval (90% CI). In the current study, for the referred indices, the cut-off values suggested by Hu and Bentler (1999), were used: SRMR \leq .08, CFI and NNFI \geq .95 and RMSEA \leq .06, although in the case of the incremental indices (CFI and NNFI) Hu and Bentler's cut-off values should not be generalized, as is equally recommended that values equal to or greater than .90 be considered (Marsh, Hau, & Wen, 2004).

The analysis was undertaken using the AMOS 7.0 (Arbuckle, 2006) structural equation analysis software.

Analysis of Model Invariance

The objective of the multigroup analysis is to evaluate if the structure of the measurement model is equivalent (invariant) in different groups that have different characteristics (e.g., Portuguese vs. Brazilian culture), thus establishing the following criteria for invariance of the models (Byrne, 2010; Cheung & Rensvold, 2002; Marsh, 1993): 1) factorial model analysis of each of the groups individually (the model should have a good fit in each group); 2) multigroup analysis by restricting the model parameters, considering the following types of invariance: free parameters model (i.e., configural invariance), fixed factorial measurement model (i.e., measurement invariance), fixed factorial and covariance measurement model (i.e., scale-invariance), fixed factorial, covariance and error measurement model (residual invariance). According to Marsh (1993) measurement is considered as a minimum criterion for the

invariance of the model and the last criterion (residual invariance) is not indicative of a lack of invariance of the model, and some authors even consider that the analysis of this criterion is infrequent due to it being too restrictive (Byrne, 2010).

According to Cheung and Rensvold (2002), the difference in values between the unrestricted model (free parameters) and the restricted model (fixed parameters), should be $\Delta CFI \leq .01$. According to Byrne (2010), many researchers consider that model invariance evaluation based solely on the difference of the chi-squared ($\Delta\chi^2$) test is too restrictive. From this perspective, Cheung and Rensvold (2002), presented proof that it may be more reasonable to base decisions on CFI differences (ΔCFI).

Results

Descriptive Analysis

According to tables 1 and 2, relative to the descriptive analysis of the results, it can be seen that, further to all the subjects having used all the available levels of answers for all the items in both samples, the average scores of the answers varied between 2.94 ($SD = 1.12$) (item 6) and 4.20 ($SD = 0.87$) (item 5), in the case of the Portuguese sample, and between ($SD = 1.09$) (item 9) and 4.12 ($SD = 0.84$) (item 10), in the case of the Brazilian sample.

It can also be seen that the answers to the various items do not show a normal univariate distribution, seeing that the standardized value (Z value) of the *skewness* and *kurtosis* measurements are situated outside the intervals -1.96 and 1.96 (for a $p < .05$ level of significance). As such, all items (with the exception of

item 6, which shows a normal skewness in both samples) present a rightward tending negative asymmetric skewness (a predominance of the higher values of the variable). On the other hand, also for both samples, items 2, 4, 5, 8 and 11 present a leptokurtic distribution, in other words, they are less peaked (values that are more concentrated on some levels of the answer), and in item 6 the opposite can be verified, in other words a platykurtic distribution (less peaked than normal, which means that the answers are more dispersed throughout the levels of the answer).

Construct Validity Analysis

According to the strategy mentioned in the procedures, the results obtained for each of the fit indices defined for the purpose of analysis of the data adjustment to the BPNQ-PE measurement model (12 items and 3 factors), for the two separate groups (table 3) and the comparison values (table 4) of the free parameters model to the two restricted models (i.e., where the factorial weighing, covariances and measurement errors were defined for the two groups).

As can be seen, considering the criteria defined in the methodology, for both the confirmatory factor analysis and the invariance analysis of the model, the values in table 3 not only show a good fit to the model, both in the Portuguese sample and the Brazilian sample, but also indicate (table 4) that the model is invariant between the two cultures. In other words, the values obtained indicate the following: that, in model 1 (i.e., configural invariance), the same number of factors is present in each group and that each of the factors is associated with the same set of items; that, in model 2 (i.e., measurement invariance), the BPNQ-PE

Table 1. Descriptive analysis of the answers to items of the BPNQ-PE – Portuguese Sample

	Mín-Max	M (SD)	Skewness	Z Value	Kurtosis	Z Value
Item1	1–5	3.83 (0.88)	–0,562	–5.73	0,227	1.15
Item2	1–5	4.16 (0.93)	–1,141	–11.64	1,239	6.29
Item3	1–5	3.56 (1.01)	–0,690	–7.04	0,313	1.59
Item4	1–5	3.78 (0.88)	–0,580	–5.92	0,435	2.21
Item5	1–5	4.20 (0.87)	–1,214	–12.39	1,768	8.97
Item6	1–5	2.94 (1.12)	–0,058	–0.59	–0,656	–3.33
Item7	1–5	3.36 (0.91)	–0,259	–2.64	0,056	0.28
Item8	1–5	4.03 (1.02)	–1,022	–10.43	0,596	3.03
Item9	1–5	3.52 (0.89)	–0,313	–3.19	0,210	1.07
Item10	1–5	3.90 (0.80)	–0,308	–3.14	–0,324	–1.64
Item11	1–5	4.18 (0.90)	–1,084	–11.06	1,105	5.61
Item12	1–5	3.21 (1.00)	–0,344	–3.51	–0,049	–0.25
Autonomy	1–5	3.31 (0.73)	–	–	–	–
Competence	1–5	3.72 (0.68)	–	–	–	–
Relatedness	1–5	4.14 (0.79)	–	–	–	–

Legend. M = mean; SD = standard deviation.

Table 2. Descriptive analysis of the answers to the items of the BPNQ-PE – Brazilian Sample

Items	Min-Max	M (SD)	Skewness	Z Value	Kurtosis	Z Value
Item1	1–5	3.60 (0.99)	–5,982	–5,982	0,012	1.15
Item2	1–5	3.81 (1.02)	–7,260	–7,260	1,760	6.29
Item3	1–5	3.56 (1.12)	–4,817	–4,817	0,091	1.59
Item4	1–5	3.91 (0.95)	–5,773	–5,773	–0,869	2.21
Item5	1–5	3.94 (0.97)	–7,173	–7,173	1,873	8.97
Item6	1–5	3.21 (1.08)	–0,756	–0,756	–2,473	–3.33
Item7	1–5	3.68 (1.02)	–4,556	–4,556	–1,404	0.28
Item8	1–5	3.91 (1.06)	–8,417	–8,417	2,182	3.03
Item9	1–5	3.19 (1.10)	–0,565	–0,565	–2,734	1.07
Item10	1–5	4.12 (0.85)	–8,573	–8,573	5,595	–1.64
Item11	1–5	3.96 (0.98)	–7,730	–7,730	2,626	5.61
Item12	1–5	3.25 (1.11)	–1,530	–1,530	–2,943	–0.25
Autonomy	1–5	3.30 (0.88)	–	–	–	–
Competence	1–5	3.88 (0.77)	–	–	–	–
Relatedness	1–5	3.99 (0.88)	–	–	–	–

Legend. M = mean; SD = standard deviation.

Table 3. Fit indices of the measurement model of the BPNQ-PE – Portugal and Brazil

	χ^2	df	SRMR	NNFI	CFI	RMSEA	RMSEA 90% CI
Portuguese Model	203.8*	51	.062	.926	.943	.070	.060–.080
Brazilian Model	173.7*	51	.052	.940	.954	.073	.061–.085

Legend. χ^2 = chi-squared; SRMR = Standardized Root Mean Square Residual; NNFI = Non-normed Fit Index; CFI = Comparative Fit Index; RMSEA = Root Mean Squared Error of Approximation; CI = Confidence Interval.

* $p < .001$.

Table 4. Fit indices for the invariance of the measurement model of the BPNQ-PE between Portugal and Brazil

	χ^2	df	$\Delta\chi^2$	Δdf	p	CFI	ΔCFI
Configural Invariance	377.52	102	–	–	–	.948	–
Measurement Invariance	426.49	114	48.97	12	.001	.942	.006
Scale Invariance	437.89	117	60.37	15	.001	.940	.008
Residual Invariance	479.34	129	101.82	27	.001	.934	.014

Legend. χ^2 = chi-squared; df = degrees of freedom; $\Delta\chi^2$ = differences in the value of chi-squared; Δdf = differences in the degrees of freedom; CFI = Comparative Fit Index; ΔCFI = differences in the value of the Comparative Fit Index.

has the same significance in both groups; that, in model 3 (i.e., scale-invariance), the comparison of the latent and observed averages is valid across the groups; that, in model 4 (i.e., residual invariance), supports the comparison between the observed items.

As can be seen in figures 1 and 2, the standardized factorial weight of the items (all statistically significant for $p < .05$), vary between .55 and .87, for the Portuguese sample, and .59 and .94 for the Brazilian sample. Furthermore, a significant positive correlation between the three factors was identified in both, the Portuguese and Brazilian samples, respectively: Competence-Relatedness ($r = .44$

and .31), Competence-Autonomy ($r = .51$ e .61) and Relatedness-Autonomy ($r = .32$ and .28), as well as, a reasonable internal consistency in both factors, both in the Portuguese ($\alpha_{\text{Competence}} = .79$; $\alpha_{\text{Relatedness}} = .87$; $\alpha_{\text{Autonomy}} = .69$), and Brazilian sample ($\alpha_{\text{Competence}} = .82$; $\alpha_{\text{Relatedness}} = .89$; $\alpha_{\text{Autonomy}} = .82$).

Discussion

The objective of the current study was to analyze the psychometric qualities (with recourse to confirmatory factor analysis) of the BPNQ-PE measurement model

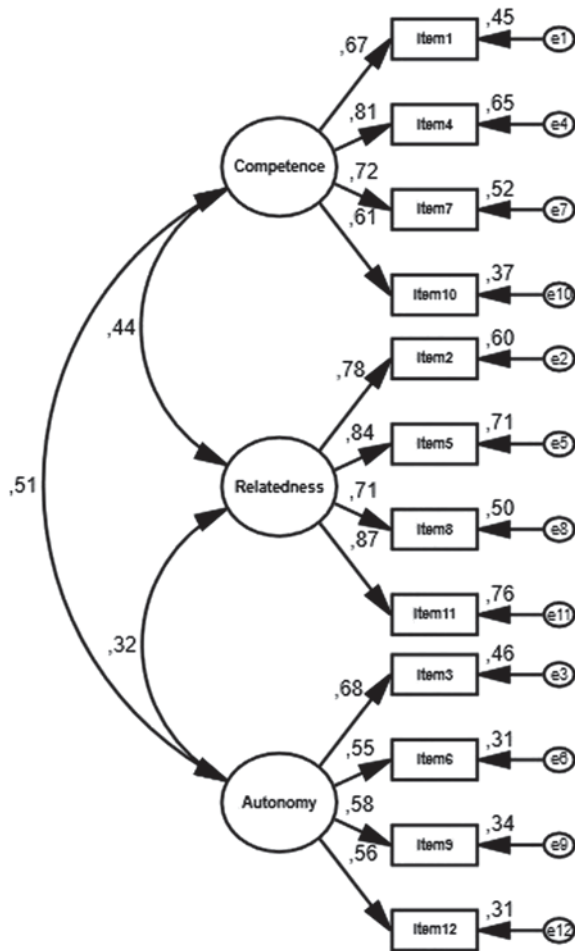


Figure 1. Standardized individual parameters (covariances between factors, factorial weight and measurement errors), all of which are significant, of the measurement model (BPNQ-PE) of the Portuguese sample.

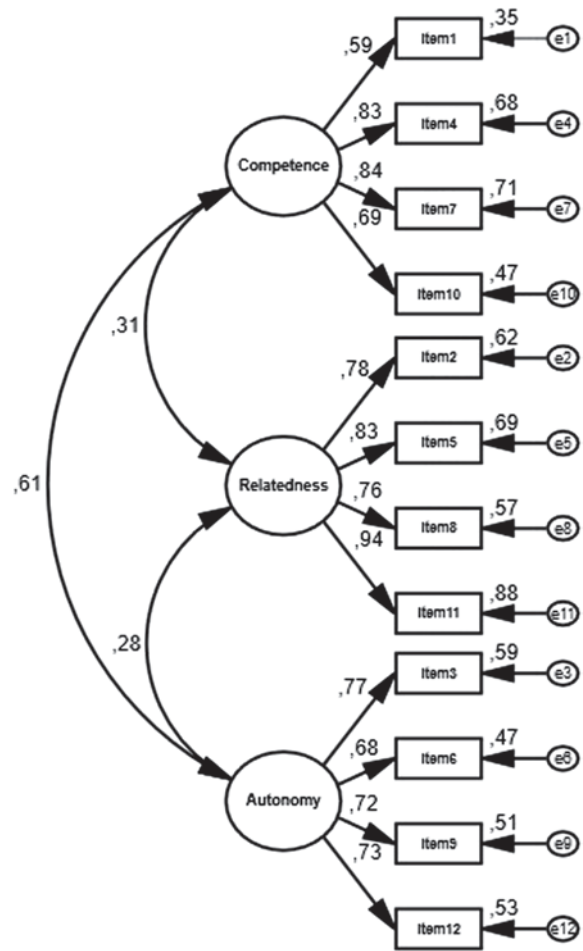


Figure 2. Standardized individual parameters (covariances between factors, factorial weight and measurement errors), all of which are significant, of the measurement model (BPNQ-PE) of the Brazilian sample.

(Lettnin et al., 2013) on a Brazilian sample, as well as undertake and invariance analysis of the model between Brazil and Portugal, thus expanding scientific evidence for use in the BPNQ-PE (Cid et al., 2011; Pires et al., 2010) in cross-cultural studies, contributing also towards what Deci and Ryan (2008) called the development of knowledge regarding the universality of underlying variables of the Self-Determination Theory, which, in this specific case is related with the satisfaction of basic psychological needs within a Physical Education context.

Generally, in descriptive terms, the results showed a non-normal univariate distribution, in other words, a leftward skewing, which is normal when instruments of this nature are used, seeing that participants in both countries present a tendency to value the items in the questionnaire (and consequently the factors with which they are associated), a fact that seems to be proven by the moderate and high averages (for both the Brazilian and Portuguese sample), thus showing the theoretical importance that is attributed to the three basic psychological

needs. Such results corroborate the various empirical studies undertaken in a PE context in other countries (e.g., Chen, 2014; Cox & Williams, 2008; Méndez-Giménez, Fernández-Río, & Estrada, 2013; Moreno-Murcia, Gimeno, Carretero, Lacárcel, & Calvo, 2012; Ntoumanis, 2001; Sánchez-Oliva, Leal, Marreiros, González, & Garcia-Calvo, 2014; Standage et al., 2003, 2005).

With regards to the psychometric qualities of the BPNQ-PE of the Brazilian sample, even though all the cut-off values adopted in the methodology, and suggested by Hu and Bentler (1999) (i.e., RMSEA), were not achieved, the results showed a fairly reasonable adjustment of the data (i.e., $\chi^2 = 173.7$, $df = 51$, SRMR = .052, NNFI = .940, CFI = .954, RMSEA = .073, RMSEA 90% CI = .061–.085), seeing that not all authors advise that Hu and Bentler's cut-off values be generalized under the penalty of excluding good models (Marsh et al., 2004). Due to this, all researchers should keep in mind that the suggested cut-off values are only a guide

and not rules set in stone (Whorthington & Whittaker, 2006). Furthermore, these values seem to be acceptable, inasmuch as their factorial structure is consistent with the structure of the original models (English and Portuguese) that were the basis for the current instrument (Moutão et al., 2012; Vlachopoulos & Michailidou, 2006), as well as with the Portuguese version of the BPNQ-PE (Cid et al., 2011; Pires et al., 2010), with the preliminary validation of the Brazilian sample (Lettnin et al., 2013) and with the Spanish adaptation of the BPNES for physical education (Moreno et al., 2008). The results showed that the scale has reasonable enough psychometric qualities that, according to Hair et al. (2009), are essentially related to the validity of the construct, in other words, to the extent by which a set of observable items reflects the latent theoretical construct that is meant to be measured, seeing that each item presents factorial weights that are relevant to the factor that was supposed to be associated in accordance with the original model.

With regards to the local adjustment values of the BPNQ-PE model in the Brazilian sample, most of the items have a factorial weight greater than .70, which is indicative of a very well defined structure (Hair et al., 2009). The results further indicate an acceptable internal consistency for all the factors (i.e., > .70) (Nunnally, 1978) and a positive correlation between three factors, more specifically between “Competence” and “Autonomy” ($r = .61$), by which these results are very similar to those of the English (Vlachopoulos & Michailidou, 2006), Portuguese (Moutão et al., 2012) and Spanish (Sánchez & Núñez, 2007) versions of the questionnaire that was the basis (i.e., BPNES), for the Portuguese version of the BPNQ-PE (Cid et al., 2011; Pires et al., 2010), which shows that the items contribute in a significant manner, simultaneously, towards the measurement of the underlying constructs.

With regards to the invariance of the model, the results support the equivalence of the measurement between two countries, in other words, the questionnaires underlying theoretical constructs (i.e., basic psychological needs for autonomy, competence and relatedness), within the context of Physical Education, are conceptualized in the same manner in both countries. Taking into consideration the assumptions of the invariance analysis of the model defined in the methodology (Byrne, 2010, Cheung & Rensvold, 2002), more specifically that which regards the results of the ΔCFI , we can state that: a) the proposed theoretical structure (the same evident variables – items are explained by the same latent variables - factors) are the same for both countries (configural invariance); b) the factorial weight of the items is equivalent for both countries (measurement invariance), in other words, the items have the same importance irregardless of the group; c) results

can be compared between the two countries using the same questionnaire (scale invariance); d) the same degree of error can be assumed with regards to the items in the instrument (residual invariance), although this last criterion is not indicative of a lack of invariance of the model, and some authors even consider that it is infrequent to analyze it due to it being too restrictive (Byrne, 2010). As such, the language (semantics) and the operational applicability equivalence of this instrument substantiated on theoretical assumptions of the SDT, between the two Portuguese speaking but culturally different countries, is verified.

These results support the results obtained in the only known cross-cultural validation study of an evaluation questionnaire regarding basic psychological needs (Vlachopoulos et al., 2013), in which the measurement model invariance of the *Basic Psychological Needs in Exercise Scale* (BPNES) between Greece, Portugal, Spain and Turkey was analyzed, concluding that the model is invariant across the 4 countries, which reinforces the psychometric qualities of this questionnaire, seeing that the BPNQ-PE was created based on the BPNES.

In conclusion, it is clear that the results of the current study support the unrestricted use of the BPNQ-PE, in future research between Brazil and Portugal, in evaluating the satisfaction of basic psychological needs within a Physical Education context. Nevertheless, it is thought that some of the conclusions obtained have some limitations that can be attended to in future studies. First of all, they are limited to the specific cultural groups being studied (Brazil and Portugal), and cannot be considered as a representation assumed to be a general representation of the population on a national level, seeing that for this to happen it would be necessary to resort to random sampling procedures. Secondly, its confined to a specific age group (children and adolescents) and to a specific context (physical education at school), and its application to other age groups is not advised, nor to other physical activity contexts. Lastly, sharing Barret (2007) opinion, which refers that the evaluation of a model is a time consuming process that is filled with many types of difficulties and that, invariably, requires an enormous amount of work, by which it is strongly recommended that more invariance studies of the measurement model relating to other groups (e.g., between sexes between subjects of different ages), in both countries, without excluding the possibility of validation in other countries (e.g., Spain), be undertaken to make this questionnaire even more robust in psychometric terms.

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