

Cross-Cultural Adaptation of the Developmental Coordination Disorder Questionnaire in Turkish Children

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Abstract

The Developmental Coordination Disorder Questionnaire (DCDQ'07) is an instrument for screening children between 5 and 15 years of age. Although it is popular, this instrument has not been adapted for use with Turkish children, and there is no valid similar screening tool in Turkey. Thus, this study aimed to provide a cross-cultural adaptation of the DCDQ'07 for Turkish children. We performed the translation process using well-established cross-cultural adaptation guidelines, and we recruited 736 parents (361 males, 375 females) of typically developing children with a mean (*M*) age of 9.27 years (standard deviation = 2 years 5 months, range: 5.0–14.9 years). We determined the internal consistency of the questionnaire by item and total score correlations, Cronbach's α and item-deleted Cronbach's α . Intraclass correlation coefficients were used to determine test–retest reliability

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after an interval of 5 days. The Cronbach's α of the Turkish DCDQ'07 was .890 for the total questionnaire. All the item-deleted Cronbach's α values were lower than the total value of .890, except the *bull in a China shop* item (Cronbach's α values .896). Test-retest reliability ranged from .99 to 1.00. The Turkish DCDQ is a valid and reliable screening tool for assessing the motor performance of children between 5 and 15 years of age.

Keywords

developmental coordination disorder, questionnaire, cross-cultural adaptation, diagnosis, clumsy

Introduction

The Dyspraxia Foundation has defined developmental coordination disorder (DCD) as "impairment or immaturity in the organization of the movement" (Ayes, 1985). In the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2013), the diagnostic criteria of DCD require classification of four deficiencies related to immaturity of motor coordination skills required for daily or academic activities: (a) acquisition and execution of coordinated motor skills are below what would be expected at a given chronological age and opportunity for skill learning and use; difficulties are manifested as clumsiness (e.g., dropping or bumping into objects) and as slowness and inaccuracy of performance of motor skills (e.g., catching an object, using scissors, handwriting, riding a bike, or participating in sports); (b) the motor skills deficit significantly or persistently interferes with activities of daily living appropriate to the chronological age (e.g., self-care and self-maintenance) and impacts academic or school productivity, prevocational and vocational activities, leisure, and play; (c) the onset of symptoms is in the early developmental period; and (d) the motor skills deficits cannot be better explained by intellectual disability or visual impairment and are not attributable to a neurologic condition affecting movement (e.g., cerebral palsy, muscular dystrophy, or a degenerative disorder).

The prevalence of DCD ranges between 5% and 6% of all children. Related to its definition and fifth edition of the Diagnostic and Statistical Manual of Mental Disorders diagnostic criteria, DCD significantly affects academic success and daily activities such as dressing, brushing teeth, tying shoes, and sport-related activities. It is also defined as both a motor and postural problem that affects the child's full participation in age appropriate life and activities associated with school success (Aarnoudse-Moens, Weisglas-Kuperus, van Goudoever, & Oosterlaan, 2009; Polatajko & Cantin, 2005). A delay in others' recognition of DCD can further negatively impact a child's self-confidence and social well-being, making early recognition of this condition important (Skinner & Piek, 2001).

There are a number of questionnaires and rating scales completed by parents or teachers for evaluating the children's motor skills in a quick, inexpensive, and reliable fashion (Martini, 2011; Schoemaker et al., 2006), and chief among them is the DCD Questionnaire (DCDQ'07), used to determine symptoms and help diagnose DCD in children between the ages of 5 to 15 years. The DCDQ'07 is a brief, basic, and standardized test, which evaluates motor performance and function in daily living activities in children. The European Academy for Childhood Disability guideline recommends the DCDQ'07 as a good assessment tool (Blank, Smits-Engelsman, Polatajko, Wilson, & European Academy for Childhood, 2012). The tool was originally developed as DCDQ with 17 items in 2000, and it was revised in 2007 as the DCDQ'07. The revised version (DCDQ'07) is composed of 15 items that are classified into three factors (general coordination, fine motor or handwriting, control during movement). The DCDQ'07 takes 10 to 15 minutes to administer (Wilson, Kaplan, Crawford, Campbell, & Dewey, 2000). It allows a comparison of a child's motor coordination and development to a normative comparison group of typically developing children. Test items are scored on a 5-point Likert-type scale. Wilson et al. (2009) determined normative cutoff points for three different age groups. While the DCDQ'07 was translated and validated in Brazilian (Prado, Magalhães, & Wilson, 2009), German (Kennedy-Behr, Wilson, Rodger, & Mickan, 2013), Canadian French (Martini, 2011), Japanese (Nakai et al., 2011), Spanish (Duque, Aristizábal, & Marín, 2012), Taiwanese (Tseng, Fu, Wilson, & Hu, 2010), Italian (Caravale, Baldi, Gasparini, & Wilson, 2014), and India (Patel & Gabbard, 2017) languages, neither this tool nor any other has been validated for use by health professionals or parents in assessing DCD in Turkey. Therefore, this study aimed to translate the DCDQ'07 into Turkish, examine the psychometric qualities of this translation with this population (test-retest reliability and internal consistency), and identify possible limitations of this Turkish adaptation.

Method

Participants

We invited the parents of the 736 children residing in Ankara to take the final Turkish version of the DCDQ'07 (see "Procedure" section for version development). All parent participants provided written informed consent. We obtained and recorded demographic characteristics of the children (see the "Results" section of this article). We also obtained ethical approval for the study protocol from the Gazi University Ethical Committee (11.05.2016-06), following procedural guidelines from Beaton, Bombardier, Guillemin, and Ferraz (2000) in the process of transcultural adaptation of the DCDQ'07.

Translation procedure. In the translation of the DCDQ'07 into Turkish, we performed the following steps:

Stage 1: Two qualified independent translators with different backgrounds, one of them native, translated the DCDQ'07 from English into Turkish (T1 and T2).

Stage 2: A synthesis of the T1 and T2 was combined into a single Turkish version of the questionnaire (T1 or T2).

Stage 3: Two native English speakers translated T1 or T2 back to English, and BT1 and BT2 versions were produced.

Stage 4: An expert committee composed of the two original translators and a physiotherapist developed the final version of the Turkish DCDQ'07, considering the semantic equivalence, idiomatic equivalence, experimental equivalence, and conceptual equivalence. During the adaptation, the *bull in a China shop* item (Item 14 in the original DCDQ'07) was not easily understood by Turkish parents and was readapted. We tested the questionnaire for clarity with five parents.

Data Analysis

As noted earlier, 736 parents of Turkish children from Ankara responded to the DCDQ'07. We used the IBM AMOS 23 program for exploratory factor analysis of the 736 parent-completed DCDQ'07. Other statistics were performed by the IBM SPSS 23 program. We expressed descriptive statistics as means (*M*), standard deviations (*SDs*), and medians for quantitative and ordinal data and as frequencies and percentages for nominal data. We determined the normal distribution of the data with the Shapiro–Wilk Test. We set statistical significance levels at $p < .05$. Test–retest reliability, internal consistency, and item–total score correlation coefficients were used to determine the reliability of the Turkish DCDQ'07. To calculate test–retest reliability, five days after their first testing, 150 of our 736 parent respondents completed the questionnaire again. We determined test–retest reliability by calculating intraclass correlation coefficients (ICC) between scores from the first and second test administrations. As the item Likert-type scale data is ordinal and not distributed normally, we used the Wilcoxon signed-rank test to evaluate whether there was a significant difference between first and second testing. The internal consistency of the Turkish DCDQ'07 was determined by Cronbach's α , with a high consistency set at values over .80. To determine each item's contribution to the total score, each item was removed alternately, and item-deleted Cronbach's α coefficients were recalculated. The item–total correlation was determined by Spearman's correlation coefficient, due to the skewedness of the data. A minimal positive value of .40 was accepted as significant.

Kaiser–Meier–Olkin and Bartlett's tests were used to determine the construct validity and the relevance of the data to an exploratory factor analysis of Turkish DCDQ'07. An eigenvalue value of > 1.00 was sought for determining the number of factors. The factor structure was determined by using Varimax

rotation. Confirmatory factor analysis was performed to evaluate the relevance of the determined factor structure. χ^2 index, relative χ^2 index, goodness-of-fit index, adjusted goodness-of-fit index, root mean square residual, normed fit index, and comparative fit index were used as fit indexes for confirmatory factor analysis.

Results

As noted, a total of 736 children were evaluated by their parents. The children's mean age was 9.27 ($SD=2.53$) years (minimum–maximum range: 5.0–14.9 years). The children's gender distribution was nearly equivalent (51% girls, 49% boys).

Reliability

Item-total score correlation coefficients, Cronbach's α coefficients, and item-deleted Cronbach's α coefficients were used to determine the internal consistency of the Turkish DCDQ'07 (see Table 1). The item-total score correlation coefficients ranged from .47 – .65, with and all of them exceeding our predetermined significance value of .40. The total Cronbach's α was .89, reflecting good consistency. When individual items were deleted alternately, all item-deleted Cronbach's α values were lower than the value of .89, but the bull in a China shop item had a value of .90. The *hits ball/birdie* item had the lowest score ($M=3.8$, $SD=1.07$), while *running* had the highest ($M=4.60$, $SD=0.81$).

ICC values were used to determine test–retest reliability. The ICCs ranged between .99 – 1.00, reflecting a strong positive correlation between the first and second test administrations. We detected no significant difference between first and second test scores (see Table 1).

Construct Validity

The bull in a China shop item had an item-deleted Cronbach's α value of .90 (higher than the Cronbach's α value of .89 for the total DCDQ'07); this item required additional explanation to be understood by Turkish parents during test performance, leading to its adaptation as *not clumsy* as it was used in an exploratory factor analysis to determine the factor structure. The Kaiser–Meier–Olkin value was .92; we judged the sample size satisfactory for factor analysis. According to Bartlett's test ($p<.001$), we affirmed the sphericity assumption to be valid. We grouped the items under two factor structures according to Varimax rotation. The items *throws ball*, *catches ball*, *hits ball/birdie*, *jumps over*, *runs*, *likes sports*, *learning new skills*, and *plans activity* were grouped under Factor 1; and the items *writing fast*, *writing legibly*, *effort and pressure*, *cuts*, *quick and competent*, and *does not fatigue* were grouped under Factor 2.

Table 1. Reliability of DCDQ'07 Items, Total Score, and Factor Structure ($n = 736$).

	Reliability of DCDQ'07 items				Factor structure	
	Mean $\pm$ SD (median)	Corrected item-total correlation	Cronbach's α if item deleted	Test-retest intraclass correlation ($n = 150$)	Factor 1 (gross motor performance)	Factor 2 (static position and fine motor performance)
DCDQ'07 items						
Throws ball	4.50 $\pm$ 0.88 (5)	.617	.884	1.000	0.731	0.277
Catches ball	4.27 $\pm$ 1.03 (5)	.624	.885	1.000	0.769	0.166
Hits ball/birdie	3.87 $\pm$ 1.07 (4)	.647	.887	.999	0.755	0.113
Jumps over	4.43 $\pm$ 0.92 (5)	.584	.885	.998	0.735	0.211
Runs	4.60 $\pm$ 0.81 (5)	.496	.887	1.000	0.632	0.283
Plans activity	4.45 $\pm$ 0.88 (5)	.577	.887	.992	0.520	0.420
Writing fast	4.43 $\pm$ 0.88 (5)	.603	.885	.999	0.484	0.529
Writing legibly	4.41 $\pm$ 0.97 (5)	.597	.887	.997	0.313	0.644
Effort and pressure	4.26 $\pm$ 1.07 (5)	.619	.889	.999	0.369	0.510
Cuts	4.52 $\pm$ 0.85 (5)	.570	.886	.993	0.408	0.579
Likes sports	4.52 $\pm$ 0.83 (5)	.472	.890	.995	0.524	0.280
Learning new skills	4.24 $\pm$ 1.00 (5)	.603	.886	.997	0.533	0.410
Quick and competent	4.30 $\pm$ 0.99 (5)	.564	.887	1.000	0.272	0.675
<i>Bull in a shop</i>	4.19 $\pm$ 1.21 (5)	.537	.896 ^a	.999	0.041	0.678
Does not fatigue	4.28 $\pm$ 1.09 (5)	.530	.893	.999	0.139	0.607
Total score	63.79 $\pm$ 10.65 (66)		.890			
Eigenvalue					6.270	1.160
Explained variation (%)					41.802	7.732

Note. DCDQ'07 = Developmental Coordination Disorder Questionnaire; SD = standard deviation; Bold represents statistical significant.

^aCronbach's α value of the total DCDQ'07 = .890.

We observed that Factor 1 involved questions about physical motor performance and Factor 2 involved questions about static position and fine motor performance; therefore, Factor 1 was named, *gross motor performance* and Factor 2 was named, *static position or fine motor performance*. This two-factor structure explained 49.53% of the total variance.

We next performed confirmatory factor analysis. The fit indexes of this study and the acceptable ranges from the literature are provided in Table 2. According to our results, although χ^2 and relative χ^2 indexes were not in the required ranges, other fit indexes were in acceptable ranges or were very close to those ranges, suggesting that the construct validity of the model was acceptable.

Discussion

This study sought to translate and adapt the DCDQ'07 into Turkish and then to test the psychometric properties of this newly adapted version. We found the internal consistency of the Turkish version of the DCDQ'07 to be as high as the original DCDQ'07 (Wilson et al., 2009). Our Turkish version of DCDQ'07 was translated in concordance with international guidelines; and, according to our results, it showed good internal consistency and high test-retest reliability. We derived a two-factor structure that appeared to accurately reflect both gross and fine motor skills. Thus, these results provide validity and reliability of the Turkish translation and cultural adaptation for this age-group. Initial test parents of five of the children in our broad sample reported that they had found the translated questionnaire easy to understand. This adapted Turkish version of the DCDQ'07 appears to be appropriate for use with Turkish children, filling a

Table 2. Confirmatory Factor Analysis ($n = 736$).

Fit indexes	Good model fit	Acceptable range	Value from the model
χ^2	$0 \leq \chi^2 \leq 2df$	$2df \leq \chi^2 \leq 3df$	337.073
$p(\chi^2)$	$.05 < p \leq 1.00$	$.01 \leq p \leq .05$	<.01
CMIN/df	$0 \leq \text{CMIN}/df \leq 2$	$2 < \text{CMIN}/df \leq 3$	3.966
GFI	$0.95 \leq \text{GFI} \leq 1.00$	$0.90 \leq \text{GFI} < 0.95$	0.944
AGFI	$0.90 \leq \text{AGFI} \leq 1.00$	$0.85 \leq \text{AGFI} < 0.90$	0.921
NFI	$0.95 \leq \text{NFI} \leq 1.00$	$0.90 \leq \text{NFI} < 0.95$	0.921
CFI	$0.97 \leq \text{CFI} \leq 1.00$	$0.95 \leq \text{CFI} < 0.97$	0.939
RMSEA	$0.00 \leq \text{RMSEA} \leq 0.05$	$0.05 < \text{RMSEA} \leq 0.08$	0.064 ($p = .001$)

Note. df = degrees of freedom; CMIN/df = relative χ^2 index; GFI = goodness-of-fit index; AGFI = adjusted goodness-of-fit index; NFI = normed fit index; CFI = comparative fit index; RMSEA = root mean square residual.

needed void for parents and professionals interested in determining whether Turkish children may have DCD.

Wilson et al. (2009) conducted a study using the 17-item DCDQ and additional items to revalidate its use with a population-based sample, and their work resulted in the revised, 15-item version (DCDQ'07) that we adapted, with higher internal consistency (.94) than the 17-item version. This valid screening instrument showed item-total correlations ranging from .93 – .94, with overall sensitivity found to be 85% and specificity found to be 71% for accurately detecting DCD. In our study, we found a total Cronbach's α of the Turkish DCDQ'07 to be .89, reflecting similarly good reliability. All item-deleted Cronbach's α values were lower than this total value of .89, except the bull in a China shop item. When this item was deleted, the item-deleted Cronbach's α value was increased and become a value of .90, leading us to change the item so as to be clearly understand within the Turkish language by a Turkish participant sample. Accordingly, the Turkish version of the DCDQ'07 also includes 15 items. While Wilson et al. determined a three-factor structure that consisted of control during movement, fine motor or handwriting, and general coordination, our study items were best grouped under two factors termed as (a) static position or fine motor performance and (b) gross motor performance.

The high internal consistency of the Turkish version of DCDQ'07 is consistent with findings for the Canadian French and Brazilian versions. While two items showed a significant difference in the test–retest analysis of the Brazilian version, there was no significant test–retest difference between any items in this Turkish version. While Wilson et al. (2009) did not examine test–retest reliability, Tseng et al. (2010) reported a reliability (Pearson's coefficient of .94; $p < .001$) for their Chinese adaptation and Prado et al. (2009) reported a high ICC of .97 for the Brazilian version. In our results, the ICC of the Turkish DCDQ'07 ranged from .99 to 1.00, indicating very high test consistency over a 5-day test–retest period.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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