Psychometric properties of the French Version of the Pictorial Scale of Physical Self-Concept for Younger Children (P-PSC-C)

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Abstract

The objective of this study was to examine the psychometric properties of a French version of the Pictorial scale of Physical Self-Concept for younger Children (P-PSC-C). A sample of 216 French-speaking Canadian children (aged 5 to 12 years) participated in this study. Results supported the validity and reliability of the *a priori* single factor structure of the P-PSC-C. Subsequent analyses also supported the partial weak, strong and strict invariance of this *a priori* measurement model as a function of children's sex, and revealed latent mean differences showing that boys tended to present higher scores on the P-PSC-C compared to girls. The results also revealed a lack of latent mean differences as a function of age, body mass Index (BMI) and physical activity/sport involvement. They also revealed evidence of differential item functioning (DIF) as a function of age and BMI (but not physical activity/sport involvement), showing that: (a) older children tended to score lower on the endurance, flexibility and physical appearance items relative to younger children; and (b) children with a higher BMI tended to score lower on the endurance item relative to children with a lower BMI. Finally, analyses of convergent validity revealed that the scores on the global P-PSC-C factor was significantly and positively related to enjoyment in sports.

Keywords: age; body mass index; physical activity; physical self-perceptions; sex.

Public Significance Statements

- The French version of the Pictorial scale of Physical Self-Concept for younger Children (P-PSC-C) has acceptable psychometric properties and can be confidently used in research or practice to assess children's global physical self-conception.
- The P-PSC-C can be used in the context of group-based comparisons as functions of age, body mass index, physical activity/sport involvement and sex.

In sport and exercise psychology, physical self-concept is considered as one of the main determinants of youth physical activity behavior and it also plays a central role in several theories seeking to explain the motivation to remain physically active (e.g., competence motivation, self-determination, social cognitive, planned behavior) (Babic et al., 2014). More importantly, body image (or the positive or negative perception of one's physical appearance), a core component of physical self-concept, has itself been found to predict a wide range of psychological outcomes (e.g., Davison & McCabe, 2006; Newman et al., 2006) and to play a key role in driving psychological well-being throughout the lifespan (e.g., Kim & Kim, 2009; Rawana & Morgan, 2014; Wang et al., 2019).

Physical self-concept was initially defined by Fox and Corbin (1989) as a multidimensional and hierarchical construct. In this conceptualization, the top of the hierarchy is occupied by global physical self-conceptions across all life domains, the intermediate level is occupied by global self-conceptions across all physical domains, and the lower level is occupied by domain-specific physical self-conceptions (such as flexibility, sport competence, appearance, physical condition, speed, physical strength, and coordination). Two well-established questionnaires have been developed to measure physical self-concept based on this conception: The Physical Self-Perception Profile (PSPP; Fox and Corbin, 1989) and the Physical Self-Description Questionnaire (PSDQ; Marsh et al., 1994). These questionnaires have also been adapted for participants in middle and late childhood (i.e., Children and Youth PSPP; Welk & Eklund, 2005; Physical-Self-Concept questionnaire for Children [PSC-C], Dreiskämper et al., 2015; Lohbeck et al., 2017). However, they remain inappropriate for use with younger children (3-8 years), who are typically unable to read or, at least, to properly understand the subtle differences in meaning captured by different physical self-concepts items (Tietjens et al., 2018).

This limitation led Tietjens et al. (2018) to develop the Pictorial scale of Physical Self-Concept for younger Children (P-PSC-C). The P-PSC-C was developed to operationalize Fox and Corbin's (1989) model by providing a direct assessment of children's global physical self-conception through the use of items directly related to the physical self-domains most commonly involved in physical education activities implemented among young children. More specifically, the P-PSC-C includes six items related to aspects of physical fitness (1. Flexibility; 2. Sportiness, or sport competence; 3. Endurance, or physical condition; 4. speed; 5. Strength; 6. Coordination), and one item related to Physical Appearance. These items are fully aligned with the various physical self-concept facets typically assessed in other physical self-concept measures (e.g., the PSDQ, PSPP, PSC-C).

Children complete the P-PSC-C using a two-step procedure (Tietjens et al., 2018). First, two figures are shown to the child: One representing a boy or a girl that possesses the characteristic that is being assessed and one representing a boy or a girl that do not possesses this characteristic. Children are then asked to point to the figure in which the boy or the girl performing the skill is most like them. Second, children choosing the figure representing the presence of the characteristic are asked if they strongly or moderately present this characteristic. Children choosing the figure representing the absence of the characteristic are asked if they possess the characteristic a little or if they do not possess it at all.

Tietjens et al. (2018) examined the applicability of the original German P-PSC-C among a sample of 27 children (3 to 6 years old). Their results supported the face validity of the P-PSC-C, its convergent validity in relation to measures of perceived locomotion, object control and enjoyments in sports, and revealed a lack of differences as function of sex.

Validation in Other Languages or Cultures

To our knowledge, only two studies have attempted to cross-validate the P-PSC-C, focusing more specifically on the Spanish (Estevan et al., 2019) and Portuguese (Nobre et al., in press) versions of this instrument. As their focus was strictly on physical fitness, both studies excluded the appearance item from the analyses. Estevan et al. (2019) administered the P-PSC-C to a sample of 365 Spanish children aged 4 to 11 years. Their results first supported the factor validity and reliability of a single factor solution. In addition, tests of measurement invariance revealed that the factor loadings differed across age groups, and that item response thresholds differed across sex. Additionally, boys demonstrated significantly higher scores than girls on the endurance, speed, strength, coordination and sportiness items, whereas girls demonstrated a significantly higher score on the flexibility item. Finally, correlational analyses showed significant and: (a) negative relations between age and the overall P-PSC-C score as well as responses to some items (flexibility, sportiness, and endurance); and (b) positive relations between sport enjoyment and the P-PSC-C overall score, as well as on all items.

Nobre et al. (in press) assessed 300 Brazilian children aged between 8 to 10 years. Their results supported the factor validity, scale score reliability, and test-retest reliability of a single factor solution, which proved to be invariant as a function of sex and age. They were also able to demonstrate the concurrent validity of the P-PSC-C in relation to measures of perceived motor competence, and perceived athletic competence.

Although informative, these studies present some limitations that need to be addressed. First, although the feasibility study of Tietjens et al. (2018) supports the possible utility of the P-PSC-C, this study did not investigate its factor validity and reliability. To date, the factor validity of the P-PSC-C factor structure was thus only demonstrated in the studies by Estevan et al., (2019) and Nobre et al. (in press), relying on an incomplete set of items. Therefore, the replication of the factor structure of the P-PSC-C and tests of its generalizability to other linguistic or cultural groups remain limited.

Second, there is very little evidence that the P-PSC-C is able to provide reliable information when used to compare subpopulations of children presenting different characteristics (e.g., age, sex, body mass-index [BMI], physical activity/sport involvement), despite the fact that previous research does generally support the presence of associations between these characteristics and youth's physical self-perceptions (Lau et al., 2004; Lohbeck et al., 2016; Murcia et al., 2007; Planinšec & Fošnarič, 2005; Sánchez-Miguel et al., 2020). The Brazilian and Spanish studies assessed the measurement invariance of the P-PSC-C as a function of sex or age. Importantly, the Spanish study failed to support the invariance of the factor loadings as a function of age, or the invariance of the items' response thresholds as a function of sex, without proceeding to a more careful examination of whether this lack of invariance could be explained by a subset of items (i.e., partial invariance; Byrne et al., 1989). Thus, the true extent to which children's responses to the P-PSC-C can be considered to be completely, partially, or not at all biased as a function of children's age, sex, BMI, and physical activity/sport involvement remains unknown.

Finally, to our knowledge, there is currently no pictorial scale available to assess physical self-conceptions among French-speaking children. This lack of a validated measure creates a significant obstacle to the implementation of cross-cultural studies involving French-speaking participants. Indeed, French is the, or one of two, most commonly spoken language in many European (e.g., Belgium, France, Switzerland), American (Canada, Haiti, French Guiana), and African (e.g., Morocco, Tunisia, Mali, Cameroon) countries.

Overviews of the Study

The objective of the study was to investigate the psychometric properties of the French version of the P-PSC-C among a sample of French-speaking Canadian children. First, the P-PSC-C was adapted to French. Second, the factor validity and reliability of the P-PSC-C were examined. Third, the measurement invariance of the P-PSC-C was investigated across sex. Fourth, the presence of differential item functioning (DIF) in responses to the P-PSC-C ratings was examined as a function of children's age, BMI and physical activity/sport involvement. Fifth, the convergent validity of the P-PSC-C was examined in relation to a measure of enjoyment in sports.

Method

Participants

The participants of this study were 216 French-speaking Canadian children (5 to 12 years old, *M* = 7.99, *SD* = 1.74; BMI: 11.29 to 31.86 kg/m², *M* = 16.66, *SD* = 3.03). Among these, (a) 6% were 5 years-old, 14.4% were 6 years-old, 25.6% were 7 years-old, 16.3% were 8 years-old, 15.3% were 9 years-old, 13.5% were 10 years-old, 6.5% were 11 years-old, and 2.3% were 12 years-old; (b) 51.4% were girls (N = 111) and 48.6% were boys (N = 105); and (c) 82.7% practiced a physical activity/sport outside school (N = 177) and 17.3% did not practice a physical activity/sport outside of school (N = 37). Potential participants were excluded if they presented a characteristic likely to bias their P-PSC-C responses or limit their ability to complete the questionnaire (i.e., developmental delay, neurological disorder, sensory or physical disabilities, or needed assistance to move).

Measures

Children Characteristics. Information about children's sex, age, height, weight, and physical/sport practice involvement outside of the school context were obtained directly from parents/legal representatives. BMI (in kg/m^2) was estimated based on children's height and weight [(Weight/(Height²)].

P-PSC-C. Following standardized translation back-translation methods (Hambleton, 2005), the P-PSC-C was translated into French. A first professional bilingual translator (not familiar with the measure itself) translated the original English items into French. These items were then back-translated into English by a second independent professional bilingual translator that was also not aware of the original English items. Finally, the back-translated items were compared with the original English items and any discrepancies were resolved in a committee including both translators and four of the authors. The final French version of the P-PSC-C items (excluding the figures which are copyrighted and cannot be reproduced here) are presented in Table S1 in the online supplements. Authors seeking to obtain a complete copy of the French P-PSC-C should contact the first author.

Enjoyment in sports. A single item was used to measure enjoyment in sports. This item was developed by Tietjens et al. (2018) and is presented in Table S1. This item has been adapted to French as part of the adaption of the P-PSC-C (using the same procedures). Participants answered this item using an answer scale identical to that used for the P-PSC-C.

Procedures

The authorization to conduct the present study was granted by the research ethics committee of the Université du Québec en Outaouais (2018-117, 2850) and by the school board of the participating schools. Six public elementary schools located in the Province of Québec (Canada) were solicited and agreed to participate. Children's parents or legal representatives were contacted by an information letter. Those who agreed for their child to participate signed an informed consent form and send it back to the school. They also completed a questionnaire about their child. Children were then met at school by members of the research team. They were informed of the objectives and procedures of the study and those agreeing to participate signed a consent form and completed the P-PSC-C. A member of the research team administered the questionnaire individually at school. A booklet comprising the figures, the sentences, and the answer scales was used. The instructions and items of the P-PSC-C were read aloud by the interviewer. For each item, children were asked to point-out their responses, which were then reported on a separate scoring sheet. Participants were eligible for a chance to win one of three $30 gift certificates.

Data Analysis

Analyses were conducted using Mplus 8.3's (Muthén & Muthén, 2017) robust weighted least squares (WLSMV) estimator to account for the ordered categorical nature of the data

(Finney & DiStefano, 2013). To account for the few missing responses at the item level (0.93% to 5.56%; M = 0.93%), models were estimated using algorithms implemented in Mplus in conjunction with the WLSMV estimator (Asparouhov & Muthén, 2010).

First, confirmatory factor analyses (CFA) were used to test the original factor structure of the P-PSC-C. The goodness-of-fit of this model was examined using (e.g., Hu & Bentler, 1999; Marsh et al., 2005; Yu, 2002): the comparative fit index (CFI $\geq$ .90 and >. 95 reflect “acceptable” and “excellent” fit, respectively), the Tucker-Lewis index (TLI; same thresholds as for the CFI), and the root mean square error of approximation (RMSEA $\leq$.08 and $\leq$. 06 represent an “acceptable” and “excellent” fit, respectively) with its 90% confidence interval. McDonald’s (1970) omega (ω) was used to estimate the composite reliability of the factor.

Second, the measurement invariance of the most appropriate factor structure (retained in the first step) was tested as a function of the sex in the following sequence (Morin et al., 2011): (i) configural invariance; (ii) weak invariance (loadings); (iii) strong invariance (thresholds); (iv) strict invariance (uniquenesses); (v) invariance of the latent variance; and (vi) latent mean invariance. Comparisons between the steps of this sequence were based on changes (Δ) in CFIs, TLIs and RMSEAs. Invariance was supported when ΔCFIs/ΔTLIs were $\leq$ .01 and ΔRMSEAs $\leq$. 015 (Chen, 2007; Cheung & Rensvold, 2002). Due to their known oversensitivity to minor misspecifications and sample size, the WLSMV chi-square test of exact fit (Wχ^2) and changes in its values (ΔWχ^2 estimated using the Mplus DIFFTEST function) will be reported, but not interpreted (Hu & Bentler, 1999; Marsh et al., 2005).

Tests of measurement invariance require the formation of different subgroups of participants, and are thus harder to conduct, or less appropriate, when the variable considered is continuous (i.e., age and BMI) or involves small groups (i.e., few children were not involved in physical activity/sport). Thus, to examine the presence of measurement bias in relation to these characteristics, we relied on tests of DIF and latent mean differences conducted within a multiple indicators multiple causes (MIMIC) CFA model. These MIMIC tests of DIF were performed separately for age, BMI and physical activity/sport involvement in the following sequence (Marsh et al., 2013; Morin et al., 2013): (a) null effects model (paths from the predictors to the latent factor and item responses were constrained to be zero); (b) saturated model (paths from the predictors to the item responses were freely estimated, while paths from the predictors to the latent factor were constrained to be zero); (c) factor-only model (paths from the predictors to the latent factor were freely estimated, while paths from the predictors to the item responses were constrained to be zero). Improvement in fit (ΔCFIs/TLIs $\geq$ .01 and ΔRMSEAs $\geq$. 015) between the factor-only and the saturated models relative to the null effects model provided support for the presence of associations between predictors and item responses. Furthermore, improvement in model fit for the saturated model relative to the factor-only models provides support for DIF. Finally, the convergent validity of the latent P-PSC-C factor with an observed score on the item measuring enjoyment in sports was examined using structural equation modeling (SEM).

Results

Factor Validity and Reliability

The fit indices associated with the *a priori* CFA solution are reported in Table S2 (online supplements). This one-factor solution resulted in an excellent (CFI/TLI/RMSEA) level of fit to the data (model 1-1). The parameter estimates from this model are reported in Table S3 (online supplements) and reveal that the factor is well-defined by moderate to strong factor loadings (λ = .416 to .801). It is interesting to note that the weakest of these factor loadings is related to the physical appearance item, as could be expected from the fact that this is the only item not focusing on physical fitness. Finally, the results show that this latent factor also present a satisfactory level of composite reliability (ω = .779).

Measurement Invariance and DIF

Measurement invariance across sex. The model fit results from the sequential tests of measurement invariance are reported in Table S2 (models 2-1 to 2-9). These results failed to support the weak (loadings; model 2-2), strong (thresholds; model 2-4), and strict (uniqueness; model 2-6) invariance of this model. However, an examination of the parameter estimates and modification indices associated with all of these solutions revealed that the lack of invariance was generally limited to a subset of items. More precisely, only the following parameter appeared to differ as a function of sex: (a) the loading of the flexibility item; (b) thresholds associated with the coordination (2 thresholds), sportiness (2 thresholds) and flexibility (1 threshold) items; and (c) the uniquenesses of the flexibility and strength items. Once equality constraints on these parameters were relaxed across sex, the resulting models of partial weak (model 2-3), strong (model 2-5) and strict (model 2-7) invariance were supported. Finally, the last two steps supported the invariance of the latent variance (model 2-8), but also revealed mean differences (model 2-9) suggesting that boys tended to score significantly higher (.443, $p = .008$) on the global P-PSC-C factor relative to girls.

DIF across age, BMI and physical activity/sport involvement. The results from the MIMIC models are presented in Table S2 (models 3-1 to 5-3). For age and BMI, results showed that the saturated (models 3-2 and 4-2) resulted in a substantial improvement in model fit relative to the null effects model (models 3-1 and 4-1). However, the factor-only model resulted in a decrease in model fit relative to the null effects model for BMI (model 4-3) and to an unacceptable level of fit to the data (according the TLI and RMSEA) for age (model 3-3). These results suggest the presence of DIF as a function of age and BMI, coupled with a lack of global effects of age or BMI on global score of the P-PSC-C. Examination of the parameter estimates from the saturated model and of the modification indices associated with the null effects model suggested that direct effects of: (a) age on endurance, flexibility and physical appearance needed to be integrated to the null effects model for age; and (b) BMI on endurance needed to be added to the null effects model for BMI. Therefore, a fourth model of partial DIF was estimated (models 3-4 and 4-4) and was found to present a level of fit comparable to that of the saturated model. For age, the results showed that, although age had no impact on the global physical self-concept factor, older children tended to score significantly lower on the endurance (-.219, $p < .001$), flexibility (-.251, $p < .001$), and physical appearance (-.325, $p < .001$) items relative to younger children[1]. For BMI, these results showed that, although BMI had no impact on the global physical self-concept factor, children with a higher BMI score significantly lower on the endurance (-.267, $p < .001$) item relative to children with a lower BMI.

Finally, results from the physical activity/sport involvement predictor showed that the saturated (model 5-2) and factor only model (model 5-3) did not result in a substantial improvement in model fit compared to the null effects model (model 5-1). These results indicate a lack of DIF and of associations between this predictor and P-PSC-C responses.

Convergent Validity

The SEM resulted in an excellent level of fit to the data [χ^2 (20) = 33.711, $p = .028$, CFI = .974, TLI = .963, RMSEA = .056, 90% CI = .019-.088], and revealed a significant and strong positive correlation between the P-PSC-C and enjoyment in sports (.724, $p < .001$).

Discussion

This study sought to verify the psychometric properties of a French adaptation of the P-PSC-C among a sample of French-Canadian children. First, our results supported the factor validity and reliability of a one-factor representation of the French P-PSC-C. Interestingly, the standardized factor loadings identified in the present study were very similar to those identified by Estevan et al. (2019) and Nobre et al. (in press) among Spanish- and Portuguese-speaking children (with the sole exception of the physical appearance item, which was not included in their study and displayed the lowest factor loading in the present study).

Second, in accordance with Estevan et al.’s (2019) results, the present results revealed a lack of measurement invariance as a function of sex. However, and contrary to Estevan et al.'s (2019) results, the present results revealed that this lack of invariance could be attributed to only a subset of items and parameters: (a) flexibility (loadings, thresholds, and uniquenesses); (b) coordination (thresholds); (c) sportiness (thresholds); and (d) strength (uniquenesses). Importantly, evidence of partial invariance suggest that the P-PSC-C can be reliability used for purposes of conducting comparisons across sex, as long as these are based on latent variable models in which the differential performance of these items is accounted for. Despite this encouraging conclusion, these results also warn researchers against using manifest scores (e.g., the mean of each participant across all items) on this instrument for purposes of comparing boys and girls. Furthermore, they also call into question the adequacy of the flexibility item, which failed all tests of invariances, and suggest that researchers interested in studying sex differences might be better off deleting this item.

Third, the results revealed significant latent mean differences, suggesting that boys presented significantly higher physical self-concept than girls. This result is contradictory to the non-significant results found by Tietjens et al. (2018). However, it is important to keep in mind that Tietjens et al. (2018) relied on comparisons based on observed (non-latent) scores among a very small sample of children, which might have impeded their ability to detect this difference. Unfortunately, this result cannot be contrasted with those reported by Estevan et al. (2019), who only reported sex differences in item responses, rather than in relation to the global P-PSC-C score. These observations thus reinforce the need for further investigations of the psychometric properties of the P-PSC-C, especially in relation to sex comparisons.

Fourth, the present results supported a lack of DIF and latent mean differences in P-PSC-C responses as a function of children's physical activity/sport involvement. The former result (i.e., lack of DIF) suggest that observed and latent scores on the P-PSC-C factor can confidently be used to compare children as a function of their involvement in physical activities/sports. However, the latter result (lack of latent mean difference) is more surprising given previous research suggesting a higher physical self-concept among children involved in physical activities and sports (e.g., Murcia et al., 2007; Planinšec & Fošnarič, 2005). This result might be explained by the relatively low number of children not involved in physical activities and sports ($N = 37$), and highlights the need for additional research in this area.

Fifth, the present results revealed some evidence of DIF as a function of age and BMI. Whereas the former is aligned with results previously reported by Estevan et al. (2019), the present study is the first to consider the role played by BMI in children's responses to the P-PSC-C. More precisely, our results show that children's response to the endurance, flexibility and physical appearance items tended to be lower as they get older, whereas their responses to the endurance item tended to decrease as a function of their BMI. This observation thus suggests that these items might be excluded from analyses seeking to assess the effects of age and BMI using manifest (non-latent variables), or that this type of DIF would have to be controlled for as part of latent analyses.

Sixth, the results revealed a lack of mean differences on the P-PSC-C factor as a function of age and BMI. Although this result contradicts previous evidence obtained among older children (De Meester et al., 2016), this study is the first to assess this possibility among younger children who completed the P-PSC-C. Thus, additional research will be required before clear conclusion can be reached regarding the role played by age and BMI in relation to young children's physical self-concept.

Finally, results from the analyses of convergent validity revealed that children with higher physical self-concepts also tended to report higher levels of enjoyment in sports. This result is consistent to those previously found by Tietjens et al. (2018) and Estevan et al. (2019), thus lending additional support to the convergent validity of the P-PSC-C.

The current study has four main limitations that should be considered when interpreting the results. First, the psychometric properties of the French version of the P-PSC-C were only assessed among a small sample of French-speaking children. Therefore, the extent to which these results would generalize to other French-speaking populations, to other linguistic groups, or to larger samples of French-Canadian children, remains unknown.

Second, the cross-cultural and linguistic invariance of the P-PSC-C was not tested in the current study. Therefore, it is currently unknown whether the factor structure of the current version of the P-PSC-C would be invariant among samples of: (a) French-speaking children from different cultures (e.g., North-American, European and North-African); and (b) children speaking other languages (e.g., English, Dutch, Greek, Portuguese, Spanish, etc.).

Third, the test-retest reliability or longitudinal invariance of the French version of the P-PSC-C was not examined in the present study. These psychometric properties should thus be more thoroughly examined in future longitudinal research.

Fourth, although we found evidence of convergent validity in relation to a measure of enjoyment in sports, this measure was operationalized using a single item. Whereas the associations found between the global P-PSC-C factor and participant's sex, age, BMI, and physical activity/sport involvement also provide valuable information on the convergent validation of scores on the global P-PSC-C factor, it remains that this facet of the validation process remains weaker than other verifications conducted in this study. Therefore, additional analyses are required to better document the convergent validity of this new measure in relation to other physical self-concept questionnaires and objective criteria (e.g., physical fitness measures).

In conclusion, results from the present study suggest that the psychometric properties of the French adaptation of the P-PSC-C are promising. This questionnaire can be used in the context of group-based comparisons as functions of age, BMI, physical activity/sport involvement and sex. However, pending further research, adjustments should be conducted for age-, sex-, and BMI- based comparisons, especially those relying on manifest scores. Finally, based on the aforementioned limitations it is premature to recommend its use in cross-linguistic/cultural and longitudinal studies.

Endnote

[1] To further investigate these results, additional analyses allowing age to have curvilinear and cubic effects were also examined. These alternative analyses supported the presence of purely linear associations between age and children's responses to these items.

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Online Supplements for:

Psychometric properties of the French Version of the Pictorial Scale of Physical Self-Concept for Younger Children (P-PSC-C)

Table S1. *French Items (for boys) of the P-PSC-C and of Enjoyment in Sports*

Table S2. *Goodness-of-Fit Statistics of Confirmatory Factor Analyses (CFA) for the P-PSC-C*

Table S3. *Standardized Parameters Estimates from the Confirmatory Factor Analyses of the P-PSC-C*

Table S1.

French Items (for boys) of the P-PSC-C and of Enjoyment in Sports

N°	Domains	Items	
1	Flexibility	Ce garçon n’est pas très bon pour se pencher vers l’avant. Es-tu Pas trop bon pour te pencher vers l’avant OU Un peu bon pour te pencher vers l’avant	Ce garçon est plutôt bon pour se pencher vers l’avant. Es-tu : Plutôt bon pour te pencher vers l’avant OU Vraiment bon pour te pencher vers l’avant
2	Sportiness	Ce garçon est plutôt bon dans tous les sports. Es-tu : Vraiment bon dans tous les sports OU Plutôt bon dans tous les sports	Ce garçon n’est pas très bon dans tous les sports. Es-tu : Un peu bon dans tous les sports OU Pas trop bon dans tous les sports
3	Physical Appearance	Ce garçon pense qu’il n'est pas très beau physiquement. Penses-tu que tu es: Pas très beau physiquement OU Un peu beau physiquement	Ce garçon pense qu’il est plutôt beau physiquement. Penses-tu que tu es : Plutôt beau physiquement OU Vraiment beau physiquement
4	Endurance	Ce garçon est plutôt bon pour courir longtemps. Es-tu : Vraiment bon pour courir longtemps OU Plutôt bon pour courir longtemps	Ce garçon n’est pas très bon pour courir longtemps. Es-tu : Un peu bon pour courir longtemps OU Pas trop bon pour courir longtemps
5	Speed	Ce garçon n’est pas très bon pour courir vite. Es-tu : Pas trop bon pour courir vite OU Un peu bon pour courir vite	Ce garçon est plutôt bon pour courir vite. Es-tu : Plutôt bon pour courir vite OU Vraiment bon pour courir vite
6	Strength	Ce garçon peut soulever des objets lourds plutôt facilement. Peux-tu : Soulever des objets lourds vraiment facilement OU Soulever des objets lourds plutôt facilement	Ce garçon ne peut pas soulever des objets lourds très facilement. Peux-tu : Soulever des objets lourds un peu facilement OU Soulever des objets lourds pas trop facilement
7	Coordination	Ce garçon n’est pas très bon pour faire deux choses en même temps, comme courir en faisant rebondir le ballon. Es-tu : Pas trop bon pour faire deux choses en même temps OU Un peu bon pour faire deux choses en même temps	Ce garçon est plutôt bon pour faire deux choses en même temps, comme courir en faisant rebondir le ballon. Es-tu : Plutôt bon pour faire deux choses en même temps OU Vraiment bon pour faire deux choses en même temps
	Enjoyment in sports	Ce garçon aime faire du sport. Est-ce que tu : Aimes vraiment faire du sport OU Aimes assez faire du sport	Ce garçon n’aime pas faire du sport. Est-ce que tu : Aimes un peu faire du sport OU N’aimes pas faire du sport

Note. P-PSC-C = Pictorial scale of Physical Self-Concept for younger Children.

Table S2.
Goodness-of-Fit Statistics of Confirmatory Factor Analyses (CFA) for the P-PSC-C

Models	N°	Description	Wχ² (df)	CFI	TLI	RMSEA	RMSEA 90% CI	CM	ΔWχ² (df)	ΔCFI	ΔTLI	ΔRMSEA
CFA	1-1	CFA	19.541(14)	.985	.978	.043	.000-.084	-	-	-	-	-
MI-CFA: Sex	2-1	Configural invariance	39.587(28)	.973	.959	.062	.000-.103	-	-	-	-	-
	2-2	Weak invariance	54.128(34)	.952	.941	.074	.033-.110	2-1	13.11(6)	-.021	-.018	+.012
	2-3	Partial weak invariance	45.867(33)	.970	.961	.060	.000-.099	2-1	7.12(5)	-.003	+.002	-.002
	2-4	Strong invariance	83.054(46)*	.912	.920	.086	.056-.116	2-3	43.60(13)*	-.058	-.041	+.026
	2-5	Partial strong invariance	56.662(41)	.963	.962	.059	.000-.095	2-3	12.13(8)	-.007	+.001	-.001
	2-6	Strict invariance	88.763(48)*	.903	.915	.089	.059-.117	2-5	30.07(7)*	-.060	-.047	+.030
	2-7	Partial strict invariance	64.659(46)	.956	.960	.061	.016-.094	2-5	8.30(5)	-.007	-.002	+.002
	2-8	Latent variance invariance	61.495(47)	.966	.969	.053	.000-.088	2-7	0.19(1)	+.010	+.009	-.008
	2-9	Latent mean invariance	76.380(48)*	.933	.941	.074	.040-.104	2-8	7.03(1)*	-.033	-.028	+.021
DIF: Age	3-1	Null effects	73.663(21)*	.859	.813	.108	.082-.135	-	-	-		-
	3-2	Saturated	20.129(14)	.984	.967	.045	.000-.086	3-1	43.80(7)*	+.125	+.154	-.063
	3-3	Factor-only	56.096(20)*	.904	.865	.092	.064-.120	3-1	9.25(1)*	+.045	+.052	-.016
	3-4	Partial DIF	24.231(17)	.981	.968	.044	.000-.082	3-2	4.21(3)	-.003	+.001	-.001
DIF: Body mass-index	4-1	Null effects	34.489(21)	.961	.948	.058	.017-.092	-	-	-		-
	4-2	Saturated	21.847(14)	.977	.954	.054	.000-.096	4-1	12.65(7)	+.016	+.006	-.004
	4-3	Factor-only	39.082(20)*	.944	.922	.071	.037-.104	4-1	0.02(1)	-.017	-.026	+.013
	4-4	Partial DIF	27.655(19)	.975	.963	.049	.000-.086	4-2	6.22(5)	-.002	+.009	-.005
DIF: PA/Sport involvement	5-1	Null effects	26.344(21)	.986	.981	.034	.000-.071	-	-	-		-
	5-2	Saturated	20.324(14)	.983	.966	.046	.000-.087	5-1	7.53(7)	-.003	-.015	+.012
	5-3	Factor-only	27.802(20)	.979	.971	.043	.000-.078	5-1	0.74(1)	-.007	-.010	+.009

Notes. Wχ²= robust weighed least square (WLSMV) chi-square; Δ = change from previous model; ΔWχ² = WLSMV chi square difference test (calculated with the Mplus DIFFTEST function); CFI = comparative fit index; CM = comparison model; df = degrees of freedom; DIF = differential item functioning; MI = measurement invariance; P-PSC-C = Pictorial scale of Physical Self-Concept for younger Children; PA = physical activity; RMSEA = root mean square error of approximation; 90% CI = 90% confidence interval of the RMSEA; TLI = Tucker-Lewis index. The fact that Wχ² values are not exact, but “estimated” as the closest integer necessary to obtain a correct *p* value explains the fact that the Wχ² and the resulting CFI values can be non-monotonic with model complexity. * $p < .01$.

Table S3.
Standardized Parameters Estimates from the Confirmatory Factor Analyses of the P-PSC-C

Items	λ	δ
Flexibility	.452	.796
Sportiness	.614	.623
Physical Appearance	.416	.827
Endurance	.621	.614
Speed	.801	.358
Strength	.532	.717
Coordination	.590	.652

Notes. λ = factor loadings; δ = uniquenesses; P-PSC-C = Pictorial scale of Physical Self-Concept for younger Children.