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Cross-cultural adaptation of the Developmental Coordination Disorder Questionnaire (DCDQ'07) for the population of Polish children

Agata Nowak

Faculty of Physical Education, University School of Physical Education, Wrocław, Poland

Summary

Study aim: The purpose of this article is to present the cultural adaptation of the DCDQ'07 *(Developmental Coordination Disorder Questionnaire)* as one of the popular and most frequently-used diagnostic instruments for diagnosing DCD in school-age children.

Material and method: The procedure for translating and evaluating the selected psychometric parameters of the DCDQ has been conducted in compliance with the guidelines for the procedure [4]. The study involved 152 parents of school-age children; the control group included 32 children. Additionally, a group of 75 children was tested with the KTK test. To assess the test–retest reliability, the group of 50 parents was tested twice with the DCDQ at an interval of 14 days.

Results: The study proved that the DCDQ is an accurate and reliable instrument for screening DCD in Polish children. The high value of all of the analysed psychometric parameters is evidenced by the following: a sensitivity of 0.75, a specificity of 0.63 and a test-retest reliability of 0.93. Internal consistency is also satisfactory and amounts to 0.92. The study also determined that the score of the DCDQ depends on the gender of the tested child, and not on his/her age.

Conclusions: According to the research, DCDQ is a useful instrument that allows for the screening of DCD in school-age children. The Polish version of the questionnaire is definitely going to fill in the gap among diagnostic instruments and will allow for further development of research on the epidemiology of DCD.

Key words: Developmental Coordination Disorder – Screening – Cross-cultural translation – Questionnaire

Introduction

Developmental Coordination Disorder (DCD) is a chronic neurodevelopmental abnormality with high prevalence, affecting 6–10% of children [1, 2]. DCD is most commonly diagnosed during early development, as symptoms are most strongly manifested in this period [23].

DCD is a global motor disorder, affecting both gross and fine motor control, and is observable via degraded and slowed body movement in many tasks. Children with DCD show difficulty in learning and reproducing both large and small movement patterns, from catching and throwing a ball, riding a bicycle and jumping to manipulating scissors, drawing and writing [3]. As this disorder impedes motor function in numerous activities that are a part of daily life, affected children are less physically adept than their peers and frequently avoid play or physical activity [14, 15, 24]. Consequently, DCD shows comorbidity with behavioural disorders such as low self-esteem and negative body image, anxiety and interpersonal difficulties [8, 27, 32]. These, in turn, may lead to obesity and other metabolic, cardiovascular and digestive diseases [9]. The literature identifies many of these conditions as secondary to DCD and can pose as much of a threat as the initial physical impairments of DCD [6, 17].

The early diagnosis of DCD is of critical importance for initiating early intervention and minimizing symptoms. However, the identification of DCD is difficult due to the heterogeneity of the pathology. Many diagnostic tests for DCD are based on assessing motor-based performance, as the basic symptoms of DCD most commonly affect motor skills [23]. In numerous studies, the literature has validated the second edition of the Movement Assessment Battery for Children (MABC) and the Bruininks–Oseretsky Test of Motor Proficiency (BOT-2) as diagnostic instruments with high sensitivity and specificity [3, 5, 11]. These tests provide an extensive analysis of motor function in child patients while also assessing the level of impairment. However, a weakness of both instruments is their exclusion of an

Author's address Agata Nowak, Faculty of Physical Education, University School of Physical Education, Paderewskiego 35, 51-612 Wrocław, Poland Agata.Nowak@awf.wroc.pl

analysis of motor function in activities of daily life, which is considered an essential diagnostic component in the Diagnostic and Statistical Manual of Mental Disorders (Criterion A and B of the DSM5) [3, 7, 21]. Another limitation is that they require specialized equipment and highly-trained staff. While these diagnostic tests are treated as the gold standard in confirming the presence of DCD, they are rarely applied in screening a population due to time and expense [16].

For this reason, Schoemaker and Wilson (2015) proposes that the most optimal early-age screening tool for DCD is a parent – or teacher-report questionnaire. They determined that only individuals who spend a great deal of time with a child are able to quantify the effects of motor deficits on everyday activities by comparing them to children with normal rates of development [29]. Emphasis was put on the fact that such an early diagnosis of DCD is rudimentary in nature due to the particular sensitivity of these kinds of questionnaires and also as a result of socioeconomic aspects [28]. However, a particular strength of such parent – or teacher-report questionnaires lies in their ability to collect data on large populations of children and help those that are most likely to have DCD . Only after a preliminary assessment can more psychometrically robust measures be applied to confirm DCD [3, 10, 33].

A number of questionnaires have been developed to screen for DCD. Of these, the most well-known is the Developmental Coordination Disorder Questionnaire (DCDQ), which was first published in the American Journal of Occupational Therapy [33].

There is no adaptation of the DCDQ'07 for the Polish population. This is doubly unfortunate due to the lack of tools of this nature in Poland and the increasing prevalence of DCD, making the identification of motor difficulties in children of increasing importance. Therefore, the aim of this work is to provide a translation of the Developmental Coordination Disorder Questionnaire from its original version in English to Polish. The next step involves verifying the psychometric properties of the translated version (internal consistency, sensitivity, specificity, test–retest reliability, discriminative validity of individual items) and its robustness in screening Developmental Coordination Disorder in a sample of Polish children.

Material and methods

Participants

The DCDQ'07-PL questionnaire was administered to the parents of children (N = 152) aged 5–15 years old from four public primary schools located in the city of Wrocław. These children formed a normative sample; none had previously been diagnosed with any developmental disorder. The parents were informed about the purpose of the study and provided written consent for their child to participate in the study. Instructions on how to complete the questionnaire were provided during local school meetings.

A control sample (n = 50) of children randomly selected from the normative sample was created. They completed the KTK test battery, which was conducted in one of the participating schools. Based on the test results, seven children were excluded from the control sample as their KTK scores (MQ < 85) indicated impaired motor coordination, leaving the control sample with 43 participants.

A clinical sample of children (n = 25) was recruited from local private therapy centres in Wrocław. All of the children in this group demonstrated impaired motor function (difficulties with fine and gross motor control), but were free of clinically relevant comorbidities such as cerebral palsy, muscular dystrophy or mental disability. The seven children excluded from the control group were included in the clinical sample, increasing the number of participants to 32.

In addition, 50 of the participating parents also completed the DCDQ'07-PL a second time 14 days later to study test-retest reliability.

Psychometric evaluation of the DCDQ'07-PL

The psychometric properties of the translated version were subsequently checked for validity and reliability. The internal consistency of the DCDQ'07-PL was examined by calculating Cronbach's alpha. Test-retest reliability was examined using Pearson's correlation coefficient. The effects of sex, age and their influence on the DCDQ'07-PL were assessed using the Mann-Whitney U test and linear regression analysis. Concurrent validity was examined using stepwise multiple linear regression analysis along with Pearson's coefficient. Construct validity was examined using the non-parametric Kruskal-Wallis H test.

Translation process

A validation protocol was established according to the guidelines developed by Beaton [4]. The first phase involved translating the DCDQ'07 from English to Polish. Based on the recommendations on adapting self-report measures, the translation process was divided into five stages. The first involved translating the questionnaire. This was undertaken by two independent translators whose native language was Polish. One of the translators was experienced in the cross-cultural adaptations of such instruments, while the second was a general translator without such knowledge. The second stage involved comparing the translations (T1 and T2) based on their syntax and terminology to create a single combined version of the two texts (T12). A back translation (B12) was then performed as the third stage in order to conduct a validity check of the item content. This back-translated version was then compared with the original to identify any ambiguities in meaning and eliminate possible errors. The original author of the DCDQ'07 was then consulted

and approved this version. The final stage involved submitting the texts to a panel of experts in DCD who worked in tandem with the translators to assess the equivalence of the source and target and the qualitative value of the translated items. This resulted in the final version of the Polish adaptation of the Developmental Coordination Disorder Questionnaire, labelled the DCDQ'07-PL.

Measures

The Developmental Coordination Disorder Questionnaire (DCDQ'07) takes only 10–15 minutes to complete by the parent of a child, who compares the motor function of their child to the child's peers. The questionnaire covers movement control, fine motor control (graphomotor skills) and gross motor control (general coordination). Five items are devoted to each factor, giving a total of 15 items, and are scored on a five-point Likert scale from "not at all like my child" (1) to "extremely like my child" (5). The questionnaire responses (level of agreement/disagreement) are added up to create a total score ranging from 15 to 75. The scores are interpreted with cut-off points for three different age groups (5–8, 8–11, 11–15 years old). Depending on the total score, the parent is informed if their child likely has or does not have DCD, where the latter would indicate the need for a more specialized diagnosis [32].

The DCDQ'07 was found to show high psychometric quality in identifying DCD, showing not only excellent internal consistency (Cronbach's alpha of 0.94), but also strong item–total correlations (ranging from 0.93 to 0.94). The sensitivity and specificity of the questionnaire was found to be satisfactory based on the standards of the American Psychological Association (0.85 and 0.71, respectively). In subsequent years, the DCDQ'07 was revalidated and translated into several languages, confirming its status as an accurate and reliable tool in multiple countries such as France, Brazil and the Netherlands [18, 25, 28].

The criterion validity of the DCDQ'07-PL was evaluated using the Körperkoordinationstest für Kinder (KTK) as a reference standard. The KTK was developed by E. Kiphard and F. Schilling in 1974 and involves the completion of four tasks on basic equipment: lateral movement using wooden blocks, monopedal high-jumping over an obstacle of increasing height, walking backwards on a balance beam and jumping from right to left over a line. The KTK displays excellent psychometric properties in children aged 5–15 years old; this has been confirmed by the studies of the original authors as well as by other researchers over time who have found it to possess an inter-rater reliability of 0.85, composite intra-rater reliability of 0.97 and test–retest reliability of 0.85 [12, 34]. The KTK is currently treated as the gold standard in both new and revised motor screening tests, such as the MABC-2 [11], and in studies assessing motor coordination in children with and without developmental problems. Raw performance scores are adjusted for age (in two of the subtests) and sex. After standardization, the results are added up to determine a motor quotient (MQ) with five levels of classification, ranging from "talented" to "motor-impaired" [12].

Results

Sample characteristics

All of the children included in the study were aged 5–15 years old, with children aged 6–10 years old composing the largest age range. The mean ages of the normative and clinical samples were 8.66 (SD = 1.59) and 8.89 (SD = 1.66) years old, respectively. Table 1 presents the

Table 1. Sample characteristics according to DCDQ age cut-offs (means ± SDs)

		DCD		Non-DCD		Total	
	Gender	Number	Age	Number	Age	Number	Age
1-st age Group	Males	4	5.65 ± 1.25	14	6.74 ± 0.63	18	6.49 ± 0.89
	Females	1	7.5	15	6.74 ± 0.82	16	6.78 ± 0.81
	Total	5	6.0 ± 1.36	29	6.73 ± 0.72	34	6.62 ± 1.59
2-nd age Group	Males	8	8.54 ± 0.50	31	8.64 ± 0.51	39	8.61 ± 0.50
	Females	8	8.85 ± 0.57	33	8.55 ± 0.50	41	8.61 ± 0.52
	Total	16	8.69 ± 0.54	64	8.59 ± 0.50	80	6.62 ± 0.51
3-rd age Group	Males	8	10.53 ± 1.05	13	10.29 ± 0.61	22	10.37 ± 0.78
	Females	4	10	13	11.18 ± 1.84	16	10.88 ± 1.66
	Total	12	10.35 ± 0.88	26	10.69 ± 1.37	38	10.58 ± 1.24
Total	Males	19	8.75 ± 2.03	58	8.58 ± 1.35	78	8.62 ± 18.50
	Females	13	9.10 ± 0.84	61	8.62 ± 1.77	74	8.70 ± 19.88
	Total	32	8.89 ± 1.66	119	8.06 ± 1.57	152	8.66 ± 1.59

age and gender distribution of the samples as well as division into chronological age groups in accordance with the DCDQ'07-PL.

The mean total DCDC-PL score was 62.39 (SD = 10.29), with females scoring higher than males at 64.41 (SD = 9.11) and 60.53 (SD = 11), respectively (Table 2). Gender proved to have a significant effect on DCDQ'07-PL scores, which was additionally confirmed using linear regression analysis ($\beta = -0.188$, $p < 0.001$). No significant interaction effect was observed between age and DCDQ'07-PL score (Table 2).

Internal consistency

Internal consistency was calculated using the entire study sample (n = 152) and found to be high (alpha coefficient of 0.92). Table 2 presents the level of correlation

Table 2. Mean (±SD) DCDQ-PL scores by DCD, Age, and Gender

Gender		DCD		Non-DCD		Total	
		Number	Score	Number	Score	Number	Score
1-st age Group	Males	4	36.0 ± 7.3	14	59.5 ± 8.3	18	54.2 ± 12.7
	Females	1	46.0 ± 5.8	15	64.8 ± 7.1	16	63.7 ± 8.4
	Total	5	38.0 ± 7.8	29	62.3 ± 8.1	34	58.8 ± 11.7
2-nd age Group	Males	8	51.5 ± 3.2	31	66.6 ± 5.6	39	63.5 ± 8.1
	Females	8	46.5 ± 5.6	33	68.0 ± 4.7	41	63.8 ± 9.9
	Total	16	49.0 ± 5.1	64	67.2 ± 5.2	80	63.6 ± 9.0
3-rd age Group	Males	8	46.0 ± 6.8	13	68.5 ± 4.1	22	60.3 ± 12.2
	Females	4	54.5 ± 1.9	13	70.5 ± 3.2	16	66.5 ± 7.7
	Total	12	48.8 ± 6.9	26	69.5 ± 3.8	38	62.9 ± 10.8
Total	Males	19	46.2 ± 7.9	58	65.39 ± 6.9	78	60.5 ± 11.0
	Females	13	48.9 ± 5.8	61	67.7 ± 5.5	74	64.4 ± 9.1
	Total	32	47.3 ± 7.2	119	66.59 ± 6.3	152	62.3 ± 10.2

Table 3. Item-total correlation coefficients

Item	Item mean ± SD	Corrected item–total correlation	Alpha if item deleted
1. Throws ball	4.26 ± 0.98	0.73	0.913
2. Catches ball	3.88 ± 1.11	0.66	0.915
3 Hits ball	3.60 ± 1.13	0.62	0.917
4. Jumps over	4.33 ± 0.91	0.65	0.916
5. Runs	4.50 ± 0.81	0.64	0.916
6. Plans activity	4.50 ± 0.78	0.63	0.917
7. Writing fast	4.10 ±1.01	0.57	0.917
8. Writing legibly	4.10 ± 1.07	0.64	0.916
9. Effort and pressure	4.03 ± 1.10	0.62	0.917
10. Cuts	4.15 ± 0.96	0.64	0.916
11. Likes sports	4.40 ± 0.89	0.72	0.914
12. Learning new skills	4.17 ± 1.00	0.69	0.914
13. Quick and competent	4.23 ± 0.91	0.63	0.916
14. "Bull in shop"	4.11 ± 1.10	0.49	0.921
15. Does not fatigue	4.11 ± 1.01	0.61	0.917

between each item and the complete scale. Corrected item–total correlations ranged from 0.61 to 0.73, indicating high to moderate correlation, except for items 14 and 7, which showed values of 0.49 and 0.57, respectively (Table 3).

Test-retest reliability

Pearson's correlation coefficient for DCDQ'07-PL test–retest reliability (based on a sample of n = 50) were significant ($r = 0.93$, $p < 0.001$), indicating good test–retest reliability and low variability.

Concurrent validity

A comparison between the DCDQ'07-PL and the KTK showed high and significant Pearson's coefficients ($r = 0.726$). Regression modelling also confirmed the concurrent validity of the questionnaire ($\beta = 0.726$, $p < 0.05$).

Predictive validity

Table 4 presents the entire sample classified as DCD-suspect or not according to the scores obtained using the DCDQ'07-PL and the KTK. The DCDQ'07-PL indicated a 63% agreement with those classified by the KTK as having DCD, and a 75% agreement with the KTK for non-DCD children (Table 4).

Table 4. Classification of DCD with the KTK compared with the DCDQ'07-PL

DCDQ-PL	KTK		
	DCD	Non-DCD	Total
DCD	24	0	24
Non DCD	8	43	51
Total	32	43	75

Construct validity

The mean score of children classified as DCD-suspect by the DCDQ'07-PL was significantly different from that of non-DCD children in comparison to using the Kruskal–Wallis test; $\chi 2(5, n = 152) = 80.839$, $p < 0.001$ (Table 2).

Discussion

This study described the multistage cross-cultural adaptation of the Developmental Coordination Disorder Questionnaire for the population of Polish children. The translation process was conducted according to the guidelines developed by Beaton *et al.* [4]. It involved several translators and experts in the fields of pedagogy and psychomotoricity. The original author was consulted about the final version of the questionnaire and, with the original author's approval, it was submitted for psychometric testing.

Based upon the presented analysis, the DCDQ'07-PL demonstrates satisfactory internal consistency and reliability. All of the questionnaire items were found to show moderate to high item–total correlations, confirming the validity of the instrument. However, attention must be paid to the two items that least correlated with the total score. The first, item 7, questioned parents on their child's handwriting speed. One explanation for why this item did not perform as expected may be that the parents were never presented with the opportunity to compare their child's handwriting speed with other children of the same age. Their only source of information regarding their child's handwriting speed would be provided by a teacher, who, in turn, could assess handwriting performance according to standardized norms rather than peer skill level. The second item of concern, item 14, addresses the child's overall coordination. The low diagnostic value of this item may be due to the fact that some parents did not properly understand the statement or that it may have been difficult for them to determine what can be considered their child's typical behaviour. The study sample was predominately composed of younger children whose fine motor skills may have been observed as clumsy and less-coordinated more as a consequence of their age rather than a developmental disorder. However, this item did not differentiate the present sample of children suspected of DCD and non-DCD children to the degree reported in Martini *et al.* [18].

One important finding in the study was the significant effect of gender on the DCDQ'07-PL score, which was similar to what was observed in studies by Tseng *et al.* [31]. The present group of Polish females showed better performance than their male counterparts. This may be related to the superior manual dexterity of Polish females, as was reported by Osiński (2003), and can be explained by females' preference to engage in physical activity that preponderantly involves fine motor skills. Males, in turn, exhibited a tendency to participate in gross motor activities [22]. This phenomenon was also described by Rivard *et al.* [26], although this was more readily observed in a younger population.

The sensitivity of the DCDQ'07-PL was satisfactory, albeit higher than the questionnaire's specificity. A similar result was reached by Wilson *et al.* (2009) when developing the revised version of the DCDQ'07 used in the present study [32]. The specificity of the DCDQ'07-PL, while significant, was below the standard recommended by the APA (2000). However, Blank *et al.* (2012) explained that this may be a desirable attribute of such screening instruments, as the cost of a false-positive result is low [3]. In this case, the aim of the DCDQ'07-PL is to identify as many DCD-suspect children as possible. They would then undergo formal diagnosis to confirm the presence of DCD [18, 30]. In this regard, the attained specificity indicates that the translated questionnaire is able to successfully differentiate

DCD-suspect children from their healthy cohorts and serves as an effective tool in screening Polish children for DCD.

One serious limitation of the study was the small clinical sample. This was due to the fact that there is no formal identification of DCD as a coordination disorder in Poland and impaired movement coordination is usually treated as comorbid or concomitant with other generally-named pathologies such as psychomotor disorder, motor disorder or sensory integration disorder. As a result of this situation, DCD is indiscernible in Poland and is frequently overlooked.

Conclusions

The present adaptation of the Developmental Coordination Disorder Questionnaire to the language and cultural characteristics of the Polish population provides an accurate and reliable instrument in the informal identification of children with DCD. The DCDQ'07-PL showed satisfactory psychometric properties and item performance was found to be highly consistent; even the two items that least correlated with the total score (items 7 and 14) did not warrant substitution or elimination from the questionnaire. As a simple and cost-effective measure, the DCDQ'07-PL will greatly contribute to furthering knowledge on DCD in Poland.

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