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Validation of The Canadian Assessment of Physical Literacy – CAPL-2 Questionnaire for German and Polish School Children

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A) conception and design of the study
B) acquisition of data
C) analysis and interpretation of data
D) manuscript preparation
E) obtaining funding

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Abstract

Physical literacy (PL) is a lifelong process of developing the motivation, confidence, physical competence, knowledge and understanding to value and take responsibility for engaging in physical activity throughout life. It is also an important concept for understanding and promoting physical activity in children and adolescents and is becoming a theoretical basis for analysing physical education in schools. One of the best known, well-operationalised assessments of PL is the Canadian Assessment of Physical Literacy – CAPL-2. The aim of the study was to translate and culturally adapt the CAPL-2 questionnaires in two EU languages, German and Polish. Data from Poland and Germany were combined for this study, with a total sample size of N=802, consisting of 58.6% Polish and 41.4% German students. We used the TRAPD (the Translation, Review, Adjudication, Pre-test and Documentation) approach to translate the CAPL-2 questionnaires. The main results of this study show that the proposed Polish and German versions of the CAPL-2 questionnaires are satisfactory for use in research or for teachers to assess PL in physical education. Our results also indicate better predictive characteristics of the CAPL-2 questionnaires for children who are very close to or who meet the moderate-to-vigorous physical activity (MVPA) recommendations for health as defined by the WHO. We recommend that adaptations be made that are consistent with the original Canadian version, but which are deeply embedded in the language and culture of the country in question, especially in their wording and terminology.

Keywords: primary school children, physical activity, test-retest, motivation, knowledge.

Introduction

All across Europe, many children and adolescents do not meet the World Health Organization (WHO) guidelines of at least 60 minutes of moderate to vigorous physical activity (MVPA) per day (Bull et al., 2020; Guthold, Stevens, Riley & Bull, 2020). A recent study shows that only 16.2% of German children and adolescents met these guidelines in 2021 (Schmidt et al., 2021). Similar negative trends were reported in the Health Behaviour of School-Aged Children (HBSC) study in Germany (Bucksch et al., 2020). Kantanista et al. (2021) also found relatively low levels of physical activity and the implementation of the WHO recommendation in Poland. A decrease in physical activity was found among Polish children and adolescents (Bronikowska et al., 2021; Fijałkowska et al., 2022). Consequently, there is a need for approaches that improve children's physical activity.

In recent years, physical literacy (PL) as a prerequisite of participation in physical activity has attracted research-

ers' attention worldwide (Carl et al., 2023). According to Whitehead (2019), a child with physical literacy knows about and understands what it means to be physically active, is motivated to be physically active, is confident when engaged in physical activity, and has physical skills. This concept of physical literacy is interpreted as a holistic approach that enables researchers to design and evaluate physical activity programmes. Consequently, standardized tools are needed to measure physical literacy internationally to collect and compare the data.

Canadian researchers play a leading role in concept-building and tracking physical literacy among children. The Canadian Assessment of Physical Literacy, second edition (CAPL-2), as a revised version of CAPL with the four domains of Motivation and Confidence, Physical Competence, Knowledge and Understanding, and Daily Behaviour, is a valid and reliable instrument for assessing physical literacy in children 8–12 years old (Shearer et al., 2021). CAPL-2 consists of two questionnaires to assess the Knowledge and Understanding and Motivation and Confidence domains. The Daily Behaviour domain is assessed subjectively from one self-report item of weekly physical activity included in the questionnaire, and objectively from step counts for one week. To measure the Physical Competence domain, three physical tests are applied (Longmuir et al., 2018b).

Recently, the complete CAPL-2 has been validated worldwide for the target group, in Greece (Dania et al., 2020), China (Li et al., 2020), Denmark (Elsborg et al., 2021), Iran (Valadi & Cairney, 2023), and Pakistan (Liu et al. (2023). Also, CAPL-2 questionnaires have been validated among Spanish children (Pastor-Cisneros et al., 2022). In China a total of 371 primary students (174 girls; 153 boys; mean age = 10.0 ± 1.0) participated in a cross-sectional validation study (Li et al., 2020). According to Beaton et al. (2000), the Chinese translation process includes five steps: (1) initial translation, (2) synthesis of these translations, (3) back translation, (4) expert committee review, and (5) test of the pre-final version. 891 school children (484 girls; 407 boys; mean age = 9.86, SD=1.47) were tested in Denmark (Elsborg et al., 2021). The CAPL-2 questionnaires were translated into Danish and adapted to the Danish context according to the World Health Organization (2009) protocol, which includes four phases: (1) forward translation, (2) expert panel back translation, (3) pretesting and cognitive interviewing, and (4) final decision making (Elsborg et al., 2021).

In the Greek validation study (Dania et al., 2020) were 576 children participated (308 girls; 268 boys; mean age=10.22, SD=1.27). The original CAPL-2 questionnaires were translated by two Greek translators, added by experts to one Greek version and back-translated by English native speakers. The pre-final version was tested by physical education (PE) teachers and primary school children to produce the final version. No reliability was reported.

In a Spanish validation study by Pastor-Cisneros et al. (2022), with 57 schoolchildren aged from 8–12 years, the authors used the process of translation-back-translation of questionnaires in accordance with WHO guidelines (2009). After the translation of the questionnaires by two Spanish translators and a consensus meeting, a first version was created. After back-translation of this version and the comparison with the original CAPL-2 questionnaires, the Spanish version was pilot tested with 10 students in a face-to-face interview, including comprehension and paraphrase statements of the items, and the final version produced.

In Pakistan, Liu et al. (2023) examined the level of physical literacy stratified by 1360 children aged 8–12 years of normal weight and overweight. In this context, the authors translated the CAPL-2 questionnaires. The differentiation between Body Mass Index revealed higher levels of physical literacy in the normal-weight children in all domains except for the Knowledge and Understanding domain, where overweight children had higher scores. The Motivation and Understanding domain correlated significantly with Daily Behaviour and Physical Competence in normal weight and overweight children. The Knowledge and Understanding domain had a weak correlation with the other domains in both groups.

Valadi and Cairney (2023) studied the levels of PL in 504 Iranian elementary school children (boys, n=327, girls, n=177) aged 8–12 years. Using forward-backward translation, the questionnaires were translated by three fluent English-speaking sport scientists. The content validity and the face validity of the Persian version was examined by eight experts in motor behaviour and sports psychology. One week after the first testing, 30 children were randomly selected to assess the test-retest reliability.

The overview presented above clearly shows that CAPL-2 is now one of the best-recognised PL assessment tools in the world. Also, considering the results of recent literature reviews in this area (Jean de Dieu & Zhou, 2021; Shearer et al., 2021), the choice of the CAPL-2 seems justified from the perspective of the need to assess all the presumed dimensions of physical literacy: cognitive, affective, physical, behavioural. In the last five years, there have been many validations of this tool in European countries and internationally. To be able to compare the PL levels of school-aged children, universal, well-validated tools for its assessment are needed. These can then form the basis for further studies and discussions on the choice of the best form and method of PL assessment in individual countries, should the need arise. This may be due, for example, to cultural differences or those related to the organisation of education (including physical education) in different countries.

To the best of our knowledge, there are no German and Polish versions of the questionnaires of CAPL-2 (Longmuir et al., 2018a). Therefore, the aim of our study is translating and culturally adapting the questionnaires of CAPL-2 in two EU languages, German and Polish, exploring the reliability for use with children 8–12 years of age, and comparing the results in Germany and Poland. All questions were translated into Polish and German in parallel and adapted separately to the Polish and German country context following the TRAPD translation model (Harkness, 2003), one of the most widely used methods to translate questionnaires (Behr & Zabal, 2020). In comparison with the translation process suggested by the World Health Organisation (2009), the TRAPD approach does not include back-translation into the native language.

The overall objective of our study is ensuring that the translated CAPL-2 questionnaires are psychometrically sound and effective for use in research and educational settings (Tsang et.al., 2017). We expect that we have questionnaires to obtain information about physical literacy in the Polish and German target group in the most reliable and valid manner (Taherdoost, 2016).

Materials and Methods

We established the sample size for our analysis based on Cohran's formula (Kotrlik & Higgins, 2001). According to statistical governmental data in the school year 2020/2,1 there were around 2 million (1.96) students aged 8–12 in Poland and 2.85 million in Germany. Based on this data, we calculated the minimum representative sample as 384 for each analysed country. We also calculated minimum sample size according to the respondent–to–item ratio of at least 8:1, which gives a sample size of at least 136 for each country. For test-retest intra-class correlation coefficient (ICC), a sample size of at least 79 is recommended, regarding an ICC of 0.50 (the minimum acceptable ICC obtained), expected ICC 0.7 and a 95% confidence interval (CI) for a two-tailed test, a probability error of 0.05 and power of 80% (Arifin, 2018; Borg et al., 2022).

Participants

A database containing data from Poland and Germany was combined for this study, with the total samples size OF N=802, n=470 (58.6%) Polish students and n=332 (41.4%) German students. The sample size for the test-retest analysis was n=138 for Polish data and n=131 for German data. Demographic characteristics of the sample containing age (8–12 years; mean age=11) and gender (53% girls) were described in Table 1.

Table 1. Sample size and demographic characteristics

Category	Poland (n = 470)	Germany (n = 332)	Total (N = 802)
Gender			
Boys n (%)	216 (46%)	160 (48.2%)	376 (46.9%)
Girls n (%)	254 (54%)	172 (51.8%)	426 (53.1%)
Age			
M (SD)	11.10 (0.84)	11.05 (0.98)	11.08 (0.90)
8 years n (%)	3 (0.6%)	5 (1.5%)	8 (1.0%)
9 years n (%)	4 (0.9%)	26 (7.8%)	30 (3.7%)
10 years n (%)	114 (24.3%)	43 (13.0%)	157 (19.6%)
11 years n (%)	169 (36.0%)	132 (39.8%)	301 (37.5%)
12 years n (%)	180 (38.3%)	126 (38.0%)	306 (38.2%)

CAPL-2 Measures

The CAPL-2 questionnaires contain two domains with four subscales, and self-reported moderate-to-vigorous physical activity (MVPA). The first domain – Motivation and Confidence – assesses participants' confidence in being physically active and motivation to participate in physical activity. The total score of this domain consists of the result of four subscales of Predilection and Adequacy items ("What's most like me?"), Intrinsic Motivation ("Why are you active?"), and Physical Activity Competence ("How do you feel about being active?"), with three items each. According to the manual, the subscale scores vary from 1.5 resp. 1.8 to 7.5, with a maximum domain score of 30 points. The second domain – Knowledge and Understanding – measures participants' knowledge regarding physical activity. The scale consists of four multiple-choice questions, with one correct and three incorrect answers for each question. The second part is

a text with a gap-fill task to complete a story. For each correctly placed word, one point is assigned, with a maximum of six points available. The total sum of the domain ranges from 0 to10 with 10 as the best score. To assess children's perceptions of their own daily physical activity, a Prochaska-screening-test-based question with the number of days the child was physically active for at least 60 minutes during the last seven days (Prochaska et al., 2001) was performed. Recoded categories ranged from 0–5, where 5 corresponds to the recommended children's engagement in moderate-to-vigorous intensity physical activity (MVPA) of at least 60 minutes daily.

Translation and Cultural Adaptation

We used the TRAPD approach (Harkness, 2003; Walde & Völlm, 2023) to translate the CAPL-2 questionnaires into Polish and German language and to adapt them to the Polish and German context. TRAPD comprises the five steps of translation, review, adjudication, pre-test and documentation. Accordingly, the CAPL-2 questionnaires were translated into German and Polish language by two Polish and two German translators each independently, with Polish and German as their first language. The two versions were reviewed by a Polish and a German expert, respectively, in the area of physical literacy. During the review stage the reviewer met with the translators to adapt the translations. In the adjudication step final decisions were made and a pre-final Polish and German version of CAPL-2 questionnaires were produced. The two versions of the questionnaires were pilot tested in Germany with 12 boys and 9 girls (mean age=9.8) and in Poland with 10 boys and 12 girls (mean age=10.2). The German and Polish research groups chose a paper-pencil version performed in Magdeburg primary schools and in PE class in Poznan and Warsaw. In the pilot testing the questionnaires were administered and the children were asked to comment on whether the questions were understandable, etc. The whole process of translation and review and the results of the feasibility studies from the pilot were documented.

Procedure

The data collection was administered by the Polish and German research group and carried out differently in Poland and Germany. In Germany, the children participated in all the tests of the four domains of CAPL-2, including the physical tests and the daily step count. All measurements were made during scheduled PE classes by trained student research assistants on site in primary schools in different German states. The students were asked to complete the questionnaires on paper independently. If necessary, the student research assistants assisted the children. Polish children of primary schools in Wielkopolskie and Mazowieckie voivodships completed only the CAPL-2 questionnaires online. Regarding COVID-19 pandemic restrictions, schools in Poland were closed during the research period and all classes were conducted remotely. Therefore, an electronic version of the questionnaires was set up in the LimeSurvey survey program. PE teachers from the participating schools were instructed on how to conduct the survey and to help students in case of any doubts. The participants filled in the questionnaires on a computer or a tablet at home during PE classes. The instructions for the questionnaires emphasized that students were to give their own opinion for each question. The questionnaires were anonymized using a code consisting of selected letters of the student's first name, surname and date of birth. This allows for data to be paired post testing.

Ethics

All research procedures were conducted with strict adherence to ethical principles as set out by the universities involved, and ethical approval was obtained from the Ethics Committees. Approval was sought and obtained from the Ministries of Education in the different German states, and in Poland the research protocol was approved by Bioethics Committee at Poznan University of Medical Sciences. Written information about the study was given in advance to the school headteachers and teachers participating in the study. Prior to the study, all parents/legal guardians provided written informed assent. All children took part in the study voluntarily and were able to withdraw from the tests at any time.

Statistical analysis

The analysis of the data was performed using Pearson's r coefficient and Spearman's rho, by calculating interclass correlation coefficient (ICC) and standard error of measurement (SEM), %SEM and minimum detectable change (MDC). In addition, an ROC curve with area under the curve (AUC) was made. Normality and homogeneity of the analysed variables and scales were checked through the Kolmogorov–Smirnov test. Based on the 95% confidence interval of the ICC estimate, values less than 0.5 show poor, between 0.5 and 0.75 moderate, between 0.76 and 0.9 good, and greater than 0.90 excellent reliability (Koo & Li, 2016). Additionally, Cronbach's alpha coefficient was calculated for reliability evaluation. Cronbach's alpha of at least 0.60 has been suggested to indicate adequate internal consistency (Connelly, 2011). The correlation coefficient results were interpreted according to the recommendation by Schober et al. (2018) as less than 0.1 – negligible; 0.1 to 0.39 – weak; 0.4 to 0.69 – moderate; 0.7 to 0.89 – strong; 0.9 to 1 – very strong. The classical threshold of $\alpha = 0.05$ was adopted as the level of statistical significance. All calculations were performed using IBM SPSS Statistics version 25.0.

Results

The intercorrelations of the CAPL-2 questionnaires subscales and the overall score on the Polish and German samples were checked to determine whether there are any relationships between the subscales of the tool and the overall score. Initially, the distributions of the variables in both samples were checked. The distribution of variables in the Polish sample are shown in Table 2 and the German sample in Table 3.

Table 2. Descriptive statistics and tests of normality of distributions for CAPL-2 questionnaire in Polish sample

	M	*Me*	*SD*	*Sk.*	*Kurt.*	*Min.*	*Max.*	*D*	*p*
TEST (N = 470)									
Predilection	5.77	6.10	1.64	-0.75	-0.36	1.80	7.50	0.15	<0.001
Adequacy	6.06	6.10	1.32	-0.69	-0.16	1.80	7.50	0.17	<0.001
Intrinsic motivation	6.13	6.50	1.41	-1.16	0.01	1.50	7.50	0.16	<0.001
PA Competence	5.82	6.00	1.31	-0.85	0.39	1.50	7.50	0.16	<0.001
Motivation and Confidence	23.77	24.30	4.37	-0.70	-0.04	9.60	30.00	0.09	<0.001
PA Comprehension*	3.79	4.00	1.61	-0.42	-0.67	0.00	6.00	0.17	<0.001
Knowledge and Understanding*	5.70	6.00	2.10	-0.41	-0.19	0.00	10.00	0.13	<0.001
Total score CAPL-2Q*	29.48	30.40	5.12	-0.64	0.01	10.60	40.00	0.08	<0.001
MVPA	3.63	4.00	1.47	-0.90	-0.62	0.00	5.00	0.22	<0.001
RE-TEST (n = 139)									
Predilection	5.80	6.10	1.47	-0.65	-0.29	1.80	7.50	0.14	<0.001
Adequacy	5.90	6.10	1.39	-0.75	-0.11	1.80	7.50	0.15	<0.001
Intrinsic motivation	6.05	6.50	1.37	-1.01	0.79	1.50	7.50	0.14	<0.001
PA Competence	5.64	6.00	1.46	-0.64	-0.07	1.50	7.50	0.14	<0.001
Motivation and Confidence	23.43	23.90	4.66	-0.71	0.16	9.90	30.00	0.08	0.056
PA Comprehension**	4.07	4.00	1.65	-0.78	-0.08	0.00	6.00	0.20	<0.001
Knowledge and Understanding**	6.14	6.00	2.03	-0.88	0.51	0.00	10.00	0.18	<0.001
Total score CAPL-2Q**	29.56	30.70	5.61	-0.92	0.71	11.40	38.80	0.10	0.003
MVPA	3.61	4.00	1.55	-0.86	-0.34	0.00	5.00	0.25	<0.001

NOTE: *missing values (n = 60), ** missing values (n = 17)

In the Polish sample, the results of the Kolmogorov-Smirnov test indicate distributions away from the Gaussian curve (non-normal), but most of the skewness does not exceed the absolute value of 1. This indicates a slight asymmetry of the distribution. In addition, outliers exceeding the third standard deviation were removed from the analyses. For this reason, analyses of the Polish sample were based on parametric tests.

In the German sample, not only the results of the normality of distribution test are statistically significant, but also skewness values outside the range of -1 to 1 were noted. Numerous outliers were also found for almost every variable. Therefore, analyses were performed using non-parametric tests.

Correlation analysis of Pearson's r (Polish sample) and Spearman's rho (German sample) were performed for the first measurement of the tool (test). The results of these analyses are presented in Tables 4 and 5.

In the Polish and German samples, the analysis of the Motivation and Confidence subscales shows that

Table 3. Descriptive statistics and tests of normality of distributions for CAPL-2 questionnaire in German sample

	M	*Me*	*SD*	*Sk.*	*Kurt.*	*Min.*	*Max.*	*D*	*p*
TEST (N = 332)									
Predilection	6.28	6.80	1.45	-1.11	0.53	1.80	7.50	0.25	<0.001
Adequacy	6.08	6.10	1.38	-0.89	0.61	1.80	7.50	0.17	<0.001
Intrinsic motivation	5.89	6.00	1.52	-0.96	0.45	1.50	7.50	0.14	<0.001
PA Competence	5.57	5.50	1.57	-0.62	-0.28	1.50	7.50	0.13	<0.001
Motivation and Confidence	23.82	24.40	4.52	-0.70	0.04	7.80	30.00	0.09	<0.001
PA Comprehension*	4.88	5.00	1.51	-1.59	1.98	0.00	6.00	0.26	<0.001
Knowledge and Understanding*	6.54	7.00	1.96	-1.07	0.92	0.00	10.00	0.20	<0.001
Total score CAPL-2Q*	30.36	31.00	5.17	-0.68	0.63	13.90	40.00	0.07	0.001
MVPA	3.54	4.00	1.52	-0.76	-0.51	0.00	5.00	0.22	<0.001
RE-TEST (n = 133)									
Predilection	6.54	7.50	1.26	-1.38	1.68	1.80	7.50	0.29	<0.001
Adequacy	6.09	6.10	1.29	-0.93	0.72	1.80	7.50	0.15	<0.001
Intrinsic motivation	5.31	5.00	1.44	-0.56	0.43	1.50	7.50	0.17	<0.001
PA Competence	5.20	5.00	1.39	-0.47	0.42	1.50	7.50	0.17	<0.001
Motivation and Confidence	23.15	24.00	3.94	-0.92	1.37	10.20	30.00	0.12	0.001
PA Comprehension**	5.48	6.00	1.03	-2.68	9.02	0.00	6.00	0.41	<0.001
Knowledge and Understanding**	7.34	8.00	1.63	-1.40	3.46	0.00	10.00	0.19	<0.001
Total score CAPL-2Q**	30.49	31.00	4.28	-0.93	1.28	17.20	39.00	0.11	0.002
MVPA	3.77	4.00	1.41	-0.93	-0.14	0.00	5.00	0.25	<0.001

NOTE: *missing values (n = 70), ** missing values (n = 19)

they are positively and moderately correlated. In addition, strong associations were observed regarding the overall score of the Motivation and Confidence domain (see table 4).

In the Polish and German samples, significant relationships were also observed for the correlation of the two domains Motivation and Confidence, Knowledge and Understanding, and MVPA. However, it turned out that the Knowledge and Understanding domain in the Polish sample is weakly related to the Motivation and Confidence domain, and yet it correlates moderately with the overall score, and it is only weekly correlated with MVPA. The Motivation and Confidence domain is also weekly to moderately correlated with the subjective measured

Table 4. Correlations within the Motivation and Confidence domain

	Poland				**Germany**			
	1	2	3	4	1	2	3	4
1. Predilection	-				-			
2. Adequacy	0.39**	-			0.42**	-		
3. Intrinsic Motivation	0.42**	0.29**	-		0.43**	0.32**	-	
4. PA Competence	0.38**	0.43**	0.66**	-	0.41**	0.46**	0.66**	-
Motivation and Confidence	0.75**	0.68**	0.78**	0.81**	0.76**	0.67**	0.77**	0.81**

NOTE: *** - $p < 0.001$; ** - $p < 0.01$; * - $p < 0.05$

Table 5. Correlations between CAPL-2Q domains, MVPA and CAPL-2Q total score

	Poland			Germany		
	1	2	3	1	2	3
1. MVPA	-			-		
2. Motivation and Confidence	0.44**	-		0.31**	-	
3. Knowledge and Understanding	0.16**	0.16**	-	0.07	0.14**	-
Total score CAPL-2Q	**0.43****	**0.90****	**0.55****	**0.30****	**0.90****	**0.52****

NOTE: **-p < 0.01; *-p < 0.05

MVPA in the German and Polish samples, respectively (see Table 5).

The data above indicate a good tool characteristic in the Polish and the German sample.

Reliability

Next, reliability was calculated based on Cronbach's α and ICC. In addition, SEM, %SEM and MDC for 95% CI were calculated. The obtained results for the Polish sample based on test-retest analysis indicate an ICC value exceeding 0.50 (moderate reliability) and even 0.75 (good reliability) for the Motivation and Confidence domain. The SEM values range from 0.56 to 1.65 and the MDC 95%, IC from 1.31 to 3.83 (see Table 6). In the case of the Knowledge and Understanding domain, a moderate reliability result was observed (see Table 7).

Table 6. CAPL-2 reliability scores for Motivation and Confidence domain and subdomains in Polish and German samples.

Motivation and Confidence	**Test-re-test reliability**			
	ICC (95% CI)	SEM	%SEM	MDC
Poland (*n* = 139)				
Predilection	0.769 (0.677-0.835)	0.78	13.74	1.82
Adequacy	0.747 (0.646-0.819)	0.69	11.52	1.60
Intrinsic motivation	0.722 (0.611-0.801)	0.74	12.19	1.71
PA Competence	0.831 (0.762-0.880)	0.56	9.80	1.31
Total domain score	**0.870 (0.816-0.907)**	**1.65**	**7.03**	**3.83**
Germany (*n* = 131)				
Predilection	0.656 (0.514-0.756)	0.73	11.10	1.69
Adequacy	0.716 (0.599-0.798)	0.69	11.19	1.59
Intrinsic motivation	0.229 (-0.047-0.438)	1.20	20.82	2.78
PA Competence	0.299 (0.031-0.495)	1.16	21.00	2.70
Total domain score	**0.646 (0.456-0.763)**	**2.38**	**9.92**	**5.52**

Table 7. CAPL-2 reliability results for Knowledge and Understanding domain in Polish and German samples.

Knowledge and Understanding	**Test-re-test reliability** (*n* = 139)			
	ICC (95% CI)	SEM	%SEM	MDC
Poland (*n* = 139) **Total domain score**	**0.690 (0.566-0.778)**	**1.26**	**22.13**	**2.92**
Germany (*n* = 131) **Total domain score**	**0.596 (0.429-0.713)**	**1.09**	**15.54**	**2.54**

In the German sample, two out of five of the ICC values are below the conventional threshold (0.50) (see Table 6). ICC values for Predilection, Adequacy and Motivation and Confidence total domain show moderate reliability. SEM values range from 0.69 to 2.38, and for MDC 95% IC from 1.59 to 5.52. In the case of the Knowledge and Understanding domain, moderate reliability was observed for the general domain (see Table 7).

To supplement, Cronbach's Alpha was calculated for individual subscales and the total CAPL-2 questionnaire score (see Table 8).

The reliability based on Cronbach's α for individual subscales of the Motivation and Confidence domain and its total score is mostly at a strong level (α > 0.70). In this case, α values in the range of 0.6 to 0.9 were recorded, but this is still an acceptable level of reliability. For Adequacy and for the Knowledge and Understanding domain in the Polish sample, the value of Cronbach's α in the first measurement is lower than 0.60 (0.578 and 0.567, respectively), which indicates a slightly reduced reliability of these subscales.

Table 8. Cronbach's Alpha results for CAPL-2 questionnaire domains and subscales for Poland and Germany.

	Number of items	Cronbach's α			
		Test		Re-test	
		Poland	Germany	Poland	Germany
Motivation and Confidence	**12**	**0.851**	**0.866**	**0.889**	**0.845**
Predilection	3	0.714	0.745	0.659	0.698
Adequacy	3	0.578	0.691	0.673	0.648
Intrinsic motivation	3	0.868	0.819	0.893	0.885
PA Competence	3	0.827	0.848	0.894	0.879
Knowledge and Understanding	**10**	**0.567**	**0.612**	**0.571**	**0.593**
Total score CAPL-2Q	**22**	**0.796**	**0.815**	**0.851**	**0.772**

The Knowledge and Understanding domain total scores mostly do not show adequate reliability in both Polish and German data. Cronbach's α values in this case are below the threshold of 0.6. However, the total CAPL-2 questionnaire score in the test and re-test is reliable for both the Polish and German samples.

Predictiveness of the CAPL-2 Questionnaire Based on Physical Activity

Due to the fact that the study was expanded with a question initially diagnosing the level of physical activity of participating children, the test-retest reliability analysis was completed for MVPA (see table 9), and an additional analysis was proposed, to check the overall diagnostic performance of the Polish and German CAPL-2 questionnaire. For this purpose, the ROC curve analysis was performed, and the AUC was estimated. The analysis was made separately for the Polish and German samples, and for the test and re-test study.

The results for the test-retest reliability of MVPA measurement showed a moderate level of reliability in both Polish and German samples. Following the CAPL-2 Questionnaire Manual, two cut-points, closest to the World Health Organization recommendations (2020) of

Table 9. Reliability results for MVPA in the Polish and German sample.

MVPA	Test-re-test reliability			
	ICC (95% CI)	SEM	%SEM	MDC
Poland	0.712 (0.597-0.794)	0.84	29.11	1.96
Germany	0.703 (0.581-0.790)	0.74	23.62	1.71

the health-enhancing physical activity for children, were checked in ROC analysis. The first cut-point for physical activity for at least 60 minutes for 5 days a week, and the second for 6 or 7 days a week. In addition, the classification was verified in both test and retest measurements (see table 10).

Both models made using data from the test sample and re-test measurement in Poland and in Germany were

Table 10. Results of ROC curve analysis for CAPL-2Q total score based on children's physical activity.

Measure	MVPA Cut point	Poland		Germany	
		AUC (95% CI)	*P*	AUC (95% CI)	*p*
Test	6-7-days-60-min.	0.69 (0.65-0.73)	<0.001	0.64 (0.58-0.70)	<0.001
	5-days-60-min.	0.52 (0.47-0.57)	0.395	0.51 (0.43-0.58)	0.843
Re-test	6-7-days-60-min.	0.69 (0.62-0.76)	<0.001	0.66 (0.56-0.75)	0.002
	5-days-60-min.	0.57(0.47-0.67)	0.190	0.41 (0.30-0.53)	0.161

statistically significant. The AUC values of the models were sufficient, indicating a quite good fit of the classification. The best data fit to the model appeared in the test sample for both countries. Figure 1 for Poland and Figure 2 for Germany show the ROC curves for the physical activity cut-off point for 6-7-days-60-minutes in the first measurement. This result indicates better predictive characteristics of the questionnaire for children who are very close to (6 days per week) or who meet (7 days per week) the recommendations for the minimum level of physical activity for health, as defined by the WHO (Bull et al., 2020).

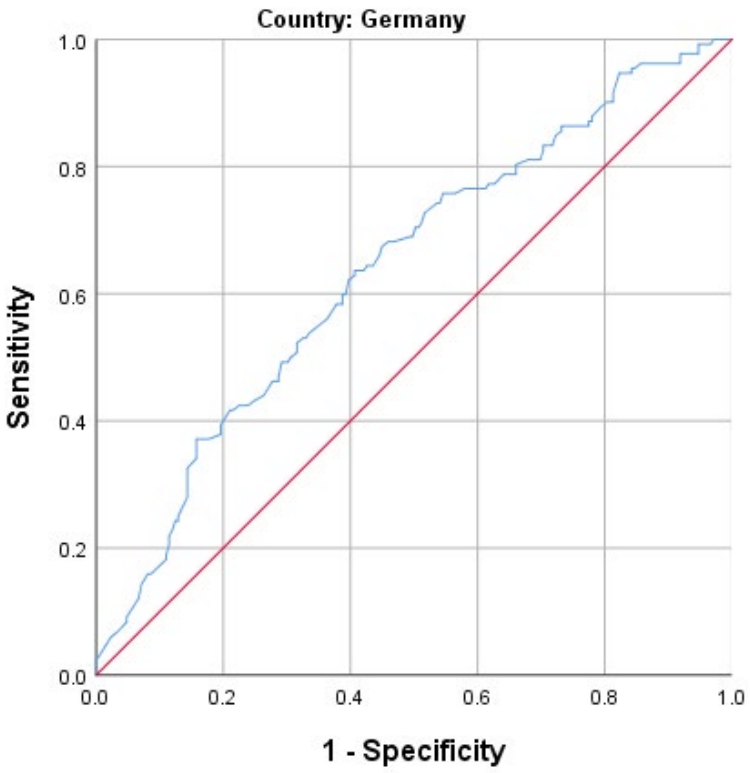

Figure 1. ROC curve for CAPL-2 questionnaire total score based on MVPA in the Polish sample

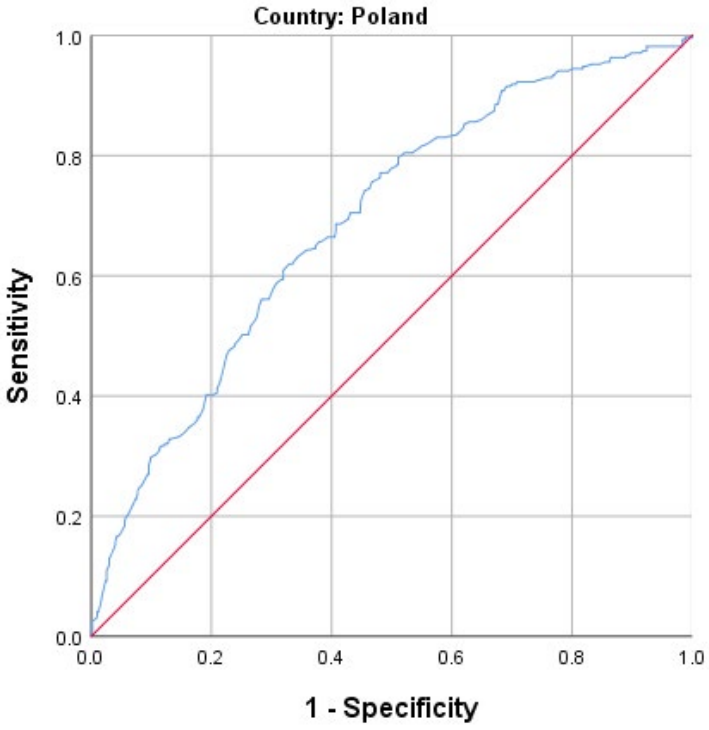

Figure 2. ROC curve for CAPL-2 questionnaire total score based on MVPA in the German sample.

Discussion

The aim of our study was to translate and culturally adapt the questionnaire of CAPL-2 to German and Polish contexts and to explore its reliability when used with children aged 8 to 12. The main results of this study show that the proposed Polish version and German version of CAPL-2 questionnaires are satisfactory for use in research or for teachers to evaluate PL in physical education.

The CAPL-2 was based on the Holistic Assessment of Learning Outcomes approach (Akubuilo, 2012; Wortman & Mamo, 2018). This approach assumes that it will be very difficult for an inactive child to achieve a high level of physical literacy. A child who possesses adequate knowledge, understanding, motivation, confidence, and physical competence would be more likely to lead an active, healthy lifestyle (Longmuir et al., 2018b).

It appears that in the Polish and German samples all subscales of the Motivation and Confidence domain are positively and moderately correlated. Strong correlation was observed regarding the Motivation and Confidence total domain with its subscales. The domain proves the good psychometric properties of the German and Polish instruments. Analysing the correlation between the Knowledge and Understanding domain and Motivation and Confidence domain, we found that they were positively correlated. However, this correlation is low for both Polish and German samples. Validation studies in Denmark (Elsborg et al., 2021), Greece (Dania et al., 2020) and Pakistan (Liu et al., 2023) did not report any correlation between those two domains. These different results could be affected by the physical education curriculum or culture differences in these countries.

Our correlation results demonstrated that students with a higher level of Motivation and Confidence are more physically active (self-evaluation of MVPA), but we could not find such direct relationships with Knowledge and Understanding domain. The same results were observed in Pakistan (Liu et al., 2023), Denmark (Elsborg et al, 2021) and China (Li et al., 2020). However, these authors analysed the Daily Behaviours domain in a subjective and objective way and found weak to moderate correlations with the Motivation and Confidence domain but none with the Knowledge and Understanding domain. As we know, there is insufficient knowledge about the importance of physical activity to promote motivation for behaviour change. Studies (Caldwell et al., 2020) show that the impact of knowledge alone is insufficient to alter the level of physical activity. Future research in the area of physical literacy should examine the extent to which the relationship between the domains of Knowledge and Understanding and Motivation and Confidence influence

daily physical activity in the long term. Furthermore, we need more empirical evidence that the concept of physical literacy with the factors of Knowledge and Motivation, on the one hand, and the level of daily physical activity and motor skills, on the other hand, is increasing physical activity as a determinant of a healthy lifestyle (Cairney et al., 2019).

Regarding test-retest ICC reliability we have obtained moderate to good results for Motivation and Confidence subscales and a good result for the total domain in the Polish sample. The same results were obtained in two (Predilection and Adequacy) of the four subscales and in the total domain of Motivation and Confidence in the German sample. This indicates the need for a more detailed analysis of the two subscales (Intrinsic motivation and PA Competence) from the German version of the questionnaire. In the Knowledge and Understanding domain the total score shows moderate ICC results for the Polish and German samples. Reliability ICC results for MVPA are moderate for the Polish and German samples. The Iranian study (Valadi & Cairney, 2023) found better inter-examiner reliability using ICC method but with 30 students within one week. In the Spanish study by Pastor-Cisneros et al. (2022), the authors report substantial results for test-retest ICC reliability with fewer than 60 students and without information about the mean age of the students.

Regarding Cronbach's α coefficient, our results for Motivation and Confidence domain demonstrate good reliability. Similar results were found in the Chinese (Li et al., 2020), Danish (Elsborg et al., 2021) and Spanish (Pastor-Cisneros et al., 2022) validation studies of CAPL-2 questionnaires. For the domain of Knowledge and Understanding, we obtained slightly lower results. The same situation was mentioned by Li et al. (2020), and the authors suggested revising the Chinese version of the Knowledge and Understanding questions to confirm correct wording. Much better results of Cronbach's α were reported by Pastor-Cisneros et al. (2022). Other validation studies of CAPL-2 questionnaires did not report Cronbach's α coefficient of reliability for this domain. For the subscales of Motivation and Confidence domain, we found acceptable to good Cronbach's α as it was in the Danish validation study by Elsborg et al. (2021). For MVPA, the Spanish study (Pastor-Cisneros et al., 2022) shows a reasonably strong α coefficient compared with the German and Polish results. However, the time in their study between pre- and post-test was three weeks compared with our study (4–5 weeks).

Our result indicates better predictive characteristics of the CAPL-2 questionnaires for children who are very close to or meet the MVPA recommendations for health, as defined by the WHO (Bull et al., 2020). This finding is in line with well-established results confirming that self-concept (including self-efficacy, perceived health, participation motives, perceived competence, and enjoyment) has been one of the strongest predictors of physical activity participation in children and adolescents (Hu et al., 2021). This result is also in line with some results which indicate that better knowledge and understanding of behaviour leads to better performance (Cornish et al., 2020). Knowledge and understanding of movement and health seems to be necessary to efficiently engage in physical activity from an early age (Cale & Harris, 2018). Own movement experiences are also of great significance, as underlined by Cornish et al. (2020). However, in the body of literature, we can find inconclusive results of the relationship of the knowledge on physical activity or other health behaviours and actual behaviours. A positive relationship was found in different studies (Chung et al., 2019; Nagy-Pénzes et al., 2020; Raghupathi & Raghupathi, 2020). The results of Nagy-Pénzes et al. (2020) show an interesting relationship of better knowledge and better performance of MVPA only for adolescent girls.

Physical literacy is fundamental to understanding the role of and lifelong participation in physical activity. In the work of Cornish et al. (2020), cited above, a very apt summary of the relationship between physical activity and physical literacy can be found. The authors emphasize that physical literacy is "a concept that creates a condition to engage in physical activity, but it is likely a bidirectional relationship exists in that increasing physical activity will increase physical literacy and vice versa" (Cornish et al., 2020, p.16). It is also suggested that physical literacy may be an important determinant of health, and an evidence-based conceptual framework for this has been established (Cairney et al., 2019).

Although the present validation of the CAPL-2 questionnaires is an important contribution to the PL literature, we could also point out some limitations of our study. The first is the dual protocol, as Poland is so far only validating CAPL-2 questionnaires and Germany is developing all CAPL-2 measurement procedures. Furthermore, we suggest comparing the German version of CAPL-2 with other instruments in the target population, such as Krenz et al. (2022) used in Germany to measure physical literacy in children aged 8–12 years. It is also necessary to consider the socio-economic differentiation of the sample analysed in order to understand its impact on PL. Due to cultural, social and geographical differences between countries, as well as differences in the organisation and curriculum of physical education in different countries, it is advisable to include research of a qualitative nature, especially in areas related to children's and young people's knowledge and understanding of physical activity. Physical education teachers, in particular, should be valuable collaborators. In general, longitudinal research is also advocated to understand variability and to capture the impact of different fac-

tors on the process of building physical literacy in children and adolescents. With longitudinal studies investigating the psychometric properties of the CAPL-2 questionnaires, we will be able to identify and understand how children's levels of physical literacy grow at different ages and grades. For future research, we recommend that the gender differences in the different age groups should also be studied.

Conclusions and implications

Our results indicate that the Polish and German versions of the CAPL-2 questionnaires are a valid and reliable measure of physical literacy in primary school children. We expected that the German and Polish versions of CAPL-2 would be an applicable instrument to measure PL in children 8–12 years old. However, due to the fact that the school age in Germany and Poland starts at 6 years and 7 years, respectively, our experience is that children aged 8–9 years do not have the reading and writing skills to fill out the questionnaires. We therefore recommend using the CAPL-2 questionnaires in these countries from the age 10–12 years.

The cooperation of researchers from Poland and Germany made it possible to validate a tool adapted to the conditions of more than one country, usable in Polish and German, and available on request in pen paper or electronic version. These questionnaires can be used extensively in research into children's self-perceived physical literacy as a screening tool and to raise the profile of physical inactivity in this population. As a screening tool, it allows professionals to identify individuals and groups to implement behaviour change programmes tailored to the educational setting. Future studies are needed to validate the full CAPL-2 in Poland.

The work of multicultural and international teams is advisable when adapting the questionnaires in other European countries. For further studies a European initiative to compare the levels of physical literacy in different EU countries in different age groups could be a fruitful approach. We recommend creating adaptations that are consistent with the original Canadian version, but deeply embedded in the language and culture of the country in question, especially in wording and terminology. We have also found that the online version of the questionnaires helps children to understand the process of completing the questionnaires, especially the first one on the Predilection and Adequacy subscales, which were often the cause of a problem. It also prevents them from accidentally missing out some questions.

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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