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Validity and Reliability of the Portuguese school physical activity environment questionnaire in adolescents

Validação e Fiabilidade da versão portuguesa do questionário de avaliação do ambiente escolar para a atividade física em adolescentes

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Abstract – The aim of this study is to analyze the psychometric properties and to examine the factorial validity of the Portuguese version of the Questionnaire Assessing School Physical Activity Environment (Q-SPACE) for school-age youth. The translated and adapted version of the questionnaire was applied and resulted in two studies: study I, in which 504 students participated (56% boys), the factorial structure of the scale was examined; in study II, which involved 501 students (53.5% boys), the factorial structure obtained in study I was tested through confirmatory factor analysis. The results of the exploratory factorial analysis, carried out in study I, showed that the Portuguese version of the Q-SPACE is composed of five factors that characterize the students' perception regarding the social and physical school environment for physical activity: equipment and space conditions; recess; school social support; physical education structure; school activity offer. Internal consistency values ranged from 0.60 to 0.89. The confirmatory factor analysis confirmed the applicability of the Portuguese Q-SPACE version, presenting adequate fit indexes: χ^2/df = 2.90, GFI = 0.92; CFI = 0.92; RMSEA = 0.06. In conclusion, Q-SPACE showed acceptable validity and reliability for assessing school physical activity environment in Portuguese adolescents.

Key words: Adolescent; Environment; Exercise; School health; Validity of test.

Resumo – *O objetivo deste estudo é analisar as propriedades psicométricas e examinar a validade fatorial da versão portuguesa do instrumento "Questionnaire Assessing School Physical Activity Environment" (Q-SPACE) para jovens em idade escolar. A versão traduzida e adaptada da escala foi aplicada e resultaram dois estudos: no estudo I, em que participaram 504 estudantes (56% eram rapazes), foi examinada a estrutura fatorial da escala; no estudo II, em que participaram 501 estudantes (53.5% eram rapazes), foi testada a estrutura fatorial obtida no estudo I através da análise fatorial confirmatória. O resultado da análise fatorial exploratória, efetuada no estudo I, demonstrou que a versão portuguesa da escala Q-SPACE é constituída por cinco fatores que caraterizam a perceção dos estudantes relativamente ao ambiente social e físico escolar para a prática de atividade física: condições dos espaços e material; intervalos; suporte social escolar; organização da educação física; diversidade de atividades. Os valores de consistência interna variaram entre 0.60 e 0.89. A análise fatorial confirmatória, comprovou a aplicabilidade da versão portuguesa do Q-SPACE, apresentando adequados índices de ajustamento: χ^2/df = 2.90, GFI = 0.92; CFI = 0.92; RMSEA = 0.06. Em conclusão, a escala Q-SPACE demonstrou uma validade e fiabilidade adequadas para avaliar a perceção do ambiente escolar para a prática de atividade física em adolescentes portugueses.*

Palavras-chave: *Adolescente; Exercício; Meio ambiente; Saúde escolar; Validade dos testes.*

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INTRODUCTION

Although literature reflects different health benefits related to the practice of physical activity (PA)[1], these levels in children and adolescents are still below the daily PA recommendations of public health for this age group[2,3]. Furthermore, with age advancement, i.e., in the transition from childhood to adolescence and also into adulthood, there is a decline in PA levels[3,4].

Multiple levels of influence PA-related behaviors (such as biological, demographic, environmental, social and psychological), are widely studied in literature. In children, demographic and biological factors, such as sex and parental nutritional status; psychological factors, such as the intention to be active, preference for PA and perceived barriers; social factors, such as parental PA; and environmental factors, such as access to facilities and PA programs; are identified as consistent correlates of PA[5]. In turn, in adolescents, sex, race and age, as biological and demographic factors; perceived competence and intention to be physically active, as psychological factors; parental support as social factors; and PA opportunities, as environmental factors, are the most consistent correlates of PA in this age group[5].

One of the theoretical approaches that seek to explain the organization of these determinants is the social ecological model[6]. Considering this model, PA is influenced by different factors, such as intrapersonal (e.g., age or self-efficacy), social environment (e.g. social support), and physical environment (e.g., space for practice)[6,7]. According to the same theoretical approach, place (school or work) can influence this behavior.

For children and adolescents, school is one of the places that can exert influence in this behavior, since it is the space in which young people spend much of their day-to-day life. It is precisely in the school context that multiple interventions have been developed[8]. However, it is important to identify the factors that determine PA behavior in the planning of these interventions[7]. Thus, among the different factors that may affect PA behavior in children and adolescents, the school environment and all the atmosphere that this institution provides for the practice of PA stands out (notably through changes in recess, in the methodology used in physical education classes and in other moments of formal sport practice and in the accessibility to PA facilities)[8-10]. However, despite an increase in the number of studies related to the influence of environmental factors on the schoolchildren PA, studies that have investigated the preponderance of the school environment in PA are still scarce[10].

The aim of this study was to analyze the psychometric properties and factorial structure of the Portuguese version of the Questionnaire Assessing School Physical Activity Environment (Q-SPACE). To test the factorial validity of the questionnaire, the cross-validity was adopted, and the sample was divided into two random sub-samples that originated study I and study II.

METHODOLOGICAL PROCEDURES

Study I

- **Process of Q-SPACE Scale Translation**

Since the original scale was developed in English language, it was essential to carry out the process of translation and cross-cultural adaptation. In order to achieve this process, the methodological recommendations suggested by Beaton, Bombardier[11] were used. Initially, two professionals (one with knowledge in the field of sports sciences and another without knowledge in the area) carried out the translation of scales from English into Portuguese. Subsequently, the two versions were compared and the final Portuguese version was developed. The back-translation from Portuguese into English was performed by a native English-speaking professional. In a subsequent phase, the versions were compared and debated. The final Portuguese version was approved by a committee composed of translators and researchers. At this stage, one item was immediately excluded ("My school provides transportation home to those students participating in after-school sports or activities"), because it is seems that this is not adequate to our reality. The comprehension of all items that constitute the final Portuguese version was tested in different age groups.

- **Participants**

Participants of this study were recruited through a randomly selected sample from an intervention study - Physical Activity and Nutrition Program for Adolescents (PANPAs), developed in schools of the 2nd and 3rd cycles from Madeira Island, Portugal. The sample consists of 504 students from eight public schools, 282 boys and 222 girls. The sample was composed of students aged 10-15 years (M=11.68, SD=1.39).

- **Instruments**

The Q-SPACE instrument was used to assess participants' perception of the school physical and social environment for PA. The original scale developed by Robertson-Wilson, Lévesque[12] consisted of 28 items evaluated on a 4-point Likert scale, ranging from 1 = "totally disagree" to 4 = "totally agree". This study resulted in 2 factors - physical environment (PE) and social environment (SE), with 12 and 8 items, respectively. Martin, McCaughtry[13] carried out the confirmatory factor analysis (CFA) of this instrument and adjusted for a factorial structure with 2 factors, with 8 items each. These studies showed satisfactory internal consistency values - Cronbach's alpha between 0.78 and 0.80 for PE and between 0.72 and 0.79 for SE[12,13].

- **Procedures**

This study was approved by the Regional Secretary of Education and by the schools in which it took place. All participants were authorized by parents in the form of informed consent form to participate in the

study. The questionnaire was filled in classroom with the presence of the researcher, who explained the purpose of the study and was available for the clarification of possible doubts.

- **Data analysis**

Initially, an exploratory analysis of data was carried out in order to verify data normality, the presence of possible outliers and missings. Two subjects had missing data and were excluded from the study. In order to examine the structural validity, the exploratory factor analysis (EFA) was performed with all items. The Kaiser-Meyer-Olkin and the Bartlett's sphericity tests were used to measure the quality of the factorization of items in order to proceed with the factorial analysis. Data were analyzed using SPSS 24.0.

Study II

- **Participants and Procedures**

Participants were recruited as previously described in study I. The sample for this study consisted of 501 participants of both sexes (53.5% of boys and 46.5% of girls), aged 10-16 years (M=11.69, SD=1.47 years). Procedures were similar to those previously reported in study I.

- **Instrument**

Similarly to the previous study, CFA will present the 20 items proposed for the Portuguese version of Q-SPACE.

- **Data analysis**

Descriptive statistics included analysis of mean, standard deviation, skewness, and kurtosis. Univariate normality was analyzed through kurtosis and skewness values. Multivariate normality was examined using the Mardia's coefficient. Given the multivariate non-normality, subjects causing interference (2.1%) were eliminated based on the Malahanobis distance. Since multivariate normality was verified, the maximum likelihood estimator was used to perform CFA using AMOS 24.0. The model was evaluated based on different fit indexes: chi-square test (χ^2); χ^2 / df ratio; comparative fit index (CFI); goodness-of-fit index (GFI); root mean square error of approximation (RMSEA). Although the χ^2 test was used, given the sample dimensionality, it is common to produce statistically significant values. Thus, it is recommended to use χ^2 / df ratio as an alternative indicator. Values close to 0 indicate good fit model[14], but values below 3[15] or below 5 are considered acceptable[16]. For CFI and GFI, value of 0.90 or higher indicates good fit[17]. For RMSEA, values of 0.06 or less indicate good fit, but values between 0.06 and 0.10[17] are considered acceptable.

RESULTS

Exploratory Factor Analysis

The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.94, which

reflects excellent suitability of the factorial analysis. The Bartlett's test sphericity also verified the appropriateness of the data for analysis (χ^2 = 5950.99, p <0.001). Through these two measures, it was ensured that the sample meets the requirements necessary to carry out the factorial analysis. EFA was started in order to investigate whether the structure was maintained or not, as in the original instrument. From the 27 items of the original scale, the Portuguese version of Q-SPACE was obtained through principal-axis factoring with oblimin rotation, which resulted in five-factorial struture (table 1). The selection of items used a factor loading of 0.40. Consequently, seven items were eliminated. Factor 1 – equipment and spaces conditions (ESC), explains 35.24%; factor 2 - recess, explains 3.86%; factor 3 - school social support (SSS), explains 3.68%; factor 4 - physical education structure (PEs), explains 2.93%; and factor 5 – school activity offer (SAO), explains 1.86%, of the total variance (47.56%). Factor loadings varied between 0.62 and 0.80 for ESC, between 0.55 and 0.68 for recess, between -0.58 and -0.55 for SSS, between 0.70 and 0.78 for PES, and between -0.70 and -0.60 for SAO. Mean and standard deviation were 3.0 (±0.60) for the perception of ESC, 2.5 (±0.79) for the perception of environment recess, 2.9 (± 0.57) for the perception of SSS for the practice of PA, 3.0 (±0.74) for the perception of PES and 3.1 (±0.57) for the perception of SAO. The internal consistency values in the different factors were higher than 0.70, except for the recess factor (α= 0.60).

Table 1. Factor loadings of items and internal consistency of each factor.

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Item 1	0.80				
Item 2	0.77				
Item 3	0.62				
Item 4	0.65				
Item 5	0.75				
Item 6	0.75				
Item 25	0.67				
Item 26	0.69				
Item 7		0.55			
Item 22		0.68			
Item 17			-0.55		
Item 19			-0.56		
Item 20			-0.57		
Item 21			-0.58		
Item 8				0.70	
Item 9				0.78	
Item 10					-0.60
Item 11					-0.70
Item 13					-0.62
Item 14					-0.65
Eigenvalues	10.019	1.58	1.50	1.26	1.03
Variance explained	35.24%	3.86%	3.68%	2.93%	1.86%
Cronbach's alpha	0.89	0.60	0.73	0.71	0.76

Confirmatory Factor Analysis

Table 2 shows the descriptive statistics of the five latent factors. For ESC, mean was 3.0 ± 0.50; for recess, it was 2.5 ± 0.72; for SSS, mean was 2.94 ± 0.54; for PES, it was 3.0 ± 0.63; and 3.04 ± 0.50 for SAO. The skewness and kurtosis values vary between -2 and 2 and were considered acceptable to demonstrate normal univariate distribution[18].

Table 2. Descriptive statistics of the Portuguese Q-SPACE version

	M±SD	Skewness	Kurtosis
ESC			
Item 1	2.85±0.82	-0.55	0.01
Item 2	3.02±0.77	-0.78	0.75
Item 3	3.03±0.78	-0.72	0.45
Item 4	2.92±0.75	-0.51	0.24
Item 5	3.03±0.76	-0.71	0.63
Item 6	3.01±0.73	-0.55	0.39
Item 25	3.05±0.71	-0.64	0.79
Item 26	3.12±0.68	-0.73	1.29
Intervals			
Item 7	2.50±0.91	-0.21	-0.79
Item 22	2.49±0.87	-0.05	-0.69
SSS			
Item 17	2.82±0.80	-0.46	-0.09
Item 19	3.03±0.64	-0.45	0.90
Item 20	2.88±0.77	-0.54	0.22
Item 21	3.05±0.73	-0.75	0.88
PES			
Item 8	3.07±0.69	-0.60	0.74
Item 9	2.95±0.74	-0.48	0.21
SAO			
Item 10	3.05±0.68	-0.56	0.76
Item 11	3.14±0.66	-0.66	1.28
Item 13	3.03±0.74	-0.75	0.82
Item 14	2.96±0.74	-0.44	0.08

The first CFA conducted obtained the following fit indexes: χ^2 / df = 3.41, GFI = 0.90; CFI = 0.89; RMSEA = 0.07. For the ESC subscale, the standardized factor loadings varied between 0.60 and 0.80; for the recess subscale, it varied between 0.47 and 0.63; for the SSS subscale, between 0.53 and 0.67; for the PES subscale, between 0.67 and 0.84 and for the SAO subscale, between 0.51 and 0.68. All items were statistically significant ($p < 0.001$). In order to improve the model fit, the errors of two items (item 3 with item 4) were correlated (figure 1). Consequently, with the model re-specification, the fit indexes improved: χ^2 / df = 2.90, GFI = 0.92; CFI = 0.92; RMSEA = 0.06.

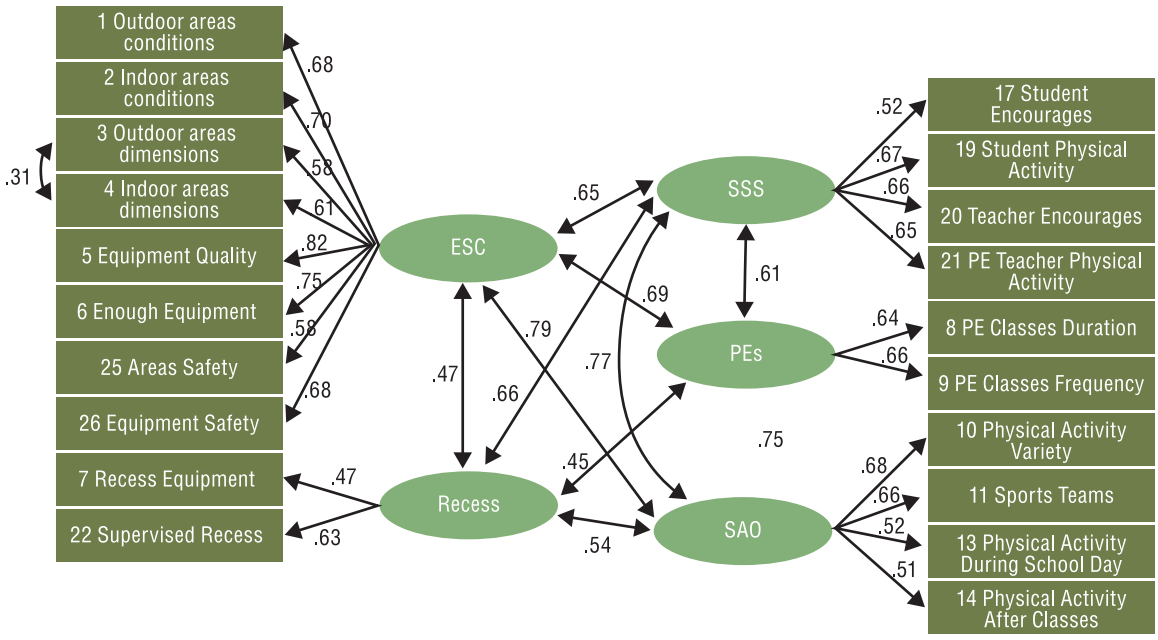

Figure 1. CFA model of the Q-SPACE Portuguese version

DISCUSSION

The aim of the present study was to adapt to the Portuguese context and to evaluate the psychometric properties of an instrument that allows evaluating students' perceptions regarding the school environment for PA.

According to ecological theoretical approaches (e.g. socio-ecological model), the behavior of PA is influenced by different factors (e.g. intra-personal or environmental), which, in turn, may be conditioned by the different contexts in which this behavior may occur[6]. For an adequate evaluation of the different factors that influence this behavior, it is crucial to use valid instruments that can support epidemiological or experimental investigations.

Despite the awareness of the importance of different environmental factors in the PA behavior[5,7], studies on this subject are still scarce[10,19], specifically those involving the school environment[10]. In these age groups, the autonomy of young people is reduced, and the role of the environment in their behavioral choices is even more preponderant[20,21]. In this sense, Q-SPACE is a valid method to evaluate school environmental factors (i.e., perception of the school environment) that influence the individual PA behavior.

After the translation and adaptation of the Q-SPACE instrument, the EFA of the Portuguese version identified five factors: SSS (4 items), ESC (8 items), recess (2 items), PES (2 items) and SAO (4 items). The SSS subscale refers to an evaluation of the school SE. The items that compose this subscale refer to participants' perceptions regarding the encouragement and participation of peers and teachers in PA. Studies have shown that social support is correlated to PA in children and adolescents[5,7]. However, the

scales that allow evaluating social support in PA in this age group include items related to parental support[22,23]. As the focus is centered on the school environment, the scale derived from Q-SPACE seems to fit this objective, as it allows circumscribing the construct to this environment, evaluating the perception of peers and teachers, which may constitute PA interference agents in this context. However, the combined inclusion of scales that evaluate psychosocial variables (e.g., peer support) and Q-SPACE is also observable in different studies[23,24].

The remaining four subscales refer to an evaluation of the characteristics of the school PE. The items that are included in the ESC subscale reflect the participants' perception regarding the quality and quantity of spaces and equipment that the school makes available for PA. The items of the recess subscale reflect participants' perceptions of the material and human resources available during school recess. The items that constitute the PES subscale reflect the participants' perception regarding the duration and weekly frequency of this curricular discipline. The items of the SAO subscale reflect participants' perceptions of the variety of curricular and extracurricular activities provided by the school. Other studies[23] generally use scales that reflect some of the characteristics of the school physical environment addressed in the different subscales of the Portuguese version of Q-SPACE, which seem to be factors that influence the behavior of PA in children and adolescents.

For the evaluation of school PE, studies use observation systems[25,26] or self-report measures (i.e., evaluation according to participants' perception). Without neglecting the importance of a measure with a more objective meaning such as that achieved with observation systems, the usefulness of an instrument such as Q-SPACE is decisive, since it is a self-report measure that shows a perceived reality. This is because it allows understanding how the individual perceives the environment and this will determine his health behavior (e.g., PA), and helps explaining the environmental factors that affect it[19].

Of the original scale[12], eight of the items were not retained, one due to the initial exclusion and the other seven because they do not appear to be implicit in any of the evaluated constructs. These items reflect the participants' perceptions regarding the quality of the physical education teacher, the information about extracurricular activities, the school transportation after activities, the negative comments of peers, the teachers' opinions about PA, the surveillance of areas and security transmitted by peers during the practice of PA. The factorial structure obtained in this study with the sample of Portuguese pre-adolescents and adolescents, was shown to be distinct from that obtained by Robertson-Wilson and Lévesque[12] in the development of the original scale, and by Martin, McCaughtry[13] in the modified version of Q-SPACE. Although the original scale was used in another population[27,28], we do not know another study that has adapted and validated this instrument for other languages and / or cultural contexts.

The Portuguese version of the instrument showed adequate internal consistency values[29]. In addition, the factorial structure obtained through

EFA was tested in another sample with Portuguese pre-adolescents and adolescents using CFA, which presented adequate fit indexes[14-17]. In this sense, it could be concluded that the factor structure of five factors evaluates the perception of Portuguese students regarding the school environment for PA.

CONCLUSION

The present research demonstrated evidence of the validity and internal consistency of the Portuguese version of the Q-SPACE instrument to evaluate the students' perception regarding the school environment for PA. Future investigations in the Portuguese school population should confirm the factor perspective presented in this study.

COMPLIANCE WITH ETHICAL STANDARDS

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Ethical approval

Ethical approval was obtained from the local Human Research Ethics Committee – Faculty of Sports, and the protocol was written in accordance with standards set by the Declaration of Helsinki.

Conflict of interest statement

The authors have no conflict of interests to declare.

Author Contributions

Conceived and designed the experiments: MJCAA; BCRS; AMLFMF. Performed the experiments: BCRS; MJCAA. Analyzed data: BCRS; MJCAA; AMLFMF. Contributed with reagents/materials/analysis tools: BCRS; MJCAA; AMLFMF. Wrote the paper: BCRS; MJCAA; AMLFMF.

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