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Cross-cultural adaptation, reliability, and validation of the Spanish perceived physical literacy instrument for adolescents (S-PPLI)

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ABSTRACT

Objective: The aim of this study was to examine the reliability and validity of the Spanish Perceived Physical Literacy Instrument (S-PPLI) questionnaire in Spanish adolescents.

Method: The participants of this study were 360 Spanish adolescents (aged 12–17 years) from three secondary schools in the Region of Murcia (Spain). A cultural adaptation process of the original version of the PPLI questionnaire was developed. Confirmatory factor analysis was applied to test the three-factor structure of physical literacy. Intraclass correlation coefficients were computed to estimate the test-retest concordance.

Results: Using a confirmatory factor analysis, the factor loading of all items above the standard of 0.40 ranged from 0.53 to 0.77, suggesting that the observed variables sufficiently represented the latent variables. Analyses for convergent validity showed average variance extracted values that ranged from 0.40 to 0.52 and composite reliability values higher than 0.60. All the correlations were below the recommended cutoff point of 0.85, which indicated that the three physical literacy factors achieved adequate discriminant validity. Intraclass correlation coefficients ranged from 0.62 to 0.79 ($p < 0.001$ for all items), which indicated moderate/good reliability.

Conclusions: Our results suggest that the S-PPLI is a valid and reliable measure of physical literacy among Spanish adolescents.

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1. Introduction

Physical literacy describes the motivation, confidence, physical competence, knowledge, and understanding that individuals develop to maintain physical activity at an appropriate level throughout their life.^{1,2} In the same way that reading, writing, listening, and speaking combine to formulate language literacy lifelong reading and communication, physical literacy is a

progressive journey in which different components (i.e., physical competence, daily behavior, knowledge and understanding, motivation and confidence) interact holistically to facilitate a lifetime of participation and enjoyment in physical activity.³ Physical literacy encompasses far more than physical education in schools or structured sporting activities, offering instead a broader conception of physical activity, unrelated to ability. Using pedagogies and the adoption of new modes of thinking, physical literacy promises more realistic models of physical competence and physical activity for a wider population, offering opportunities for everyone to become active and motivated participants.⁴

In the context of physical education, the term physical literacy has become a common topic among teachers and professionals involved in athlete development.⁵ Since physical literacy is the

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ultimate goal of physical education, the definitions of physical literacy are intended to assist physical education teachers in implementing quality physical education curricula, extracurricular activities and health promotion programs, which are designed to foster the development of physical literacy among adolescents. From this connection, the United Nations Educational, Scientific and Cultural Organization (UNESCO)⁶ has asserted that quality physical education should be a core component of school curricula, as it is a foundation for lifelong engagement in physical activity and sports for adolescents. Quality physical education is designed to develop interest in sports, engage regularly in physical activity, and lead an active and healthy lifestyle.⁶ This is why physical education is recommended to be mandatory and valued at all educational levels, with weekly frequency that promotes a healthy and active lifestyle.⁷ Specifically, it has been found that adolescents who participated in physical education classes 1–2 days/week had 26% higher odds of being sufficiently active, with slightly greater odds for boys (30%) than girls (15%).⁸

Physical literacy is developed through participation in physical activity⁹ that can be seen as a special type of intelligence related to the ability to produce movements, which is not equivalent to physical activity but rather an important antecedent to physical activity.⁹ Adolescents are entitled to a learning experience in quality physical education that develops their physical literacy and fosters the following key attributes: a) their physical self and self-confidence; b) motivation to engage; c) how they interact with the environment, self-express and communicate with others; and d) knowledge and understanding of how to maintain physical activity.^{1,2} Therefore, when adolescents improve their physical literacy, they have self-confidence in fundamental movement, coordination, and control with respect to the changing environment. They can also demonstrate verbal and nonverbal communication to interact with other people in a physical environment and enjoy discovering new physical activities.

According to Whitehead,¹⁰ a summative assessment is not appropriate for evaluating physical literacy, as physical literacy is a complex and multifaceted concept. Instead, it is more appropriate to chart progress in physical literacy, as it is a personal journey that should be measured by considering individuals' prior knowledge, understanding, and experiences rather than comparing them to others. Regarding physical literacy assessment, a systematic review by Jean de Dieu and Zhou¹¹ synthesized the existing tools in the scientific literature. Examples of these assessment tools are the Passport For Life (PFL),¹² the Canadian Assessment for Physical Literacy (CAPL),^{3,13} the Physical Literacy Assessment for Youth (PLAY) tools,¹⁴ and the Perceived Physical Literacy Instrument (PPLI)¹⁵ (among others).¹¹ Although physical literacy is better comprehended using both objective measures (e.g., accelerometers, physical tests, pedometers) and subjective measures (e.g., questionnaires),¹⁶ including objective measures requires significant economy, space, and time for testing.¹⁷ Thus, self-report questionnaires are more easily accessible when the inclusion of more objective measures is not possible.

Among self-reported physical literacy tools in adolescents, the PPLI was validated by Sum et al.,¹⁵ including nine items encompassed in three different domains. This tool was previously designed and validated for physical education teachers by Sum et al.¹⁸ (including 18 different items). PPLI was based on a literature review and focus group interviews and consisted of an 18-item instrument. Subsequently, further validation was performed for adolescents, which included nine different items from the original instrument,¹⁵ grouped into three different domains: “knowledge and understanding”, “self-expression and communication with others”, and “sense of self and self-confidence”. Therefore, we decided to adapt and validate this assessment tool for several

reasons: a) it showed high validity in the systematic review including the assessment tools available to date¹¹; b) it is a self-reported measure, thus allowing assessment in a simpler and more accessible way¹⁷; and c) to our knowledge, there is no Spanish self-report instrument to measure the self-perception of physical literacy of adolescents. Since physical literacy is recognized as foundational to participation in physical activity throughout the life course,^{2,19,20} its understanding seems to be critical to moving forward intervention efforts surrounding physical inactivity. Therefore, the purpose of this study was to examine the reliability and validity of the Spanish Perceived Physical Literacy Instrument (S-PPLI) questionnaire in adolescents from this country.

2. Methods

2.1. Participants

Participants in this study were Spanish adolescents (aged 12–17 years) from three secondary schools in the Region of Murcia (Spain). The detailed methodology of the Eating Healthy and Daily Life Activities (EHDLA) study has been published elsewhere.²¹ A subsample of 360 Spanish adolescents from the EHDLA study was selected. Two classes were randomly selected in each grade, and parental consent was obtained before the questionnaire was distributed. The questionnaires were completed by participants in quiet conditions before the physical education classes. A research assistant was available to clarify questions raised by the participants, and the questionnaires were returned within the lesson. The average range of questionnaire completion time was 8–10 min.

All participants were asked to provide informed consent with emphasis on the voluntary nature of the survey before participating in the study. Approval for the use of human subjects was obtained from the Bioethics Committee of the University of Murcia (ID 2218/2018), the Ethics Committee of the Albacete University Hospital and the Albacete Integrated Care Management (ID 2021–85).

2.2. Instrument

Perceived physical literacy, understood as a specific intelligence related to physical competence, confidence, knowledge, motivation, and understanding to value and take responsibility for maintaining certain physical activities and pursuits throughout life,² was evaluated by the Perceived Physical Literacy Instrument (PPLI), an 18-item tool that was originally designed for physical education teachers.¹⁸ The PPLI for adolescents consists of nine items scored on a 5-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree) (Table S1). The nine items of the PPLI are equally divided into three subscales: a) “knowledge and understanding” (three items); b) “self-expression and communication with others” (three items); and c) “sense of self and self-confidence” (three items). Since the original version is quite generic and not created for a designated population or profession, it was validated without changes in vocabulary for adolescents, showing confirmatory factor analysis a good fit to the model among this population.¹⁸

2.3. Procedures

In the absence of any validation study in the Spanish population, a cultural adaptation process was developed following the methodology suggested by Beaton et al.,²² as follows:

- a) In the first stage (initial translation), a pair of bilingual translators, competent in both English and Spanish, independently translated the original questionnaire from English to Spanish.

- b) In the second stage (synthesis of the translations), versions were pooled and synthesized into a single common translation.
- c) In the third stage (back translation), working from the translated versions of the questionnaire and totally blinded to the original version, two other translators, whose mother tongue was English and who had mastered Spanish, produced two new independent translations into the original language of the scale (English).
- d) The fourth stage was the expert committee review. The committee was composed of four physical education researchers selected according to predetermined criteria (scientific production, experience with adolescents, and translation, adaptation, and validation of instruments), one language expert, and the main research investigator. Two face-to-face meetings were held during the review process. The role of the expert committee was to evaluate the original instrument and all translated versions and develop the pre-final version of the questionnaire for field testing. The decisions made by the committee to achieve equivalence between the source and target versions of the questionnaire were based on semantic, idiomatic, functional, and conceptual equivalence.
- e) The fifth stage was the field test of the Spanish version of the questionnaire for textual clarity.

Finally, to ensure that the responses were understandable to adolescents, the final Spanish version of the S-PPLI (Table S2) was pretested on 30 voluntary participants in this study. Their responses were analyzed to identify whether any modifications were necessary, which was not the case.

2.4. Data analysis

Construct validity. Confirmatory factor analysis (CFA) was performed to cross-validate and confirm the three-factor structure derived in the analysis. The goodness-of-fit test on the model was assessed using chi-square, root mean square error of approximation (RMSEA; <0.08), comparative fit index (CFI; >0.90), and standardized root mean square residual SRMR; < 0.08.²³ Additionally, we used a chi-square test to compare the results between the proposed models (i.e., a three-factor solution) and other alternative models (i.e., a one-factor or two-factor solution). Convergent validity was assessed through the factor loading of each of the items, the values of composite reliability (CR) and the average variance extracted (AVE) of the three factors. Conversely, discriminant validity was checked by obtaining the Spearman's rho (ρ) coefficients between the factors in the model. Discriminant validity is established when the ρ coefficient between factors is below 0.85.

Reliability. We used two approaches to examine the reliability of the instrument: internal consistency²⁴ and test-retest reliability.²⁵ For the first, we calculated McDonald's omega coefficient (ω) and Cronbach's alpha coefficient (α). For the test-retest reliability, we calculated the intraclass correlation coefficient (ICC).

Finally, the mean difference in the S-PPLI was calculated according to sociodemographic variables (i.e., sex, age, and experience in sports). All analyses were carried out with the software JASP (University of Amsterdam, Amsterdam, Netherlands) version 0.16.3. After checking and confirming the validity of the raw data, the research team then conducted a CFA. CFA was used as a critical step in refining the instrument and identifying the factorial structure of physical literacy in the PPLI.

3. Results

Table 1 indicates the characteristics of the study participants in relation to sex, age, and sports experience. Most of the sample had between seven and nine years of experience in sports (28.1%).

CFA was performed to cross-validate and confirm the three-factor structure derived in the analysis (Table 2). The factor loadings of the three-factor model structure for S-PPLI are shown in Fig. 1. The factor loading of all items above the standard of 0.40²⁶ ranged from 0.53 to 0.77, suggesting that the observed variables sufficiently represented the latent variables. The final fit statistics were all adequate as follows: chi-square ($\chi^2 = 52.260$; $df = 24$; $p < 0.001$; $CFI = 0.976$; $RMSEA = 0.057$; $SRMR = 0.031$) (Table 2). We further examined the factor structure by conducting an alternative one-factor model and three two-factor models to compare with the three-factor model. The results showed that the three-factor model had a significantly better fit than the one-factor model and the other three two-factor models. The chi-square difference test between models was significant ($\Delta\chi^2 14.771$ to 23.611 ; $df, 24$ to 27 , $p < 0.05$ for all), which indicated that all the latent variables had satisfactory discriminant validity.²⁷ Overall, our results revealed that the three-factor validity of physical literacy was satisfactory.

Analyses for convergent validity are shown in Table 3. The AVE values ranged from 0.40 to 0.52, and the CR values were higher than 0.60.²⁸ When AVE is less than 0.5 but CR is higher than 0.6, the convergent validity of the construct is still adequate.²⁹

To assess discriminative validity, the correlations among the factors were checked. Table 4 shows the correlation values for the three-factor structure. All the correlations were below the recommended cutoff point of 0.85, which indicated that the three physical literacy factors achieved adequate discriminant validity.

Additionally, we examined the mean scores for physical literacy factors by demographic characteristics (Table 5), which showed that factor scores differed by demographic group. Boys showed greater scores than girls among all three factors, which means that boys perceived themselves to possess a higher sense of self and self-confidence, self-expression and communication with others and knowledge and understanding ($p < 0.001$ for all). Adolescents who had more than seven years of sports experience showed higher self-perceived physical literacy among all factors than those with less than six years of sports experience ($p < 0.05$ for all). Conversely, no differences were found according to age group.

Table 6 shows the results of test-retest reliability. Overall, the ICC ranged from 0.62 to 0.79, with the lowest value found for PPL9 (“I am aware of the benefits of sports related to health”). The ICC

Table 1
Characteristics of the study participants (N = 360).

Sociodemographic variable	n (%)
Sex	
Boys	182 (50.6)
Girls	178 (49.4)
Age	
12 years old	40 (11.1)
13 years old	74 (20.6)
14 years old	84 (23.3)
15 years old	75 (20.8)
16 years old	49 (13.6)
17 years old	38 (10.5)
Experience in sports	
None	28 (7.8)
1–3 years	54 (15.0)
4–6 years	67 (18.6)
7–9 years	101 (28.1)
10–13 years	81 (22.5)
14 years or more	29 (8.1)

Table 2
Model comparison for confirmatory factor analysis (N = 360).

Model	df	χ^2	$\Delta\chi^2$	RMSEA	SMRM	CFI
Three-factor model	24	52.260	—	0.057	0.031	0.976
Two-factor model ^a	26	67.031	14.771*	0.060	0.032	0.967
Two-factor model ^b	26	67.641	15.381*	0.067	0.032	0.964
Two-factor model ^c	26	72.239	19.978*	0.070	0.033	0.960
One-factor model	27	75.871	23.611*	0.071	0.034	0.958

CFI, comparative fit index; df, degrees of freedom; RMSEA, root mean square error of approximation; SMRM, standardized root mean square residual. * $p < 0.001$.

^a “Knowledge and understanding” items and “Self-expression and communication with others” items loading on to first factor.

^b “Sense of self and self-confidence” items and “Self-expression and communication with others” items loading onto the first factor.

^c “Knowledge and understanding” items and “Sense of self and self-confidence” items loading onto the first factor; “Self-expression and communication with others” loading onto the second factor.

values were significant for all items on the S-PPLI ($p < 0.001$). Similarly, the values of McDonald’s ω and Cronbach’s α suggest adequate internal consistency ($\omega = 0.87$; 95% CI, 0.81–0.86; $\alpha = 0.87$; 95% CI, 0.85–0.89).

4. Discussion

The purpose of this study was to translate, adapt, and validate the S-PPLI for adolescents based on the previous development of the PPLI.^{15,18} Our data support that the three-factor structure as proposed by the PPLI developers¹⁵ fit well to the Spanish version. Our findings showed that the S-PPLI had good validity and reliability in Spanish adolescents’ perceptions of their own physical literacy in relation to three different dimensions (i.e., “knowledge and understanding”, “self-expression and communication with others”, and “sense of self and self-confidence”). Because physical literacy may present a novel and holistic framework for health-enhancing physical activity interventions that consider factors vital to sustained participation in physical activity across the life course,¹⁹ the S-PPLI could be used to measure this novel and relevant concept among Spanish adolescents.^{15,18}

The items “I am physically fit, in accordance with my age” (PPLI1), “I possess self-management skills for fitness,” (PPLI4), and “I possess self-evaluation skills for health” (PPLI5) indicated that adolescents with greater physical literacy should have a greater sense of self and self-confidence. Our results showed that adolescents with higher experience in sports had a greater sense of self and self-confidence,

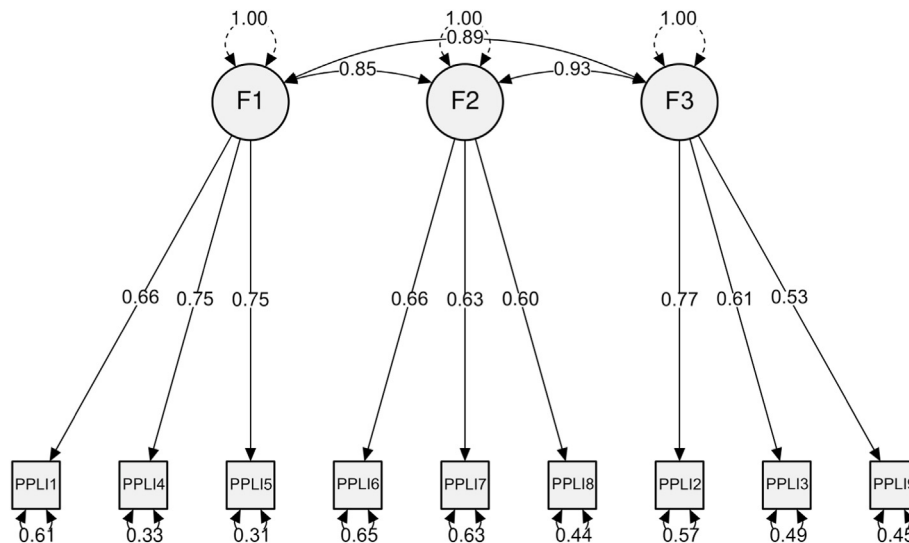


Fig. 1. Factor loading of the three-factor model structure for the Spanish Physical Literacy Instrument.

Table 3
Factor structures by confirmatory factor analysis (N = 360).

Code	Item	Estimate	z	CR	AVE
Factor 1: Sense of self and self-confidence					
PL1	I am physically fit, in accordance with my age	0.65	12.123*	0.76	0.42
PL4	I possess self-management skills for fitness	0.79	15.072*		
PL5	I possess self-evaluation skills for health	0.80			
Factor 2: Self-expression and communication with others					
PL6	I have strong social skills	0.64	9.995*	0.66	0.40
PL7	I am confident in wild/natural survival	0.62	9.796*		
PL8	I am capable in handling problems and difficulties	0.67			
Factor 3: Knowledge and understanding					
PL2	I have a positive attitude and interest in sports	0.62	10.535*	0.68	0.42
PL3	I appreciate myself or others doing sports	0.66	9.956*		
PL9	I am aware of the benefits of sports related to health	0.71			

AVE, average variance extracted; CR, composite reliability. * $p < 0.001$.

Table 4
Correlations between factors in the three-factor structure for the Spanish version of the Perceived Physical Literacy Instrument.

	Factor 1	Factor 2	Factor 3
Factor 1	–	–	–
Factor 2	0.528*	–	–
Factor 3	0.663*	0.529*	–

Data are expressed as Spearman's rho (ρ). Factor 1 = "Sense of self and self-confidence"; Factor 2 = "Self-expression and communication with others"; Factor 3 = "Knowledge and understanding"; Total = Sum of Factors 1, 2, and 3. * $p < 0.001$.

which is in line with a previous study performed among Spanish adolescents.³⁰ Concerning sex, previous literature has reported differences in sense of self during physical activity, where boys were stronger in building self-confidence through physical activity^{31,32} and where significant positive effects were found between physical activity and self-esteem and self-concept.³³ This sex discrepancy has also been corroborated in Spanish adolescents.³⁴

Table 5
Mean scores for physical literacy factors by sociodemographic characteristics.

Sociodemographic variable	N	M (SD)	p
<i>Factor 1: Sense of self and self-confidence</i>			
Sex			
Boys	182	11.1 (2.3)	<0.001
Girls	178	10.2 (2.2)	
Age group			
12–14	198	10.6 (2.1)	0.702
15–17	162	10.7 (2.5)	
Experience in sports			
6 years or below	149	10.0 (2.2)	<0.001
7 years or above	211	11.1 (2.3)	
<i>Factor 2: Self-expression and communication with others</i>			
Sex			
Boys	182	11.5 (2.3)	0.003
Girls	178	10.8 (2.1)	
Age group			
12–14	198	11.1 (2.0)	0.586
15–17	162	11.1 (2.5)	
Experience in sports			
6 years or below	149	10.8 (2.1)	<0.001
7 years or above	211	11.4 (2.3)	
<i>Factor 3: Knowledge and understanding</i>			
Sex			
Boys	182	12.8 (2.0)	<0.001
Girls	178	11.7 (2.0)	
Age group			
12–14	198	12.3 (2.0)	0.647
15–17	162	12.1 (2.1)	
Experience in sports			
6 years or below	149	11.6 (2.0)	<0.001
7 years or above	211	12.7 (2.0)	

Table 6
Test-retest reliability based on the intraclass correlation coefficient for the Spanish version of the Perceived Physical Literacy Instrument.

Item	ICC ^a	95% CI	α^b	ω^b
PL1	0.79	0.75–0.82	0.86	0.86
PL2	0.76	0.71–0.80	0.85	0.85
PL3	0.59	0.52–0.65	0.86	0.86
PL4	0.68	0.62–0.73	0.85	0.85
PL5	0.63	0.57–0.69	0.85	0.85
PL6	0.74	0.69–0.78	0.86	0.86
PL7	0.72	0.67–0.77	0.86	0.86
PL8	0.63	0.56–0.69	0.86	0.86
PL9	0.62	0.55–0.68	0.86	0.86

CI, confidence interval; ICC, intraclass correlation coefficient; PL, physical literacy.

^a According to Shrout and Fleiss.²⁵

^b Value if item dropped.

One previous study among Spanish adolescents found that physical self-concept is an essential resource for proper personal and social development during this age phase.³⁵ As suggested by Sum et al.,¹⁵ it is possible for adolescents to make use of their self-confidence in physical activity and apply it to different situations in other contexts that also promote their social development.

On the other hand, the items "I have strong social skills" (PPLI6), "I am confident in wild/natural survival" (PPLI7), and "I am capable in handling problems and difficulties" (PPLI8) suggest that adolescents with greater physical literacy may have greater self-expression and communication with others. Adolescents who learn to express themselves appropriately and acquire communication skills through physical activity are freer to express their feelings, more well-balanced emotionally, and become independent.³⁶ In fact, in Spain, it has been found that adolescents who engage in greater physical activity have greater external influences, fears of making mistakes and lower psychological well-being.³⁷

Importantly, the items "I have a positive attitude and interest in sports" (PPLI2), "I appreciate myself or others doing sports" (PPLI3), and "I am aware of the benefits of sports related to health" (PPLI9) depicted that adolescents with higher physical literacy may have a higher knowledge and understanding of the health benefits of engaging in sufficient physical activity. Adolescents who gain knowledge and understanding about the importance of achieving sufficient levels of physical activity and its health benefits, as well as those who have a positive attitude and interest in being physically active, can develop a greater appreciation of their own and others' activity.¹⁵ In this sense, physical activity confers benefits for several domains of cognition and metacognition in youths.³⁸ Supporting this idea, a systematic review and meta-analysis by García-Hermoso et al.³⁹ found that improving the quality of physical education classes (i.e., increasing youths' participation in physical activity during physical education) may improve cognition and academic performance in youths.

Concerning the other three physical literacy domains (i.e., motivation, confidence and physical competence, and interaction with the environment), these are interrelated and reciprocally influenced by the sense of the self, self-expression and communication with others, as well as knowledge and understanding, which may influence adolescents' physical literacy perceptions.² Thus, the three domains evaluated in the current study offer valid results and produce reciprocal associations with physical literacy, which is in line with the original PPLI version.¹⁵ The exploration of each domain regarding its causal relationship and hierarchical order would further strengthen the concept of physical literacy and its influence on adolescents' health and physical activity levels.

This study has some limitations to be acknowledged. First, due to the cross-sectional design of this study, we cannot establish cause and effect relationships; thus, predictive validity could not be examined. Second, this study only examined the factorial structure, convergence validity, and internal consistency reliability but not criterion validity. Third, only three factors from the PPLI were examined. Further studies examining other factors (i.e., confidence and physical competence, motivation, and interaction with the environment) are needed. Fourth, this self-reported perceived physical literacy instrument was another limitation of this study. In this sense, a combination of methods (i.e., quantitative, qualitative) has been required to better characterize overall progress in physical literacy.⁴⁰ Conversely, this study has some strengths that must be declared. This study had a rigorous design with a large and randomly selected sample analyzing perceived physical literacy among Spanish adolescents. Similarly, to our knowledge, it is the first tool that allows the assessment of physical literacy in Spanish adolescents. Another notable strength is the empirical evidence added to support physical literacy measurement through a holistic

approach⁴⁰ while demonstrating the international and cross-cultural capacity of PPLI for adolescents.¹⁵

5. Conclusions

Our results suggest that the S-PPLI is a valid and reliable measure of physical literacy among Spanish adolescents. The S-PPLI could be extensively applied to determine adolescents' self-perceived physical literacy and possibly to understand other sources of insufficient physical activity. Future studies are needed to test the three further physical literacy domains (i.e., motivation, confidence and physical competence, and interaction with the environment) to improve the measurement of a holistic construct of self-perceived physical literacy in Spanish youth.

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Authors' contribution statement

Conceptualization, J.F.L.-G., methodology, J.F.L.-G.; software, J.F.L.-G.; validation, J.F.L.-G.; formal analysis, J.F.L.-G.; data curation, J.F.L.-G.; writing—original draft preparation, J.F.L.-G.; writing—review and editing, V.M.-V, P.J.T.-L., and A.G.H.; visualization, J.F.L.-G.; supervision, A.G.-H. All authors have read and approved the final version of the manuscript.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jesf.2023.03.002>.

References

- Whitehead M, ed. *Physical Literacy across the World*. first ed. Routledge; 2019. <https://doi.org/10.4324/9780203702697>.
- Whitehead M. In: *Physical Literacy: Throughout the Lifecourse*. first ed. Routledge; 2010.
- Healthy Active Living, Obesity Research Group. *Canadian Assessment of Physical Literacy. Manual for Test Administration*. Manual for Test Administration - Second Edition; 2017. <https://www.capl-eclp.ca/wp-content/uploads/2017/10/capl-2-manual-en.pdf>.
- Faigenbaum AD, Rial Rebullido T. Understanding physical literacy in youth. *Strength Condit J*. 2018;40(6):90–94. <https://doi.org/10.1519/SSC.0000000000000417>.
- Lundvall S. Physical literacy in the field of physical education – a challenge and a possibility. *J Sport Health Sci*. 2015;4(2):113–118. <https://doi.org/10.1016/j.jshs.2015.02.001>.
- United Nations Educational, Scientific and cultural organization. *Quality physical education: Guidelines for policy makers*. <https://en.unesco.org/inclusivepolicy/sites/default/files/learning/document/2017/1/231101E.pdf>; 2015.
- Bandeira A da S, Ravagnani FC de P, Barbosa Filho VC, et al. Mapping recommended strategies to promote active and healthy lifestyles through physical education classes: a scoping review. *Int J Behav Nutr Phys Activ*. 2022;19(1):36. <https://doi.org/10.1186/s12966-022-01278-0>.
- Uddin R, Salmon J, Islam SMS, Khan A. Physical education class participation is associated with physical activity among adolescents in 65 countries. *Sci Rep*. 2020;10(1), 22128. <https://doi.org/10.1038/s41598-020-79100-9>.
- Giblin S, Collins D, Button C. Physical literacy: importance, assessment and future directions. *Sports Med*. 2014;44(9):1177–1184. <https://doi.org/10.1007/s40279-014-0205-7>.
- Whitehead M. What is physical literacy and how does it impact on physical education? In: Capel S, Whitehead M, eds. *Debates in Physical Education*. Routledge; 2012:37–52. <https://doi.org/10.4324/9780203100189>.
- Jean de Dieu H, Zhou K. Physical literacy assessment tools: a systematic literature review for why, what, who, and how. *Int J Environ Res Publ Health*. 2021;18(15):7954. <https://doi.org/10.3390/ijerph18157954>.
- Physical & Health Education Canada (PHE Canada). *Passport for life*. <https://passportforlife.ca>; 2013.
- Healthy Active Living and Obesity Research Group. *Canadian Assessment of Physical Literacy. Manual for Test Administration*; 2014.
- Kriellaars D, Way R. Physical literacy within the educational context in Canada. *Int Counc Sport Sci Phys Educ ICSSPE Bull*. 2013;65:361–367.
- Sum RKW, Cheng CF, Wallhead T, Kuo CC, Wang FJ, Choi SM. Perceived physical literacy instrument for adolescents: a further validation of PPLI. *J Exerc Sci Fit*. 2021;16(1):26–31. <https://doi.org/10.1016/j.jesf.2018.03.002>.
- Rotz HL, Alpous A, Boyer C, Longmuir PE. Identifying criteria for a physical literacy screening task: an expert delphi process. *Exerc Med*. 2020;4:7. <https://doi.org/10.26644/em.2020.007>.
- Ryom K, Hargaard AS, Melby PS, et al. Self-reported measurements of physical literacy in adults: a scoping review. *BMJ Open*. 2022;12(9), e058351. <https://doi.org/10.1136/bmjopen-2021-058351>.
- Sum RKW, Ha ASC, Cheng CF, et al. Construction and validation of a perceived physical literacy instrument for physical education teachers, 5. In: Ginsberg SD, ed. *PLOS ONE*. vol. 11. 2016, e0155610. <https://doi.org/10.1371/journal.pone.0155610>.
- Cornish K, Fox G, Fyfe T, Koopmans E, Pousette A, Pelletier CA. Understanding physical literacy in the context of health: a rapid scoping review. *BMC Publ Health*. 2020;20(1):1569. <https://doi.org/10.1186/s12889-020-09583-8>.
- Belanger K, Barnes JD, Longmuir PE, et al. The relationship between physical literacy scores and adherence to Canadian physical activity and sedentary behavior guidelines. *BMC Publ Health*. 2018;18(S2):1042. <https://doi.org/10.1186/s12889-018-5897-4>.
- López-Gil JF. The eating healthy and daily life activities (EHDLA) study. *Children*. 2022;9(3):370. <https://doi.org/10.3390/children9030370>.
- Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine*. 2000;25(24):3186–3191. <https://doi.org/10.1097/00007632-200012150-00014>.
- Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct Equ Model Multidiscip J*. 1999;6(1):1–55. <https://doi.org/10.1080/1070519909540118>.
- McDonald RP. *Test Theory: A Unified Treatment*. xi. Lawrence Erlbaum Associates Publishers; 1999:485.
- Shrout PE, Fleiss JL. Intraclass correlations: uses in assessing rater reliability. *Psychol Bull*. 1979;86(2):420–428. <https://doi.org/10.1037/0033-2909.86.2.420>.
- Kline RB. In: *Principles and Practice of Structural Equation Modeling*. fourth ed. The Guilford Press; 2016.
- Anderson JC, Gerbing DW. Structural equation modeling in practice: a review and recommended two-step approach. *Psychol Bull*. 1988;103(3):411–423. <https://doi.org/10.1037/0033-2909.103.3.411>.
- Bagozzi RP, Yi Y. On the evaluation of structural equation models. *J Acad Market Sci*. 1988;16(1):74–94. <https://doi.org/10.1007/BF02723327>.
- Fornell C, Larcker DF. Evaluating structural equation models with unobservable variables and measurement error. *J Market Res*. 1981;18(1):39. <https://doi.org/10.2307/3151312>.
- Moral-García JE, Román-Palmero J, López García S, et al. Self-esteem and sports practice in adolescents. *Rev Int Med Cienc Act Física Deporte*. 2021;21(81):157–174. <https://doi.org/10.15366/rimcafd2021.81.011>.
- Lenney E. Women's self-confidence in achievement settings. *Psychol Bull*. 1977;84(1):1–13. <https://doi.org/10.1037/0033-2909.84.1.1>.
- Lirgg CD. Gender differences in self-confidence in physical activity: a meta-analysis of recent studies. *J Sport Exerc Psychol*. 1991;13(3):294–310. <https://doi.org/10.1123/jsep.13.3.294>.
- Liu M, Wu L, Ming Q. How does physical activity intervention improve self-esteem and self-concept in children and adolescents? Evidence from a meta-analysis, 8. In: Wallander JL, ed. *PLOS ONE*. vol. 10. 2015, e0134804. <https://doi.org/10.1371/journal.pone.0134804>.
- Moreno Murcia JA, Cervelló E. Physical self-perception in Spanish adolescents: effects of gender and involvement in physical activity. *J Hum Mov Stud*. 2005;48:291–311.
- Grao-Cruces A, Nuviala A, Fernández-Martínez A, Pérez-Turpin JA. Association of physical self-concept with physical activity, life satisfaction and Mediterranean diet in adolescents. *Kinesiology*. 2014;46(1):3–11.
- Lupu E, Özcan D. Self – expressing one's feelings and the impact of physical activities over them. *Procedia - Soc Behav Sci*. 2014;136:469–474. <https://doi.org/10.1016/j.sbspro.2014.05.358>.
- González-Hernández, Gómez-López, Pérez-Turpin, Muñoz-Villena, Andreu-Cabrera. Perfectly active teenagers. When does physical exercise help psychological well-being in adolescents? *Int J Environ Res Publ Health*. 2019;16(22):4525. <https://doi.org/10.3390/ijerph16224525>.
- Lubans D, Richards J, Hillman C, et al. Physical activity for cognitive and mental

- health in youth: a systematic review of mechanisms. e20161642-e20161642 *Pediatrics*. 2016;138(3). <https://doi.org/10.1542/peds.2016-1642>.
39. García-Hermoso A, Ramírez-Vélez R, Lubans DR, Izquierdo M. Effects of physical education interventions on cognition and academic performance outcomes in children and adolescents: a systematic review and meta-analysis. *Br J Sports Med*. 2021;55(21):1224–1232. <https://doi.org/10.1136/bjsports-2021-104112>.
40. Edwards LC, Bryant AS, Keegan RJ, Morgan K, Cooper SM, Jones AM. 'Measuring' physical literacy and related constructs: a systematic review of empirical findings. *Sports Med*. 2018;48(3):659–682. <https://doi.org/10.1007/s40279-017-0817-9>.