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Spanish adaptation and psychometric evidence of the teacher-report version of the Children's Problems Checklist: early identification of the impairment related to ADHD symptoms

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ABSTRACT

Attention Deficit Hyperactivity Disorder (ADHD) affects 5–7% of the population, with symptoms like executive dysfunction and impulsivity starting in early childhood. Diagnosis involves evaluating symptom impact on daily life. We adapted and assessed the Spanish version of the Children's Problems Checklist (CPC) for teachers. We evaluated 470 preschoolers (52.34% boys, M = 4.757, SD = 0.875) using the CPC, ADHD Rating Scale (ADHD-RS-IV), and Strengths and Difficulties Questionnaire (SDQ). Confirmatory Factor Analysis showed a good fit (CFI = 0.913, RMSEA = 0.08), and CPC demonstrated strong reliability (ω = 0.821). It correlated positively with ADHD-RS-IV dimensions (r = 0.494–0.662, $p < 0.001$) and predicted behavioral problems (F = 40.278, Adjusted $R^2 = 0.201$, $p < 0.001$). This first teacher-report adaptation of the CPC for Spanish-speaking preschoolers shows robust psychometric properties and utility in assessing ADHD impairment-related behavioral problems.

IMPACT STATEMENT

This study provides the first Spanish adaptation and validation of the teacher-report version of the Children's Problems Checklist (CPC), offering a reliable and valid tool for assessing impairment associated with ADHD symptoms in preschoolers. By confirming the original factor structure and demonstrating strong convergent and predictive validity, this work enables early and culturally appropriate identification of functional difficulties in Spanish-speaking educational contexts. The availability of this tool supports earlier detection and intervention for preschoolers whose functioning is impacted by ADHD symptoms, contributing to improved developmental and educational outcomes.

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Introduction

Attention Deficit/Hyperactivity Disorder (ADHD) is classified as a neurodevelopmental disorder, with an estimated prevalence between 5 and 7% (Polanczyk et al., 2014; Thomas et al., 2015). Its core symptoms include inattention and/or hyperactivity and impulsivity, and diagnosis requires that these symptoms significantly impair the child's functioning across two or more settings (APA, 2013; Barkley, 2006; Sibley & Kuriyan, 2016). The onset of these symptoms typically manifests in early childhood and tends to persist over time (Di Lorenzo et al., 2021; Sibley & Kuriyan, 2016).

A longitudinal study revealed that 75–85% of preschool children who met diagnostic criteria for ADHD continued to meet the same criteria three years later (APA, 2013; Lahey et al., 1994). The prevalence of ADHD in the preschool stage (3–5 years) is around 2–5% (Canals et al., 2018, 2021; Danielson et al., 2018; Marin-Mendez et al., 2018), although detection at this age can be challenging because the core

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symptoms of ADHD, such as inattention, hyperactivity, and impulsivity, may present as common behavioral manifestations in children of this age, without necessarily indicating the presence of a disorder (Egger et al., 2006). Therefore, evaluating the impairment caused by ADHD symptoms in the child's functioning is crucial for an accurate diagnosis and to avoid false positives.

The term 'impairment' refers to the impairment or weakening in the overall functioning of the individual, especially in essential areas of their life, such as academic, social, or occupational domains. In the diagnosis of ADHD, it is relevant to assess the negative impact that symptoms have on the individual's ability to carry out daily tasks, learn, socialize, and effectively function in their environment (da Silva et al., 2023; Mishab, 2022; Miyahara et al., 2022; Thöne et al., 2023). Previous studies have highlighted that the diagnostic likelihood of ADHD in preschoolers decreased by more than half when considering the diagnostic criterion of impairment associated with symptoms, that is, evaluating whether these symptoms negatively affect any area of the child's functioning (Dreyer, 2006; Healey et al., 2008; Molina-Torres et al., 2022; Overgaard et al., 2023).

Research findings support assessing not only the symptoms of ADHD but also the functional impairment associated with these symptoms since while they are interrelated, they represent different constructs (Arildskov et al., 2022). Significant impairment in the child's life is a criterion included in numerous diagnostic categories of the DSM in the child and adolescent population (Fabiano & Pelham, 2009).

Fabiano et al. (2012) discuss a variety of scales, such as the Children's Global Assessment Scale (CGAS) (Shaffer et al., 1983), the Columbia Impairment Scale (CIS) (Canino et al., 2013), and the Child and Adolescent Functional Assessment Scale (CAFAS) (Hodges, 2014), to assess the impact of symptoms of neurodevelopmental disorders on different areas of a child's life. Additionally, specific scales have been developed to evaluate different domains of a child's life affected by Attention Deficit/Hyperactivity Disorder (ADHD), such as the Impairment Rating Scale (IRS) (Fabiano et al., 2006). This scale examines the impact of ADHD symptoms on the child in social, family, educational, and emotional domains, employing five questions where adults respond by marking a continuum ranging from 'no problem' to 'extreme problems; needs treatment or assistance'. To date, the IRS has been used mainly within school-aged samples. A recent review on ADHD in preschoolers covered various validated assessments for evaluating preschool ADHD (Halperin & Marks, 2019). Among the measures assessing areas potentially affected by ADHD symptoms at this age, the Children's Problem Checklist (CPC), is considered a valid scale for assessing dimensions associated with preschool ADHD in children aged 36 to 60 months (Healey et al., 2008). The CPC evaluates the level of impairment caused by ADHD symptoms in preschool-aged children. The scale consists of seven items for the parents' and six for the teachers' versions. In the original study, the CPC demonstrated good levels of reliability and validity in preschoolers (Healey et al., 2008). Although its utility is highlighted, the CPC has not yet been adapted in other countries, which complicates its inclusion in ADHD assessment protocols for preschoolers, particularly in countries where English is not the spoken language.

The purpose of this study was therefore to adapt the CPC for use in Spanish-speaking teachers by translating it into Spanish. We focused on the teachers' version of the Children's Problems Checklist and examined the factor structure and performance of it with a Confirmatory Factor Analysis. Also, we analyzed the convergent and predictive validity of the measure, and the reliability by calculating internal consistency indexes. And finally, we ran a measurement invariance across gender for confirming the interpretation of the test. We thus performed Student's T-test and Mann-Whitney's U-Test for analyzing the differences between preschool boys and girls on the evaluation of behavioral problems.

Materials and methods

Participants

A random sampling technique was used to target specific individuals for inclusion in the study. Participants were sourced from kindergarten educational centers, which were chosen to be representative of the Spanish context. The recruitment process took place between February and April 2023. Teachers were included if they met the following criteria: (a) individuals aged 18 years or older; (b) currently teaching a kindergarten class in a Spanish educational institution; and (c) demonstrating adequate reading comprehension to complete the assessment protocol. Teachers with sensory, physical, or psychological

Table 1. Sociodemographic information of the sample.

		n/M (%/SD)		
Children		Total (N = 470)	Boys (n = 246)	Girls (n = 224)
Age		4.290 (0.776)	4.280 (0.784)	4.300 (0.768)
Educational level	3 years	93 (19.787)	51 (10.851)	42 (8.936)
	4 years	149 (31.702)	77 (16.383)	72 (15.319)
	5 years	228 (48.511)	119 (25.319)	109 (23.192)
		M (SD)		
Teachers		Total (N = 23)	Men (n = 2)	Women (n = 21)
Age		41.304 (10.140)	38.000 (4.243)	41.619 (10.777)

Note: n = frequency, M = mean, SD = Standard deviation.

impairments that could impede their ability to understand and complete the evaluation instruments were excluded from the study.

For the children sample, four hundred and seventy children were included in this research. Children were aged between 3 and 5 years (M = 4.290, SD = 0.776), and 52.34% (n = 246) were boys (Table 1).

A total of 23 teachers participated in this study. Teachers were aged between 27 and 64 years (*M* = 41.304; SD = 10.140), and 87.50% were women (Table 1).

According to Fidell and Tabachnick (2003) a minimum of fifteen people per item is required for the psychometric analysis.

Instruments

Children's Problems Checklist (CPC; Healey et al., 2008) assesses impairment caused by symptoms of Attention Deficit Hyperactivity Disorder (ADHD) in preschool children. The CPC assesses various areas of the child's life, including family relationships, interactions with peers, relationships with adults, self-esteem, sleep quality, and propensity for accidents. Each item focuses on evaluating the presence of difficulties in one of these domains, with the informant, whether the parent or the teacher, indicating whether the child has difficulties in each area. The response is given on a Likert-type scale, where 0 indicates the absence of a problem, 1 represents mild problems, 2 reflects moderate problems, and 3 indicates severe problems.

It is important to highlight that the CPC provides two complementary perspectives, as both parents and teachers contribute their assessment of the child's behavior and difficulties. The test has demonstrated validity and stability in preschoolers, according to the results of previous studies, showing satisfactory temporal stability and concurrent validity compared to other measurement tools. Although normative data is available, it has been observed that these are limited to American populations (Healey et al., 2008).

The CPC therefore emerges as a valuable contribution to the field of ADHD assessment in preschoolers, offering a comprehensive and detailed insight into the problems that may arise in various areas of the child's life, from the perspective of teachers.

Attention Deficit Hyperactivity Disorder Rating Scale, Fourth Edition (ADHD-RS-IV) (ADHD-RS-IV; DuPaul et al., 2016; Spanish adaptation: Vallejo-Valdivielso et al., 2019) was used to assess ADHD symptom severity. This assessment scale is based on the 18 specific symptoms of ADHD according to the DSM, where the evaluator assigns a score on a four-point scale ('Never or rarely' = 0, 'Sometimes' = 1, 'Often' = 2, 'Very often' = 3). It can also be completed by parents and teachers. The psychometric properties of this scale have been well-established for children over five years old (DuPaul et al., 2016; Vallejo-Valdivielso et al., 2019). Recent data similarly indicate high reliability and validity when used with preschool-aged children (McGoey et al., 2007). It is important to note that the ADHD-RS-IV was updated by Marín-Méndez et al. (2019), including examples of different behaviors adapted to the preschool stage. This revised version consists of 18 items and has been incorporated into our test as an integral part of the set of questions distributed among various teachers from different centers to conduct the study. For this study, it shows strong reliability through the internal consistency values of $\alpha = 0.95$ for the general factor, $\alpha = 0.95$ for the innatention subscale, and $\alpha = 0.94$ for the hyperactivity subscale.

Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997, 1999) was used to assess various emotional and behavioral problems in children and adolescents aged 4 to 16. There are two versions in Spanish: one for parents and one for teachers. It comprises 25 items with a 3-point Likert response scale

(0 = not true; 1 = somewhat true; 2 = totally true). The extended version used in this study includes an 'impact supplement' that evaluates the extent to which the child's difficulties interfere with daily life. The items are categorized into 5 scales: Emotional symptoms, behavioral problems, hyperactivity/inattention, peer relationship problems, and prosocial behavior. The reliability of this instrument, measured through Cronbach's α in a Spanish sample, is 0.77 (Rodríguez-Hernández et al., 2012). For this study, it shows acceptable reliability through the internal consistency values of α = 0.74 for the general factor, α = 0.72 for behavioral problems, α = 0.82 for prosocial behaviors, α = 0.71 for hyperactivity, α = 0.70 for emotional symptoms, and α = 0.70 for peer relationship problems.

Study procedure and linguistic validation

The adaptation of the CPC involved a systematic process comprising five stages, outlined in the protocol for test adaptations (Hernández et al., 2020; Muñiz et al., 2013). Initially, a direct conceptual translation from English to Spanish was conducted by two bilingual translators proficient in both languages (Stage 1). Following the guidelines mentioned above, these translators were native Spanish speakers with no project affiliation, and collaborated to produce a preliminary Spanish version of the scale. Subsequently, a third independent translator offered unbiased feedback, facilitating the comparison and synthesis of all translated versions until each item was accurately rendered (Stage 2). In the third stage (Stage 3), two additional bilingual translators translated the Spanish draft back into English, yielding the final English rendition. The linguistic equivalence of these back-translated versions was rigorously assessed considering cultural nuances with the original measure by the translators and a neutral collaborator. In the fourth stage (Stage 4), a Spanish research committee comprising four experts in ADHD and preschoolers ensured both linguistic fidelity and cultural appropriateness. Any disparities identified were meticulously addressed through consultation. Participants reported no difficulty understanding the scale or selecting response options, expressing overall satisfaction with the instrument (Stage 5). No suggestions were made for additional item inclusion during the interviews.

Once the tool was adapted, the sample collection was carried out by a team of three highly qualified professionals in psychology, who are integral members of our research team. These specialists personally traveled to different participating educational centers in the study to ensure a precise and rigorous process. On-site, the questionnaires were implemented by the teachers themselves in the presence of the interviewers, thus ensuring an environment conducive to obtaining reliable data. It is crucial to highlight that, prior to sample collection, all participants were thoroughly informed, and they provided their explicit consent to be part of the research.

The procedure followed in this research was approved by the Ethics Committee of the University of Alicante, under the file registration number UA-2023-06-30_1. This investigation is also based on the International Test Commission Guidelines for test translation and adaptation (Muñiz et al., 2013). This approval ensures compliance with the highest ethical and regulatory standards in our research.

Data analysis

First, descriptive analyses were run for the entire sample. This encompassed computing central tendency metrics such as means and standard deviations for both individual items and dimensions, as well as for the general factor of the test.

A Confirmatory Factor Analysis (CFA) was conducted to examine the factorial structure of the CPC using the Jamovi software (version 2.6.26.0). Given the ordinal nature of the data (i.e. 4-point Likert-type items), we employed the Robust Weighted Least Squares Mean and Variance adjusted estimator (WLSMV), which is recommended for ordinal variables with fewer than five response options (Kline, 2023; Rhemtulla et al., 2012). Model fit was evaluated using the following criteria: a Comparative Fit Index (CFI) ≥ 0.90, Tucker-Lewis Index (TLI) ≥ 0.90, Root Mean Square Error of Approximation (RMSEA) between 0.05 and 0.08, and a Standardized Root Mean Square Residual (SRMR) ≤ 0.08 (Brown, 2015). Factor loadings were considered acceptable if ≥ 0.40.

In regard to the convergent validity, we analyzed bivarite Pearson's correlations between the general factor of the CPC and the dimensions and general factor of the ADHD-rating scale. Correlations were considered significant when $p < 0.05$, and the interpretation was based on Hernández-Lalinde et al. (2018). Null correlations were considered when $r_{xy} < 0.10$; from $r_{xy} = = 0.11$ to $r_{xy} = 0.30$, weak correlations; from

r_{xy} = 0.31 to r_{xy} = 0.50, moderate correlations; and values from r_{xy} = 0.51 to r_{xy} = 1.00 show strong correlations. We also computed the Average Variance Extracted (AVE), which indicates that the construct of the CPC explains at least 50% of the variance in the items (Hair et al., 2014).

Additionally, stepwise regression analyses were also run to measure the predictive validity with the CPC's items as predictive variables, and both the dimensions and the general factor of the SDQ as outcome variables. Gender and age were included as control variables. A significance level of 0.05 was set to determine null hypotheses.

We also examined reliability indicators using both Cronbach's Alpha and McDonald's Omega Internal Consistency Coefficient for all dimensions and the overall factor of the inventory. These analyses were conducted using JASP (version 0.18.3). While Cronbach's Alpha is widely used to assess internal consistency, McDonald's Omega offers a coefficient that is not constrained by assumptions of one-dimensionality, data heterogeneity, or covariances among expected scores of inventory items (Kalkbrenner, 2023; Ventura-León & Caycho-Rodríguez, 2017). Consequently, the latter appears to be more robust, as it is based on a factor analytic model (Kalkbrenner, 2023; Ventura-León & Caycho-Rodríguez, 2017). For coefficient Alpha, acceptable reliability evidence ranges from 0.70 to 0.84, and values from 0.85 provide strong reliability. Similarly, for coefficient Omega, acceptable reliability evidence ranges from 0.65 to 0.80, and values from 0.81 indicate strong reliability (Kalkbrenner, 2023; Ventura-León & Caycho-Rodríguez, 2017).

Furthermore, given that the sample comprises both adolescent boys and girls, the invariance of the CPC between genders was examined. Consequently, the study's sample size provides adequate power to assess invariance (Cheung & Rensvold, 2002). In all the conducted invariance models, individual CPC items were treated as exogenous variables. Maximum Likelihood Estimation was utilized, as it is commonly regarded as the optimal method when administering questionnaires with a Likert-type response scale ranging from 2 to 5 points (Rand-Giovannetti et al., 2020; Rhemtulla et al., 2012).

The data in this study were examined using three distinct models of invariance: configural, metric, and scalar. Configural invariance assesses whether the same underlying factor structure is present across groups. Metric invariance evaluates whether the strength of relationships between observed variables and latent constructs is consistent across groups. If the questionnaire fails to demonstrate metric invariance, it suggests that the instrument may be measuring different constructs across groups. Scalar invariance examines whether the intercepts of observed variables are equivalent across groups. A lack of scalar invariance implies that, in this study, the same score could indicate different levels of executive dysfunction between groups (Chen et al., 2020). In order to confirm whether the invariance hypothesis, suggesting that the interpretation of the CPC is consistent between girls and boys (H_0), holds true, the p-value for the invariance test must exceed 0.05 for each of the models constructed (both metric and scalar) (Rosseel & Loh, 2024; Van De Schoot et al., 2015). Should the instrument fail to demonstrate metric or scalar invariance, suggesting differences in the interpretation of the CPC (H_1). All data analyses were calculated using JASP (version 0.18.3) and Jamovi (2.6.26.0) programs.

Results

Descriptive analysis and performance of the CPC Spanish teacher-report version

Descriptive statistics, such as ranges, means, standard deviations, and floor/ceiling effect were calculated for the items and the general factor of the CPC. The results are shown in Table 2.

Also, we ran Pearson's correlations among the items and the general factor of the Spanish version of the CPC. All the correlations seem to be positive, strong and significant, except for the items 5 and 6, which indicates the lowest correlations with other items. They are weak and moderate correlations (Table 3).

Table 2. Standard errors covariances estimated of the items.

Items	SE
1. Does this child disrupt the classroom?	0.031
2. Does this child have difficulty getting along with children at school?	0.015
3. Does this child have difficulty making or keeping friends?	0.025
4. Does this child have difficulty getting along with teachers and/or other adults?	0.010
5. Does this child feel bad about him/herself?	0.030
6. Does this child have many accidents (e.g. falls, gets hurt, spills things)?	0.041

Note: SE = Standard error.

Validity of the CPC Spanish version

Construct validity: confirmatory factor analysis

The model shows very adequate fit indices, with $\chi^2_{(9)} = 21.364$, $p = 0.011$, CFI = 0.947, TLI = 0.912, RMSEA = 0.054 (95% CI [0.001, 0.124]), SRMR = 0.042. Furthermore, the factor loadings of all the items of the Spanish self-reported version of the CPC are above 0.4 (Figure 1), and standard error covariances estimated were also close to zero (Table 4). Therefore, we decided to keep all of them as the original version. Moreover, the AVE shows that the construct explains at least a 50% of the items' variance (≥0.50).

Table 3. Descriptive statistics, floor and ceiling effect of the items and the general factor of the CPC Spanish version.

Items	R	M (SD)	Skewness	Kurtosis	Floor effect, %	Ceiling effect, %
1. Does this child disrupt the classroom?	0–3	0.309 (0.637)	2.114	3.900	77.660	22.340
2. Does this child have difficulty getting along with children at school?	0–3	0.206 (0.499)	2.620	7.131	83.191	16.809
3. Does this child have difficulty making or keeping friends?	0–3	0.174 (0.488)	3.262	11.816	86.383	13.617
4. Does this child have difficulty getting along with teachers and/or other adults?	0–3	0.102 (0.367)	4.086	18.640	91.702	8.298
5. Does this child feel bad about him/herself?	0–3	0.162 (0.475)	3.336	11.997	87.660	12.340
6. Does this child have many accidents (e.g. falls, gets hurt, spills things)?	0–3	0.191 (0.552)	3.276	11.043	86.809	13.191
General factor of the CPC	0–3	1.145 (2.186)	2.910	10.720	–	–

Note: R = Range, M = mean, SD = Standard deviation.

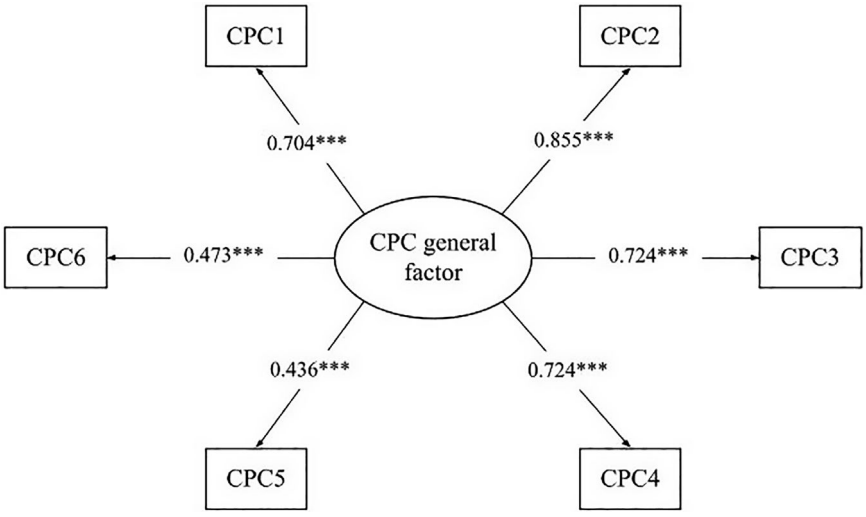

Figure 1. Item-factor loadings of the teacher-report version of the CPC in the Spanish study sample (N = 470). *** = $p < 0.001$.

Table 4. Pearson's correlations analysis and confidence intervals among items and the general factor of the teacher-report CPC Spanish version.

Items	1.	2.	3.	4.	5.	6.	7.
1.	–						
2.	0.677*** [0.625, 0.724]	–					
3.	0.430*** [0.353, 0.501]	0.657*** [0.602, 0.705]	–				
4.	0.558*** [0.493, 0.618]	0.548*** [0.482, 0.608]	0.567*** [0.503]	–			
5.	0.265*** [0.179, 0.379]	0.327*** [0.243, 0.405]	0.384*** [0.304, 0.459]	0.395*** [0.316, 0.468]	–		
6.	0.365*** [0.284, 0.441]	0.390*** [0.311, 0.464]	0.343*** [0.261, 0.420]	0.272*** [0.186, 0.354]	0.264*** [0.178, 0.346]	–	
7. General factor of the CPC	0.786*** [0.749, 0.818]	0.834*** [0.804, 0.860]	0.764*** [0.723, 0.799]	0.737*** [0.693, 0.776]	0.588*** [0.525, 0.644]	0.628*** [0.570, 0.680]	–

***$p < 0.001$.

Table 5. Pearson's correlations and confidence intervals between the CPC general factor and ADHD-RS subscales and its general factor.

	1.	2.	3.	4.	5.
1. General factor of the CPC	–				
2. Inattention (ADHD-RS subscale)	0.561*** [0.496, 0.620]	–			
3. Hyperactivity (ADHD-RS subscale)	0.651*** [0.595, 0.700]	0.618*** [0.559, 0.671]	–		
4. Impulsiveness	0.494*** [0.422, 0.559]	0.496*** [0.425, 0.562]	0.764*** [0.724, 0.799]	–	
5. General factor of the ADHD-RS	0.662*** [0.608, 0.710]	0.905*** [0.887, 0.920]	0.877*** [0.854, 0.896]	0.772*** [0.732, 0.806]	–

***$p < 0.001$.

Construct validity: convergent validity

Table 5 indicates the relationships between the general factor of the CPC and the dimensions and the general factor of the ADHD-RS. All correlations are positive, strong and significant.

Construct validity: predictive validity

Five stepwise multiple linear regression analyses were made to determine the predictive value of each item of the CPC on the subscales of the SDQ. Gender and age were introduced as confounding variables (Table 6).

All the models are statistically significant ($p < 0.001$), explaining from 4.6% to 36% of variance of the SDQ dimensions (emotional symptoms, conduct problems, hyperactivity, peer problems, and prosocial).

Reliability of the CPC Spanish teacher-report version

Internal consistency indexes were analyzed for the reliability of the CPC. For the general factor of the test, Cronbach's alpha (0.809, CI 95% [0.781, 0.834]) and McDonald's Omega (0.821, CI 95% [0.796, 0.846]) are acceptable. Also, Table 7 shows item-test correlations, which are ranged from 0.416 to 0.739.

Invariance measurement across gender

Table 8 presents the fit indices of the models developed for the invariance analysis, and the parameters of the invariance test aimed at verifying the hypotheses. Our findings show that the metric and scalar models created for this measurement do not meet fit indexes, since all the tests are significant ($p < 0.001$).

Discussion

The main goal of this study was to adapt the teacher-report version of the Children's Problems Checklist (CPC) for use with Spanish preschoolers and to analyze the psychometric properties of this version. Particularly, we examined the factor structure, convergent and predictive validity, the internal consistency for the test reliability, and the measurement invariance across gender and age.

Regarding our results of the confirmatory factor analysis, fit indexes are adequate and the items factor loadings are all above 0.4. That is, our Spanish teacher-report version of the test confirmed the original structure, and we can maintain the same items for assessing Spanish preschoolers (Healey et al., 2008). Also, our findings revealed that the items of our test strongly and significantly correlate with the subscales of the ADHD-RS. However, item 5 (Does this child feel bad about him/herself?) and 6 (Does this child have many accidents (e.g. falls, gets hurt, spills things?) present the lowest correlations, but still weak-moderate and significant. The item 5 appears to be more endogenous, and teachers may struggle evaluating these kinds of introspective aspects. Indeed, according to the literature, teachers are good observers for externalizing behaviors, but not for internalizing ones (Costa-López et al., 2023). Teachers can thus identify more likely hyperactivity symptoms, which are more related to externalizing behavior problems (i.e. runs and climbs excessively, impulsive decision-making, or struggling in interpersonal relationships), than inattention symptoms since they are somehow manifested in a cognitive manner and not easily observed in the classroom with other children (Dupaul et al., 2011; Zoromski et al., 2015). The research findings have demonstrated that a lack of attention, a form of internalization of symptoms, for example, negatively impacts the

Table 6. Stepwise multiple regression analysis with the symptoms listed on the CPC as predictors of strengths and difficulties of the children measured by the SDQ (N = 470).

				95% CI				
	B	*β*	p	Lower	Upper	F	Adjusted R^2	p
Model 1								
Item 5_CPC	0.339	0.569	<0.001	0.295	0.384	223.555	0.322	<0.001
Model 2								
Item 5_CPC	0.311	0.521	<0.001	0.266	0.356	127.526	0.350	<0.001
Item 6_CPC	0.092	0.179	<0.001	0.053	0.131			
Model 3								
Item 5_CPC	0.289	0.484	<0.001	0.241	0.336	89.012	0.360	<0.001
Item 6_CPC	0.076	0.149	<0.001	0.036	0.117			
Item 3_CPC	0.069	0.118	0.005	0.021	0.116			
Model 4								
Item 2_CPC	0.313	0.505	<0.001	0.264	0.361	160.199	0.253	<0.001
Model 5								
Item 2_CPC	0.189	0.305	<0.001	0.125	0.253	101.001	0.299	<0.001
Item 1_CPC	0.143	0.295	<0.001	0.093	0.193			
Model 6								
Item 2_CPC	0.154	0.249	<0.001	0.091	0.218	80.139	0.336	<0.001
Item 1_CPC	0.135	0.278	<0.001	0.086	0.184			
Item 5_CPC	0.135	0.208	<0.001	0.084	0.186			
Model 7								
Item 1_CPC	0.303	0.452	<0.001	0.249	0.357	120.049	0.202	<0.001
Model 8								
Item 1_CPC	0.262	0.391	<0.001	0.205	0.320	68.874	0.224	<0.001
Item 6_CPC	0.128	0.165	<0.001	0.061	0.194			
Model 9								
Item 3_CPC	0.164	0.213	<0.001	0.096	0.233	22.235	0.043	<0.001
Model 10								
Item 3_CPC	0.208	0.270	<0.001	0.133	0.284	14.792	0.056	<0.001
Item 1_CPC	−0.078	−0.132	0.008	−0.136	−0.020			
Model 11								
Item 3_CPC	0.180	0.233	<0.001	0.101	0.259	11.641	0.064	<0.001
Item 1_CPC	−0.086	−0.146	0.004	−0.144	−0.028			
Item 5_CPC	0.087	0.110	0.025	0.011	0.163			
Model 12								
Item 3_CPC	−0.272	−0.292	<0.001	−0.353	−0.191	43.759	0.084	<0.001
Model 13								
Item 3_CPC	−0.204	−0.219	<0.001	−0.293	−0.116	28.561	0.105	<0.001
Item 1_CPC	−0.121	−0.170	<0.001	−0.189	−0.053			
Model 14								
Item 5_CPC	0.144	0.365	<0.001	0.110	0.177	72.105	0.132	<0.001
Model 15								
Item 5_CPC	0.113	0.287	<0.001	0.079	0.147	53.130	0.185	<0.001
Item 2_CPC	0.090	0.241	<0.001	0.058	0.123			
Model 16								
Item 5_CPC	0.103	0.263	<0.001	0.069	0.137	40.278	0.201	<0.001
Item 2_CPC	0.070	0.187	<0.001	0.036	0.104			
Item 6_CPC	0.053	0.158	<0.001	0.023	0.084			

Note: Models 1, 2, 3 = emotional symptoms as dependent variable, Models 4, 5, 6 = conduct problems as dependent variable, Models 7, 8 = hyperactivity as dependent variable, Models 9, 10, 11 = peer problems as dependent variable, Models 12, 13 = prosocial as dependent variable, Models 14, 15, 16 = general factor of the SDQ as dependent variable, CI = confidence interval, B = unstandardized coefficients, *β* = standardized Beta coefficients.

Table 7. Correlations between items and the general factor, and cronbach's alpha and McDonald's omega values if each item were removed.

Items	$R_{it}c$	*α*-i	*ω*-i
1.	0.624	0.769	0.779
2.	0.739	0.740	0.745
3.	0.642	0.763	0.786
4.	0.644	0.773	0.784
5.	0.416	0.810	0.824
6.	0.434	0.811	0.829

Note: $r_{it}c$ = Correlation between item and the test, *α*-i = Cronbach's Alpha internal consistency coefficient value if item is removed, *ω*-i = McDonald's Omega internal consistency coefficient value if item is removed.

Table 8. Fit indexes for the configural, metric, and scalar invariance models across gender (N = 470).

	Model fit indexes										Measurement invariance test		
	χ^2	df	*p*	CFI	TLI	RMSEA	90% CI	SRMR	AIC	BIC	$\Delta\chi^2$	Δdf	*p*
Configural	137.119	18	<0.001	0.873	0.789	0.168	0.142, 0.195	0.055	2787.932	2937.354	–	–	–
Metric	219.139	23	<0.001	0.792	0.728	0.191	0.168, 0.214	0.128	2859.952	2988.621	82.020	5	<0.001
Scalar	261.005	29	<0.001	0.753	0.745	0.185	0.165, 0.206	0.157	2889.818	2993.583	41.866	6	<0.001

Note: χ^2 = chi-square, RMSEA = root mean square error of approximation, TLI = Tucker–Lewis index, CFI = comparative fit index, SRMR = standardized root mean square residual, df = degrees of freedom, CI = confidence interval, $\Delta\chi^2$ = chi-square difference test.

reading abilities of preschool and primary school children. Teachers can identify reading difficulties, but they may not be able to pre-detect attentional deficiencies (Fabio et al., 2023). Additionally, teachers' knowledge about ADHD and their experience working with students with ADHD can influence the effectiveness of interventions for these students (Kulikova et al., 2023). It is crucial for teachers to have a clear understanding of ADHD to be able to identify and support students with this disorder (Monteiro et al., 2022; Navarro-Soria et al., 2024). However, further research is needed to explore whether teaching factors, such as knowledge about ADHD, moderate the effectiveness of interventions for students with ADHD (Eisensmith et al., 2022).

However, due to the strong relationships between our test and the ADHD-RS, it can be stated that CPC can measure the impairment related to ADHD symptoms. Based on previous research, the ADHD-RS appears to be a golden standard questionnaire for the assessment of ADHD symptoms and its inattention, hyperactivity and combined subtypes of the diagnosis (Langberg et al., 2010; Mercier et al., 2016; Szomlaiski et al., 2009; Zhang et al., 2005). Similarly, our results also show evidence of a predictive role for all the subscales of the SDQ, especially for emotional symptoms, conduct problems, and hyperactivity. Our Spanish adaptation of the CPC appears to perfectly predict behavioral problems which are essential aspects of ADHD profiles. Particularly, all the items play a role as predictors of behavioral symptoms, except for item 4 ('Does this child have difficulty getting along with teachers and/or other adults?'). This can be explained due to the statements used to assess the relationship with other adults from both tests. As mentioned before, the predictive validity was conducted with the SDQ test, and this test has an item that says 'Has your child been popular with other adults?'. The writing of this item may make the rater interpret the item in a different manner. This could suggest that the interpretation of the item 4 of the CPC cannot work as a predictor since it is unique. Nevertheless, the other items perfectly predict the dimensions of the SDQ test, such as emotional symptoms, conduct problems, hyperactivity, peer problems, prosocial behaviors. The items of the CPC test explain between 22.4% and 36% of the variance of the emotional symptoms, conduct problems, and hyperactivity. Peer problems and prosocial behaviors are less explained by the CPC test items. However, the models created are significant and well adjusted.

Regarding the reliability of the test, our results demonstrate that the Spanish teacher-report of the CPC test has an adequate reliability through the internal consistency, achieving values above 0.8. Also, correlations between the items and the test are above 0.3 in all the items. Our internal consistency values are similar to the original ones. That is, our Spanish teacher-report test is accurate to assess these behavioral symptoms related to ADHD.

In relation to the analysis of the invariance, our study can suggest that the interpretation of the Spanish test adaptation can be different between preschool boys and girls. As a matter of fact, recent studies have found gender differences in the evaluation of ADHD symptoms. Previous research has highlighted gender differences in the assessment of ADHD symptoms, attributed to diverse factors such as variability in the symptomatic expression of the disorder, influenced by biological, social and cultural aspects (Hasson & Fine, 2012). This has been evidenced in numerous studies, addressing reasons including neurobiological differences and social and cultural expectations (Biederman et al., 2002; Gershon & Gershon, 2002). The literature points out that differences in brain structure and function could contribute to the variability of symptoms between boys and girls with ADHD. Also, sociocultural expectations may influence how symptoms manifest, with externalizing symptoms being more evident in boys and internalizing symptoms in girls (Fraticelli et al., 2022). The detection and diagnosis of ADHD may also be affected by gender stereotypes, with health professionals who may have unconscious biases impacting assessment and diagnosis (Fresson et al., 2019; Hinshaw, 2002). In addition, girls with ADHD may develop

coping and compensatory strategies that decrease the visibility of externalizing symptoms, such as hyperactivity, especially in school settings (Guy et al., 2022).

Strengths, limitations, and future investigation

This study presents some strengths. First, this research examines the first adaptation of the CPC test into a non-original language. Also, this Spanish teacher-report adaptation shows adequate psychometric properties for its use by teachers with preschoolers, demonstrating good reliability and validity of the test, as well as confirming the original factor structure. This is in line with previous studies which have indicated the importance of the evaluation of ADHD symptoms-related impairment in toddlers (Halperin & Marks, 2019).

However, this investigation is not without limitations. Although the test shows good reliability through the internal consistency values, the reliability test-retest can provide results of the test temporal stability. Despite the acceptable sample size for this research, another limitation is related to the location of the recruitment. Participants are recruited from a region of Spain, and other Spanish-speaking regions or countries are therefore important to be assessed due to the cultural differences.

Additionally, although our analyses treated children's scores as independent, the data have a nested structure (i.e. children are nested within classrooms/teachers), which may have introduced statistical dependencies. Clustering of this kind can affect the estimation of standard errors and parameter significance, potentially biasing the results (Julian, 2001). Future studies should consider using multilevel modeling techniques where sample size and structure permit, or applying statistical corrections for clustering effects. At a minimum, this should be recognized as a limitation of the current design and addressed more explicitly in future research.

Another important limitation of the present study is the failure to establish measurement invariance across sex. Although the CPC demonstrated an adequate fit at the full-sample level using the WLSMV estimator, neither metric nor scalar invariance was supported in multigroup confirmatory factor analysis (CFA), indicating that the construct assessed by the CPC might not be interpreted equally by teachers when evaluating boys and girls.

Future studies could explore partial measurement invariance by identifying non-invariant items and testing whether it is possible to constrain a subset of parameters equivalently across groups while allowing others to vary (Byrne et al., 1989). Furthermore, researchers could consider using Bayesian structural equation modeling with informative priors, as well as incorporating approximate invariance testing procedures or residual covariances. These approaches offer greater flexibility and can provide robust alternatives to traditional confirmatory factor analysis (CFA) when there is model misfit (Asparouhov et al., 2015; Van De Schoot et al., 2015). These approaches could provide greater insight into whether the CPC functions equivalently across subgroups in diverse populations.

Future studies may consider the possibility to adapt into Spanish the parent-report version of this test to compare the evaluations between parents and teachers, as cross-situationally is required for a diagnosis to be made. Furthermore, this study will provide the educational and social community in Spanish/Spanish speaking populations a gold standard screening questionnaire for the impairment related to ADHD symptoms. Early detection is important in order to provide intervention as early as possible for those whose functioning is impaired.

Conclusions

In conclusion, our findings provide the scientific and educational communities with a screening questionnaire for the assessment of impairment related to ADHD symptoms in preschool children within Spanish speaking populations. Our tool indicates good psychometric evidence of reliability, validity and factor structure that allows Spanish teachers to use this in assessing the children they teach.

Author contributions

I. N-S, J. M-T, B. C-L: Conceptualization, Methodology, Software, Data curation, Writing - Original draft, Visualization, Investigation. **D. H**: Supervision, Validation. **I. N-S, J. M-T, B. C-L, D. H**: Writing - Review and Editing.

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Data availability statement

All data generated or analyzed during this study are included in this published article. The availability of data must be personally requested to the corresponding author at borja.costa@ua.es

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