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Validity and reliability of a pictorial scale of physical self-concept in spanish children

Validez y fiabilidad de la escala pictográfica de autoconcepto físico en niños y niñas españoles

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Abstract

The pictorial scale of Physical Self-Concept in Children (P-PSC-C) is a relatively new instrument for investigating physical self-concept in childhood. The current study aims to examine the validity and reliability of the Spanish version of the P-PSC-C, and also to analyse the validity according to the children's age. A sample of 365 primary school age (M = 9.21, SD = 1.92) students participated; divided in two groups, those aged 9 or younger and those 10-11 years old. Surveys were used to assess perceived physical concept individually. Confirmatory factor analysis (CFA) with diagonally weighted least square estimator specifically designed for ordinal data and a scaled test statistic was conducted. Ordinal alpha using a polychoric correlation matrix and Kendall's τ were used to analyse reliability and correlation between items, respectively. The results of the CFA showed a one-dimensional excellent fit for the whole sample. According to the age groups, the CFA revealed that the item assessing flexibility had a low factor loading for older children (λ = .11). Weak invariance was shown for gender. Item statistics and reliability values were otherwise good. This study shows a high potential for the pictorial scale to be suitable for the given age groups in measuring physical self-concept.

Key words: physical self-concept; childhood; pictorial scale; confirmatory factor analysis.

Resumen

La escala pictográfica de Autoconcepto Físico en niños y niñas es un instrumento novedoso para investigar el autoconcepto físico en la niñez. Este estudio pretende analizar la validez y fiabilidad de la versión española de la escala pictográfica de Autoconcepto Físico en niños y niñas, también según su edad. En el estudio participó una muestra de 365 niños y niñas (M = 9.21, D.T. = 1.92) de centros educativos de infantil y primaria que fueron divididos en dos grupos, aquellos de 9 años o menores y los de 10-11 años. Se realizaron entrevistas individuales para medir el autoconcepto físico. Se aplicaron pruebas de análisis factorial confirmatorio (AFC) con estimaciones específicas ponderadas de mínimos cuadrados diseñado específicamente para datos ordinales. Para analizar la fiabilidad y correlación entre ítems, se utilizó una matriz policórica de correlación y la τ de Kendall, respectivamente. Los resultados del AFC para toda la muestra de estudio mostraron un ajuste unidimensional excelente. Respecto a la validez según los grupos de edad, los AFC mostraron que el ítem de flexibilidad tuvo una carga factorial baja e insuficiente en los niños de mayor edad (λ = .11). Según el sexo, la invarianza fue débil. Los datos estadísticos de los ítems y la fiabilidad fueron buenos. Este estudio muestra un alto potencial para la utilización de la escala pictográfica para medir el autoconcepto físico en los grupos de edad analizados. La escala pictográfica de autoconcepto físico es relativamente nueva para estudiar el autoconcepto físico en la niñez.

Palabras clave: autoconcepto físico; niñez; escala pictográfica; análisis factorial confirmatorio.

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Introduction

Across childhood, low levels of motor competence as well as low levels of physical self-concept are negatively associated with physical inactivity (Babic et al., 2014; Utesch, Dreiskämper, Naul, & Geukes, 2018). Currently, many children fail to reach physical activity recommendations (WHO, 2018) which is associated with a range of health factors, including decreased cardiovascular fitness, decreased bone strength, and higher levels of body fat with implications for cognitive and mental health (Hulteen, Morgan, Barnett, Stodden, & Lubans, 2018). Motor development theoretical models (Robinson et al., 2015; Stodden et al., 2008) in children and adolescents have focused on the relationship between actual and perceived competence, physical activity and physical fitness (Clark & Metcalfe, 2002), stating that to be physically skilful and active, children and adolescents must be physically proficient and perceive themselves as such in different environments (Haubenstricker & Seefeldt, 1986). The importance of perceived physical ability, hereby, is a sub factor of self-concept that is mainly related to physical fitness. Physical self-concept has been theoretically conceptualised as being relevant to children's and adolescents' health (Babic et al., 2014; Bardid et al., 2016; Stodden et al., 2008). It is defined as a person's perception of his/her physical self, which commonly includes domains that relate to motor domains, such as strength, body attractiveness, or general sportiness (Babic et al., 2014; Harter, 1982; Shavelson, Hubner, & Stanton, 1976). That is, one's own level in physical fitness seems to be critical for the development of overall physical self-concept (Harter, 1981a). In their exercise and self-esteem/concept model, Sonstroem and Morgan (1989), and Sonstroem, Harlow and Josephs (1994) claim self-esteem/concept enhancement through physical activity participation is mediated by physical self-worth. In fact, some studies have confirmed that physical self-concept is a mediator between actual competence and physical activity participation (Barnett, Morgan, van Beurden, & Beard, 2008; Jekauc, Wagner, Herrmann, Hegazy, & Woll, 2017) and that the accuracy of physical self-concept can be important for future physical activity (Utesch, Dreiskämper, Naul, et al., 2018). Moreover, these aforementioned findings and models suggest that as children age and develop, the relationship between their physical performance and related self-perceptions becomes stronger (Robinson et al., 2015; Stodden et al., 2008).

The structure of self-concept is described in terms of three main characteristics (Shavelson et al., 1976): multidimensional, hierarchical, and developmental. Multidimensional implies differentiated distinct components that a person can understand in terms of different areas (i.e., academic and non-academic), with the non-academic domain encompassing social, emotional and physical self-concept. Within the domain of physical self-concept, Marsh and colleagues (Marsh, Relich, & Smith, 1983) identified physical ability and physical appearance as particular subdomains. Marsh and Shavelson (1985) found support for the multidimensional nature of self-concept, that is, self-concepts in more particular domains are subsumed under self-concepts in more general domains. In 2006, Marsh and Craven confirmed that these different dimensions of self-concept (e.g., physical ability or appearance) are distinctive, because they arise from perceptions of personal behaviour in particular situations. Recent research discussed if young children are capable enough to differentiate these particular domains of the physical self (Lohbeck, Tietjens, & Bund, 2017; Tietjens et al., 2018) with increased differentiations with age (Harter, 2012; Wigfield & Karpathian, 1991). This is why physical self-concept is considered to be developmental. Hierarchical means that perceptions of behaviour lead to perceptions in certain domains and this contributes to a general self-concept, that is, perceptions of specific behaviours (such as

physical fitness) are overlaid by more general perceptions in a given subdomain (e.g., school, social relationships), with general self-concept at the apex of the pyramid (Shavelson et al., 1976). The multidimensionality of self-concept is well accepted (Bong & Skaalvik, 2003), nonetheless the hierarchical model has been criticised because the different domains may not reflect a higher order factor (Harter & Pike, 1984).

Those conducting developmental research (e.g., Harter, 1981a, 1982, 1984, 2012) have examined thoroughly children's and adolescents' capabilities in reporting their physical self-concept according to their developmental stages (i.e., sensorimotor, preoperational, concrete operational and formal operational stages; Piaget, 1952). Young children's self-perception focuses on their behavioural and physical characteristics, whereas older children incorporate a more abstract psychological perspective in their descriptions (Wigfield & Karpathian, 1991). These changes can be due to development in cognitive processing as children age (Harter, 1982). Young children confuse the wish to be competent with the reality (Harter & Pike, 1984), so until around eight years-old, there is limited ability to report self-judgements accurately. Thus, one of the main recommendations from Harter is the importance of using appropriate and suitable procedures for the assessment of young children's perceived competence. In this line, the instruments used should be (1) pictorial, (2) have the ability to provide an appropriate number of choices per item (e.g., two choices instead of four), and (3) should be adapted according to the age range. Recent studies in the field have confirmed the reliability and validity of different pictorial scales in the assessment of children's perceived competence in young age groups (Barnett et al., 2015, 2016; Tietjens et al., 2018).

Another issue in the utilisation of self-report scales for assessing physical self-concept, is the existence of non-aligned tools between actual performance and related perceptions. To understand how well children's perceptions are aligned with their actual performances, it is suggested that the constructs are identified in a similar way (Barnett, Ridgers, Zask, & Salmon, 2015). Otherwise there is the possibility children might perceive their physical ability differently to their actual level (Barnett et al., 2016) and, consequently the predictive validity is reduced. Thus, when considering that physical fitness refers to a set of physical aspects that people have or achieve, such as endurance, strength, speed or flexibility (Caspersen, Powell, & Christenson, 1985; Utesch, Dreiskämper, Strauss, & Naul, 2018), it follows, that a measure of self-concept should assess similar items. In this line, during childhood, actual physical competence in terms of physical fitness, must involve these aforementioned attributes (i.e., cardiorespiratory and muscular endurance, strength, speed, coordination and flexibility) (Utesch, Dreiskämper, Strauss, et al., 2018).

Considering the recommendations from Harter (Harter, 1981b, 1982, 2012; Harter & Pike, 1984), and the importance of an aligned scale, a research group from Germany and Australia has created a new pictorial scale for assessing perceived physical competence in children (Tietjens et al., 2018). The scale is derived from the Physical Self-Description Questionnaire (PSDQ) designed by Marsh (1996) to measure nine specific components of physical self-concept (strength, body fat, physical activity, endurance/fitness, sports competence, coordination, health, appearance, flexibility). The Pictorial Scale of Physical Self-Concept for Children (P-PSC-C) thus assesses a series of physical abilities such as strength, endurance, speed, flexibility, general sportiness and coordination, and also, physical appearance but as a one-dimensional construct. It is in line with other questionnaires measuring physical self-concept in other age groups, i.e. the PSDQ (Marsh, 1996) for adults, or the PSC-C (Dreiskämper, Tietjens, Honemann, Naul, & Freund, 2015) for children older than 10 years. The P-PSC-C is feasible, reliable and presents appropriate face and construct validity in

young children (Tietjens et al., 2018). However, there is no evidence of construct validity of this scale in Spanish speaking children nor has this scale been studied in children from different age groups.

Studies analysing Spanish speaking children's physical self-concept [by using the Self-Perception Profile for Children scale from Harter (Harter, 2012) or the Physical Self-Perception Profile scale from Fox and Corbin (Fox & Corbin, 1989)] showed contradictory results. On the one hand, for primary school children, the factorial structure did not fit properly and reliability was limited, possibly due to more abstract self-description and not well developed cognitive skills (Atienza, Balaguer, & Moreno, 2002). Whereas for children aged 10-11 years-old, whilst the model for measurement of physical self-concept needed modifying, after modification there was a good fit (Moreno-Murcia, Cervelló, Vera, & Ruiz-Pérez, 2007). When physical self-perception was studied in adolescents, some difficulties in understanding the content was also highlighted in some cases (Atienza, Fox, Balaguer, & Moreno, 2004), nonetheless, the structural equation modelling supported the validity of the instrument used.

Hence, taking into account that physical fitness is a key factor in child development and an important predictor (in conjunction with the child's perception) of relevant health outcomes such as physical activity (Robinson et al., 2015; Stodden et al., 2008), it seems important to have appropriate instruments to assess this construct. Thus, the purpose of this study was to examine the internal consistency and construct and convergent validity through confirmatory factorial analysis of the Spanish version of the P-PSC-C in two age ranges in childhood. As a result of the nature of cognitive and motor development in childhood and due to the nature of the P-PSC-C, it is hypothesised that this scale will present appropriate construct and convergent validity for children. Moreover, older children (late childhood) will show more reliable reports than the younger children (middle childhood).

Methods

Participants

The current study is a part of a larger longitudinal project wherein children parents and physical education teachers report during three consecutive years in three time points (i.e., an assessment per year) (e.g., Estevan et al., 2018). A non-probabilistic recruitment from ten schools (one kindergarten and nine primary schools) in the Valencian Community (Spain) was followed for a convenience sample of 365 children (44.4% girls), 4 to 11 years of age (M = 9.21, SD = 1.92) who participated in the study voluntarily. All the school Principals contacted agreed to participate in the study and all parents provide informed consent for their child's participation. Children were included in data analyses if they: (1) were between 4 and 11 years-old; (2) were in full-time enrolment in a mainstream primary school or kindergarten; (3) had Spanish as the main language at school; (4) provided his/her own verbal assent to be involved. Children were excluded from the analyses if they had a physical, neurological, learning or intellectual disability. Approval was obtained from the Institutional Review Board of the University (H1446557620395).

Instruments

The pictorial instrument P-PSC-C designed by Tietjens et al. (2018) to assess perceived physical competence in children was translated from English to Spanish following a back-translation process. This process consisted of four main steps: (1) an independent English specialist translated the original version into Spanish; (2) another specialist, who did not have access to the original English version, completed a back translation to English; (3) these back translations were read by two authors who made some suggestions for language adjustment to better reflect the intention. Finally, (4) the translated version into Spanish was semantically adjusted by the Spanish authors of this paper to reflect the movement skills appropriately in agreement with the two specialists. No changes on the item drawings and scoring system were made.

The P-PSC-C consists of seven items representing physical self-concept: physical fitness (5 items: strength, endurance, speed, flexibility and coordination), general sportiness (1 item) and physical appearance (1 item). Each item was rated on a 4-point ordinal scale following a two-step dichotomous choice structure. First, children have to choose which child in the two given pictures is most like themselves (i.e., the child who is competent or who is less competent at the given item). Second, they have to choose between 'really good' or 'pretty good' in the case they chose the child who is competent, or between 'sort of good' or 'not so good' in the case they chose the child who is less competent. The range score for the total scale was 7 – 28. Two sex-specific versions of the P-PSC-C were used: one for boys and one for girls.

An additional pictorial item following the same format as the P-PSC-C related to perceived enjoyment in sport and physical activity (i.e., This boy/girl likes to do sports – This boy/girl doesn't like to do sports. Which boy/girl is the most like you?) was used as an estimation of convergent validity.

Procedure

Data assessment was conducted by research assistants (all specialists in teaching Physical Education in primary school) who received a 4h training consisting of two different sessions involving practical examples with children aged 6 – 7 years-old. The purpose of this training was to explain instructions appropriately, to administer the questionnaire by a survey objectively and to minimise the risk of bias.

Data collection was conducted in the respective schools and kindergarten in a quiet room using an individual survey (administration time per child was around 10 min). At first, the whole sample was assessed, then 7 – 10 days later a subsample of four schools were selected out of the ten schools, and these pupils (n = 223) were reassessed to determine test-retest reliability.

Statistical analysis

Since the measurement scales in the context of physical self-concept are expected to be skewed, only an ordinal scale is expected. Therefore, all model requirements were specified for ordinal scales. First, descriptive parameters for all items were calculated and a correlation matrix using Kendall's τ was provided. Second, reliability was estimated as point estimation using polychoric reliability, which estimates reliability of ordinal Likert scales using the polychoric correlation matrix (cf. Gadermann, Guhn, & Zumbo, 2012). McDonald's ω and Cronbach's α are presented in terms of comparability with other studies. Reliability was moreover analysed as a function in contrast to a point estimation. The reliability function

estimates the reliability along the continuum of physical self-concept levels. Regarding test retest reliability, Kendall's τ was calculated for all eight items.

On the measurement model level, a one-dimensional latent variable was assumed. Physical appearance as the second domain of physical self-concept was not considered in the present measurement model as it does not belong to the fitness dimension. Sport enjoyment is not considered to be part of physical self-concept, rather, it is considered to be an outcome or related variable. Therefore, a one-factor confirmatory factor analysis (CFA) was conducted to test the assumed one-dimensional model that is measured by the items strength, endurance, speed, coordination, flexibility and general sportiness as these items describe the hypothesised physical fitness domain according to the theoretical model of Shavelson et al. (1976). The diagonally weighted least square estimator specifically designed for ordinal data and a scaled test statistic was used. Latent factors were standardised, allowing free estimation of all factor loadings (see https://osf.io/pg4fy/?view_only=a77df7f94e0e460b8dc4b7489aaef2da for open code and the exact model specifications). Within the CFA, probabilistic scale usage of participants was investigated by modeling threshold parameters between each response category for each item. Threshold analysis was conducted in order to check the assumed ordinal structure of the scale. Further, considering the present sample consisted of participants in a wide age range, the question of whether physical self-concept differentiates across childhood was conducted by testing measurement invariance for children younger than 10 years and children aging 10 years or older. Further, measurement invariance was examined for gender. Evaluation of CFA model fit was guided by criteria proposed by Hu and Bentler, (1999; CFI > .90, TLI > .90; RMSEA < .06, SRMR < .08). As Harter (1982), Dreiskämper et al. (2015) and Tietjens et al. (2018) found in childhood, physical self-concept is influenced by gender and age, with boys rating themselves higher than girls in all the single items except flexibility, and older children showing lower physical self-concept levels. Therefore, differences according to gender and whether there is a negative correlation between age and physical self-concept evaluations, will be tested using Student *t*-tests and Spearman correlations, respectively ($p < .05$).

All statistical analyses were conducted via the System for Statistical Computation and Graphics R version 1.1.423 (R Core Team, 2016) with the packages *lavaan* (Rossel, 2012), *semTools* (semTools Contributors, 2016), and *psych* (Revelle, 2017).

Results

Confirmatory validity

Item characteristics for all variables assessed are presented in Table 1. Participants reported the highest levels of physical self-concept in the coordination and speed domains whereas the lowest levels were reported under general sportiness. The results show that all items are answered on the upper level of the scale (also seen by the median). This means that children tend to rate their physical self-concept relatively high.

Bivariate correlations of all variables assessed are presented in Table 2. Small to medium positive correlations were found between the variables. Descriptively, flexibility has the lowest correlations with the other items.

Scale reliability was acceptable given the age of the children and the nature of the scale (ω_h = .63; for better comparison with other scales, Cronbach's α = .74). However, reliability was also estimated as a function. This means, that the reliability is estimated for each level of physical self-concept (i.e., many point measures for each possible level of physical self-

concept), instead of a point measure. The analysis shows that reliability function has the form of a normal distribution, which is shifted (see Figure 1 for a graphical illustration of the relationship between level of physical self-concept and level of reliability). Thus, reliability is low for children with very low levels and very high levels of physical self-concept. The maximum of the reliability curve occurs for children that are below average. The reason would be that the majority of children tend to estimate their physical self-concept relatively high and, therefore, the discrimination of the scale would be lower for children with high physical self-concept levels. Considering the age of the sample, test-retest reliability was acceptable for all items with values ranging from $.47 < \tau < .77$ (see Table 1). However, coordination shows the weakest test-retest reliability, which emphasises that children have the largest difficulties with this concept in this age group.

Table 1. Descriptive Statistics of the study variables

	M	*SD*	Median	Test-retest reliability Kendall's tau	Test-retest reliability *p*
Sportiness	2.60	0.92	3	.50	< .001
Flexibility	2.76	1.03	3	.66	< .001
Endurance	2.78	0.96	3	.67	< .001
Speed	2.98	0.94	3	.57	< .001
Strength	2.84	0.88	3	.61	< .001
Coordination	2.99	0.97	3	.47	< .001
Appearance	2.91	0.88	3	.77	< .001
Enjoyment	3.40	0.80	4	.67	< .001

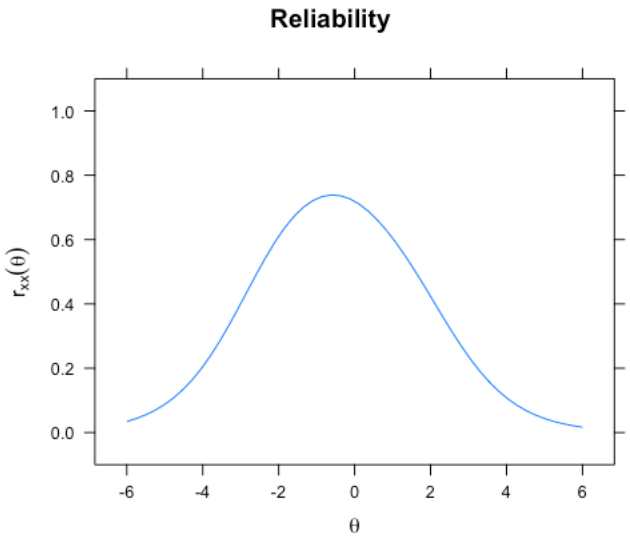

Figure 1. Reliability curve for the six-item scale of physical fitness consisting of strength, endurance, speed, flexibility, general sportiness, and coordination. The axis of abscissas (x-axis) shows the level of physical self-concept (i.e., θ) from low levels (negative) to an average level (zero) to high levels (positive). The axis of ordinates (y-axis) shows the level of reliability that can be interpreted in the same way as Cronbach's α. The blue line represents the reliability function for the given physical self-concept level.

The one-dimensional CFA was calculated using the items general sportiness, flexibility, endurance, strength, speed, and coordination. The fit for the one-dimensional CFA was excellent (χ^2 = 29.80, *df* = 9, *p* < .001; CFI = .99; TLI = .98; RMSEA = .055, 90% CI = .019 – .090; SRMR = .046). Standardised factor loadings regarding the general physical self-concept factor were λ = .33 – .75. Standard errors were *SE* = .04 – .06 are presented in detail in Table 3. The additional analysis regarding measurement invariance for children from 6-9 (*n* = 128) vs. children from 10-11 (*n* = 237) showed only configural invariance, but no metric invariance (*p* = .01). This means that the factorial structure between both age groups was equivalent, but the loadings for the different items were different. The CFA with group factor age ($\chi^2_{younger}$ = 28.925, χ^2_{older} = 19.662, *df* = 30, *p* < .001; CFI = .96; TLI = .94; RMSEA = .097, 90% CI = .065 – .013; SRMR = .069) revealed that the item assessing flexibility had an insufficiently low factor loading for older children (λ = .11), which is an indicator for a more differentiated self-concept in older age groups. Further, the additional analysis regarding measurement invariance for gender (boys vs. girls) showed configural invariance and weak (loading) invariance (*p* = .65), but no strong (intercept) variance (*p* < .001), which means that the loadings between boys and girls can be regarded as being similar (χ^2_{boys} = 12.681, χ^2_{girls} = 18.926, *df* = 30, *p* < .001; CFI = .98; TLI = .97; RMSEA = .065, 90% CI = .023 – .102; SRMR = .060). This means that boys and girls score differently (comparable to the means on the scale) on the latent total score. For instance, boys score higher in endurance than girls.

Table 2. Correlation Matrix with Kendall's tau.

	Flexibility	Sportiness	Endurance	Speed	Strength	Coordination
Flexibility	1					
Sportiness	.16	1				
Endurance	.21	.41	1			
Speed	.16	.26	.44	1		
Strength	.13	.30	.19	.16	1	
Coordination	.12	.34	.25	.29	.18	1

Note. All correlations were significant *p* < .02.

Detailed analysis regarding the scale usage showed ordered threshold parameters for all variables in the full sample as well as for older and for younger children separately (see Table 3). This means, the scale is used in the expected way and the children respond to the scale in an ordinal way responding higher on the Likert scales with higher overall physical self-concept.

Criterion validity

Spearman-correlations (rho or ρ) showed significant negative correlations between age and flexibility (*rho* = -.37), general sportiness (*rho* = -.11), endurance (*rho* = -.27), and the overall factor (*rho* = -.36). Also, sport enjoyment was positively related to all items (.13 < τ <.48). Furthermore, the relationship between enjoyment and composite physical self-concept was τ = .45 (*p* < .001), which can be interpreted as a convergent validity estimation.

Paired *t*-tests showed significant differences between boys and girls in the items endurance, velocity, strength, coordination and general sportiness in terms of boys rating themselves higher than girls ($t_{(2, 359)}$ = 3.01 – 4.63, p = .001 - .02). Girls rated themselves higher in flexibility ($t_{(2, 359)}$ = -2.31, $p < .05$). No differences were found for appearance ($p > .05$).

Table 3. Results from confirmatory factor analysis.

	λ	SE	Z	*p*	Threshold 1	Threshold 2	Threshold 3
Full sample							
Sportiness	.72	.06	19.68	< .001	-1.12	-0.16	0.96
Flexibility	.33	.04	5.55	< .001	-1.05	-0.30	0.54
Endurance	.75	.04	20.52	< .001	-1.19	-0.36	0.64
Speed	.65	.04	16.00	< .001	-1.39	-0.55	0.38
Strength	.44	.05	8.77	< .001	-1.43	-0.47	0.70
Coordination	.57	.05	12.72	< .001	-1.34	-0.54	0.33
Children aged 6-9							
Sportiness	.77	.05	14.48	< .001	-1.23	-0.32	0.68
Flexibility	.45	.08	5.37	< .001	-1.99	-1.01	-0.12
Endurance	.72	.06	11.53	< .001	-1.47	-0.98	0.26
Speed	.67	.06	11.15	< .001	-1.98	-1.15	0.01
Strength	.58	.07	8.17	< .001	-1.47	-0.73	0.58
Coordination	.62	.07	9.07	< .001	-1.47	-0.63	0.02
Children aged 10-11							
Sportiness	.72	.05	13.43	< .001	-1.07	-0.07	1.14
Flexibility	.11	.08	1.41	.160	-0.79	0.02	0.99
Endurance	.72	.05	14.59	< .001	-1.07	-0.09	0.89
Speed	.59	.06	10.43	< .001	-1.21	-0.31	0.55
Strength	.33	.07	5.02	< .001	-1.40	-0.34	0.77
Coordination	.53	.06	9.24	< .001	-1.27	-0.50	0.51

Discussion

Physical self-concept is said to be a crucial factor in the context of motor development (e.g., Stodden et al., 2008; Babic et al., 2014). This is because the interaction between fitness and motor competence and especially ones' self-perception, is argued to be important for the amount of physical activity in childhood (Moreno-Murcia et al., 2007; Utesch, Dreiskämper, Naul, et al., 2018). Recent literature (e.g., Tietjens et al., 2018) claims the necessity of valid and age-appropriate instruments in order to investigate relevant factors that have the possibility to influence or even foster physical activity, especially in childhood. This creates the need for instruments that can measure physical self-perceptions (or in other words physical self-concept). Therefore, this study aimed to offer an instrument that uses an age-appropriate measurement (i.e., a pictorial scale with a decision-tree type answer format, requiring two dichotomous decisions for each item, in one-to-one situations with only a few items) in order to measure the physical fitness part of physical self-concept in a child friendly

way in Spanish. The questionnaire was originally developed and tested for feasibility in German (Tietjens et al., 2018) and includes items about endurance, speed, strength, coordination, flexibility and general sportiness. The results presented in this study show a high potential for the pictorial scale to be suitable for the given age group in measuring physical self-concept. Item statistics and reliability values are good for the present age group. However, not surprisingly for this age group, the within item distribution (scale usage within the single items) and distribution of the composite score reflecting overall physical self-concept are relatively high, which supports the assumptions present in the literature of developmental psychology (Harter, 2012).

Results for scale validity could be confirmed regarding the assumed factorial structure and also the tested scale-usage as reflected by the conducted invariance tests and the order of the three thresholds per item, which was as intended. These results confirm that a one-dimensional of physical self-concept in this age group is possible. This is found for both age groups and for gender and fits to the assumptions of a one-dimensional structure in young age groups (e.g., Harter, 1982; Tietjens et al., 2018). However, the only small to medium correlations between the items that concur with those obtained in Spanish pre-adolescent youth (Borrego-Balsalobre, López-Sánchez, & Díaz-Suárez, 2014; Moreno-Murcia et al., 2007) would indicate that these single items do not measure the same physical ability, but single parts of it which are differentiated over the period of childhood (Marsh & Ayotte, 2003). Alternatively, it may be that the components of physical self-concept are still becoming differentiated as individuals age and grow (Moreno-Murcia et al., 2007). This is also supported by the results of the invariance analysis: on the one hand convergence validity is shown in general comparing both age groups; on the other hand, empirical assumptions about age influences were confirmed in the present study, because it showed that some items might not fit into the one-dimensional understanding of physical self-concept with higher age (i.e., flexibility). The idea that flexibility is the first item that splits from a one-dimensional fitness-related physical self-concept (also named physical ability) has also been found in actual fitness tests. Utesch, Dreiskämper, Strauss et al. (2018) showed that flexibility does not fit into the one-dimensional measurement of physical fitness at the age of 9, but that it is relatively stable (Utesch, Zinner, & Büsch, 2018). In this study, we found that flexibility does not fit into the one-dimensional model for children aged 10-11 years old, which is one year later compared to the actual fitness. These results evidenced the complexity of the assessment of physical ability may be due to children's cognitive development and sport related-social stereotypes (Moreno-Murcia et al., 2007) wherein harmonious and beauty movements such as dance seem to be linked to females and strength and endurance disciplines such as football or handball seem to be related to boys. As a result, it would be necessary to analyse children's physical self-concept longitudinally from childhood into adolescence according to the gender.

Further evidence related to the convergence validity of the Spanish version of the P-PSC-C is the positive relationship with sport enjoyment. Those children who perceive themselves as more physically competent report high enjoyment in physical activity and sport practice (Lohbeck, Tietjens, & Bund, 2016). The results of the current study show high scores in sport enjoyment, with the maximum value being the median one (see Table 1). Due to one of the current major public health concerns (i.e., obesity in childhood) (Mitchell, Moore, Bibeau, & Rudasill, 2012), especially in Spain, and the existence of a positive relationship between engagement and enjoyment in physical activity (Lohbeck et al., 2016), this could imply an inspiring outcome in terms of physical activity promotion and preventive healthy weight status in Spanish children.

Another factor related to children's weight status is physical appearance. It must be also noted that perceived physical appearance is negatively related to children's overweight and obesity in those with low physical fitness (Mitchell et al., 2012). Even though the connection between perceived physical ability and physical appearance appears evident, it is suggested these factors are analysed separately (Shavelson et al., 1976) which is what was done in this study. Interestingly, according to Moreno-Murcia et al. (2007) who already pointed out the heterogeneity of findings in the physical appearance according to the children's gender in different cultures, the results of the current study shows Spanish boys and girls reported similarly in their physical appearance. These results can be seen as positive because it appears to promote social relationships and the physical activity engagement (Moreno-Murcia et al., 2007), nonetheless, these particular associations need to be studied in future research.

Results also show that children rated themselves relatively high on the items. This also fits to general empirical findings regarding children's self-perception (Alfermann et al., 2003; Babic et al., 2014). As Dreiskaemper et al. (2018) discuss, this over-estimation can be explained by a lack of experience and possibilities of comparisons and seems to be normal for young to middle childhood. As the threshold parameters are ordered for all items, the skewness of the scale based on the high self-ratings does not influence the construct validity of the scale. The negative correlations to age are in line with empirical findings (Harter, 1988) as well as answer distributions in other questionnaire studies in this age range (e.g., Barnett et al., 2016; Dreiskaemper et al., 2015; Tietjens et al., 2018).

Next to these age-typical results, the differences between genders in terms of boys rating themselves higher than girls on nearly all items of physical ability except flexibility (here, girls had higher levels) confirm empirical assumptions about gender differences. This was also supported by the invariance testing on gender, which showed gender differences in the latent mean of physical self-concept, but equal item loadings. In particular, the gender related differences fit to known results in other self-concept questionnaires in sport (e.g., Dreiskaemper et al., 2015; Stiller et al., 2004; Marsh, Craven, & Debus, 1991) and in perceptions of motor skill (Estevan et al., 2018).

From a conceptual perspective, it can be challenging for children to understand and report on their physical self-perception, maybe due to the abstract notion of the physical self-concept (Moreno-Murcia et al., 2007). This highlights the necessity of using appropriate adapted scales to assess what is set out to do (Marsh, Asci, & Tomas, 2002). Concretely, the pictorial scale PSC-C can be applied to assess perceived physical concept in young children.

Physical Education can contribute to the development of physical self-concept in youngsters and to attitudes toward the practice of physical activity that can extend through the lifetime (Moreno-Murcia et al., 2007). According to the current Spanish Law of Education in Primary School (Spanish Royal Decree, 2014), there are 14 main goals every pupil must acquire; one of them is related to the use of different images and expressions to create visual proposals. Another one is to recognize health, accept ones and others' bodies, and respect differences by using physical education as a way to promote social and personal development. Moreover, during physical education classes it is also considered that children must acquire an integrative knowledge, procedures, attitudes and feelings linked to healthy motor behaviour. To get this goal, the teachers must promote critical attitudes so that the pupils understand perceptual, emotive and cognitive aspects related to motor tasks and derived feelings (Spanish Royal Decree, 2014). As a result, the perception, interpretation and evaluation of motor behaviour must be present in the learning process not only during the practice lessons but also in the theoretical ones. Thus, the use of the P-PSC-C during physical education classes that is

mainly related to block 4 "Physical Activity and Health" so that content related to physical fitness (i.e., endurance, strength, flexibility, etc.) could be taught so that pupils' self-esteem/concept is enhanced.

Moreover, children's physical self-perceptions are integral in influencing their choice to initiate and maintain physical activity (Mitchell et al., 2012). Physical self-concept also relates to physical fitness, that is, low levels of fitness are associated with greater risk of poor physical self-perceptions (Mitchell et al., 2012). Moreover, in Spain, the development of physical fitness and perceived physical self-concept is associated with physical activity and both can be enhanced through physical education lessons (Borrego-Balsalobre et al., 2014). With the curricular aims in mind, it is suggested to physical education teachers that use of the P-PSC-C may help the pupils to realize what is self-concept (related to the physical field), and how pupils perceive themselves, in order to promote pupils' physical competence and indirectly, their physical activity practice.

This study is not without limitations. The design is cross-sectional, so we can only describe differences between two different age or gender groups. In order to analyse developmental effects and changes, longitudinal designs are needed. It must be noted that some of the sub-latent factors assessed in the study (e.g., physical appearance) have been done by using one item. It is recommended that future studies in the assessment of children's physical concept analyse the association between this pictorial item and new specific scales with at least three or more pictorial items. Furthermore, this study cannot test predictive validity, for example for physical activity behaviour. As different models (Hulteen et al., 2018; Robinson et al., 2015; Stodden et al., 2008) argue that there is a reciprocal effect between physical activity, motor competence/fitness and physical self-concept, research should focus on the predictive power of physical self-perception more in depth.

Conclusion

The P-PSC-C is a relatively new instrument for investigating physical self-concept in childhood. It has the potential to track children's physical self-concept from early age onwards. As it is comparable to other instruments for older age groups (e.g., the PSC-C and the PSDQ, because it is based on the same determinants of physical fitness / physical self-concept) it gives the opportunity to track children over the complete period of childhood and youth. Therefore, developmental aspects such as changes due to a more realistic self-perception of one's abilities can be observed. Also, socialization aspects like possible gender differences can be analysed. To empower children to be physically active, it is important to strengthen their self-perception as it has the potential to effect their motivation and enjoyment. This interaction hasn't been looked at in detail yet for these age groups. The instrument is applicable to address these research questions but also to be used in intervention studies on physical activity due to the relatively quick assessment. Besides, longitudinal designs can help to answer the questions of what predictors influence the development of physical self-concept and, on the other hand, how physical self-concept itself can be a predictor for health behaviour like physical activity.

Moreover, as German, English (in progress) and Spanish translations are available, the chances of intercultural studies in motor development and physical self-concept are possible. As the interplay between actual fitness and physical self-concept is said to be an important factor for physical activity behaviour (Hulteen et al., 2018), instruments like the P-PSC-C are a useful and necessary new tool for physical activity and motor development research.

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