

Cross-cultural Adaptation and Psychometric Properties of Nepali Version of Developmental Coordination Disorder Questionnaire

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ABSTRACT

Background

Revised developmental coordination disorder questionnaire (DCDQ'07) is the best available population-based screening tool to identify developmental coordination disorder and being a parent reported tool, it needs to be available in Nepali language for its application in Nepali population.

Objective

The objective of this study was to cross-culturally adapt developmental coordination disorder questionnaire into Nepali (DCDQ-NP). The psychometric properties of Nepali version of Developmental coordination disorder questionnaire were established.

Method

The adaptation was done following Beaton's guideline and the psychometric properties was studied in the community sample of 165 parents of school going children of 5-15 years. Fifty parents were asked to refill the questionnaire after the two weeks period. The study determines internal consistency, test retest reliability, floor and ceiling effect and construct validity.

Result

Significant cultural adaptation was required to obtain relevant Nepali version. The Nepali version of Developmental coordination disorder questionnaire demonstrates high internal consistency ($\alpha = 0.912$), excellent test-retest reliability (IC = 0.901) and the floor and ceiling effect were acceptable. Principal component analysis showed three factor structure accounting 62% of variance.

Conclusion

The developmental coordination disorder questionnaire into Nepali were successfully translated and culturally adapted preserving its original concept. It showed good psychometric properties in a Nepali population. The adapted questionnaire shall be of significance in carry out further research in developmental coordination disorder in Nepal.

KEY WORDS

Cross cultural adaptation, Developmental coordination disorder, Parent reported, School going children, Screening

INTRODUCTION

The pre-requisites for development of a child to perform age-related skills with precision is acquisition of the motor coordination.¹⁻³ Approximately 5-6% of the children in the world are affected by motor limitations called Developmental Coordination Disorder (DCD). These affect the participation of the children in home and academic activities, as specified in the Diagnostic and Statistical Manual of Mental Disorders (DSM-V).^{3,4}

DCD is an inadequately recognised area of school health and the early identification is essential for prevent of further consequences in child's self-esteem and overall performance.⁵⁻⁸ The diagnosis of DCD is based on four criteria by DSM V and recommendation by European Academy for Childhood Disability (EACD).^{3,6} DCD is testable on standardised tests of motor performance and is confirmed with parent and teachers report.^{3,4,6} In countries where school health screening is not a norm, these deficits are passed on as clumsiness and are not presented to paediatrician by parents.^{4,9}

The Developmental coordination disorder questionnaire DCDQ'07 incorporates three subsets of coordination that is 'Control during the movement', 'Fine motor / Handwriting' and 'General coordination'. The questionnaire also fulfils the criteria B of diagnosis of DCD by DSM.^{6,10,11} In a multicultural country where English is not the first language, the tool cannot be deployed to gather data. A Nepali questionnaire would facilitate the identification of children with possible DCD. Therefore, The aim of this research was to cross culturally adapt DCDQ'07 into Nepali (DCDQ-NP) and study its psychometric properties.

METHODS

Initially the permission was taken from the original author of DCDQ'07 and the study protocol was approved by University ethical review board. Informed written consent was obtained from all the participants prior to data collection. The conduct and reporting of this research were guided by the guidelines proposed by Beaton and colleague for translation and cross-cultural adaptation of self-report measures and by the Consensus-based Standards for the selection of health Measurement Instrument (COSMIN) guideline.^{12,13} The study was conducted in two phases: Phase I - Cross-cultural adaptation of DCDQ'07 into Nepali DCDQ-NP and Phase 2 - Investigation of the psychometric properties of DCDQ-NP.

Phase 1: Cross-cultural adaptation into Nepali version of DCDQ

The cross-cultural adaptation based on proposed guideline presented in figure 1.

Stage 1: Initial translation

The two forward translators, one from the physiotherapy

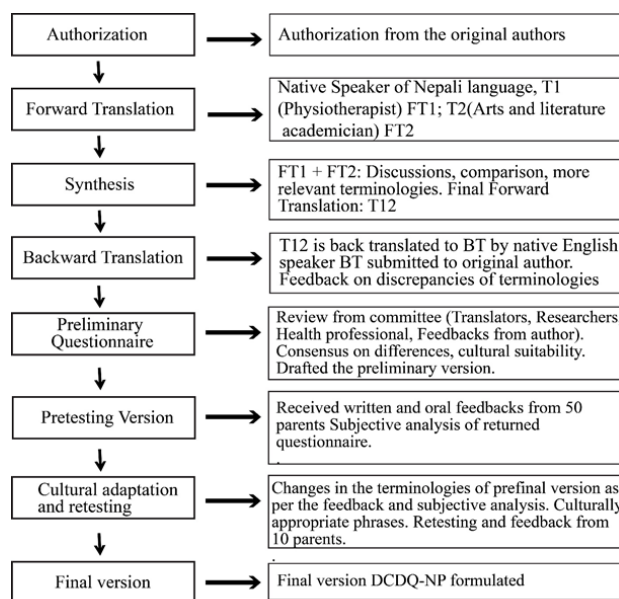


Figure 1. Flow diagram of cross-cultural adaptation

background (T1) and other from the academic background of arts and literature (T2) were each asked to translate DCDQ'07 to Nepali language. This produced two forward translations FT1 and FT2.

Stage 2: Synthesis of Translations

FT1 and FT2 had some structural discrepancies with no significant difference in the meaning of the sentence. The discussions were avidly done to select an appropriate word to replace the proverb 'A bull in a China Shop' in Question 14. Review committee that included the initial translators, team of researchers and a health professional discussed the discrepancies in the two forward translations. The final forward translation was then deduced after the discussions (T12) and the detailed report of the process was prepared.

Stage 3: Back Translation

The back translator who didn't comply with the purpose of the translation and had not previously encountered the original version in any form produced a copy of back translation (BT) into English, from final forward translation (T12). The back translation couldn't exactly trace back the words like 'birdie' in question 2; 'fort' and 'motor activity' in question 6; 'printing' in question 7-9; proverb in question 14 and 'fatigue' in question 15. The back translation was submitted to the original author and the few cultural differences in the terminologies were discussed through mail.

Stage 4: Formation of preliminary questionnaire

The committee of the forward translator, backward translator, team of researcher, health professional and feedback from the original author were discussed. The DCDQ'07 was referred as DCDQ-NP. The words like 'birdie' in question 2 which was adapted as 'cock'; 'fort' and 'motor activity' in question 6 was adapted as 'house' and

'physical activity' respectively; 'printing' in question 7-9 was removed; proverb in question 14 was adapted and 'fatigue' in question 15 was adapted as 'tired'. The meaning of each question was preserved. On the further discourse of the committee and some minor changes in sentence structures, the prefinal version (V1) was drafted.

Stage 5: Test of pre final version

The questionnaire (V1) was distributed to around fifty parents of different school and the feedbacks from around thirty-five parents were received in either written or verbal form. Parents had trouble understanding the main Likert scoring system which was direct translation of the original version 'Not at all like your child, A bit like your child.....' Few found the word replaced for the proverb 'A bull in a China shop' culturally offensive and inappropriate. On evaluating the questionnaire that was returned after being filled, there was inconsistency in the answer of question 14 and 15.

Stage 6: Cultural adaptation and generation of final version

Based on the feedback of the pre final version a review committee adapted the Likert scale scoring method from 'Not at all like your child, A bit like your child.....' to 'Not at all like other children, A bit like other children.....' by encouraging a comparison with other normal children of same age as suggested in the narration of the original version. The more relevant and culturally appropriate word was selected to replace the proverb of question 14 by 'Clumsy Child' and slight change in sentence structure was done in question 15. The prefinal version was reformulated (V2) again distributed to fifteen parents randomly who were asked to differentiate the understanding of the first version (V1) and the second version (V2) using the Likert scale. On the level of understanding, the second version of the questionnaire (V2) scored better in the Likert scale demonstrating the better understanding of the scoring system, relevance of the word that replaced the proverb and consistency in the answers of question 14 and 15 compared to answers of rest of the question. The reports of the entire process of translation and adaptation along with the redrafts and final version was submitted to original author and further studies were done after receiving her permission. The reformulated version (V2) was adapted as the final version which was called DCDQ-NP.

Phase 2: DCDQ-NP psychometric testing procedure

In a cross-sectional study design, DCDQ-NP was administered to parent of 5-15 years school going children of four different schools which included a government school and three boarding school to diverse the sample through different socioeconomic and educational backgrounds. Sample selection was simple random sampling. The selected students were explained the purpose and handed with the stapled papers which included information sheet, consent form and questionnaire. Parent greater than 18

years of age, who have completed at least primary school education and are able to complete questionnaire were included in the study. The half-filled forms, parents who didn't provide consent or didn't return the forms, form of child with neurological condition were excluded from the sample. Data were collected at two points of time from the parents at two weeks interval. For the initial assessment forms were distributed to each class from grade 1 to grade 8 to include children aged 5-15. Two days' time was given in between the distribution date and collection date. The collection was done for two more days to assure the maximum collection (fig. 2). The questionnaire was redistributed to randomly select 70 parents in the two weeks' time. The final sample after recollection and exclusions was 50.

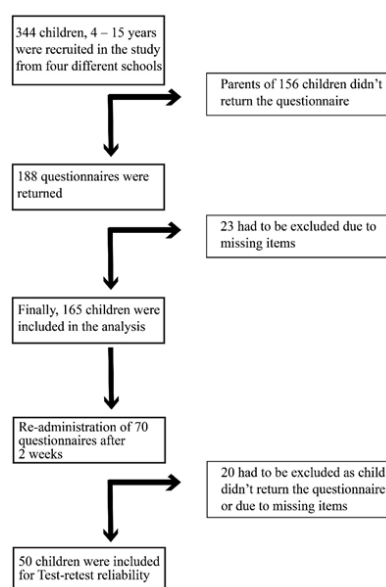


Figure 2. Sample distribution and return of DCDQ-NP

The data analysis was done using Statistical Package for Social Sciences (SPSS) 25.0. The descriptive statistics was used for analysing the demographics of the sample.

Internal consistency and corrected item total correlation from parent sample was computed using Cronbach's alpha, it was considered satisfactory if Cronbach's Alpha was ≥ 0.7 .¹⁴⁻¹⁶

The test retest reliability from parent sample was computed using Intra class Correlation Coefficient (ICC3,1 model) two-way mixed model. We hypothesized that the test-retest reliability would be excellent which will lie between 0.7-0.9.¹⁷

Instrument sensitivity was assessed using floor and ceiling effects, defined as the proportion of participants reporting the lowest and highest scores for each instrument dimension. Floor or ceiling effects $> 15\%$ were considered not sensitive in the target population.¹⁴⁻¹⁶

To assess construct validity, a factor analysis of DCDQ-NP items was conducted with the sample using principal

component analysis (PCA) using Varimax and Kaiser normalization rotation method to replicate methods previously used in the literature.¹⁸ Kaiser-Meyer-Olkin (KMO) test was used to test sampling adequacy and Bartlett’s test was used to test for sphericity. Eigenvalues were calculated to select number of components in Exploratory Factor Analysis (EFA).

RESULTS

Out of 344 questionnaires that was distributed among four different schools, the response rate with completion was around 47.96% among Nepali parents (fig. 2). The final sample of parents of 165 children ranging from the age of 5 years 8 months to 14 years 11 months were present in the sample with mean age of 10.30 years (SD ± 2.47) which included total of 72 male and 93 female children. The parents who filled the questionnaire were of age 18 to 58 years who spent mean 9 hours with their children (table 1).

Table 1. Description of the participants

Variables	Mean(SD)	Range
Age of child in years	10.30 (± 2.47)	5 yrs 8 mos. - 14 yrs 1 mos.
Age of participant in years	34.67 (± 7.18)	18 yrs - 58 yrs
Time spent by parents with child in hours	9.13 (± 4.9)	2 hrs. - 18 hrs.
Gender of child	Frequency (%)	
Male	72 (43.6%)	
Female	93 (56.4%)	
Total	165 (100%)	
Gender of participant		
Male	57 (34.5%)	
Female	98 (59.4%)	
Education		
Primary	32 (23.4%)	
Secondary	48 (35%)	
Higher secondary	30 (21.9%)	
Undergraduate	23(16.8%)	
Masters	4(2.9%)	
Missing	28(16.9%)	
Occupation		
Agriculture	26(15.8%)	
Business	35(21.2%)	
Housewife	23(13.9%)	
Teacher	13(7.9%)	
Other	32(19.3%)	
Missing	36(21.8%)	

SD: Standard deviation

Internal consistency

The translated version DCDQ-NP showed an excellent internal consistency of Cronbach alpha value 0.91

calculated by including individual items of entire 165 sample. The item total correlation ranged from 0.50 to 0.72 which showed moderate to good correlation among items. The value of Cronbach alpha didn’t alter significantly when anyone item was removed with value ranging from 0.90 to 0.91 (table 2).

Table 2. Reliability of DCDQ-NP.

Items of DCDQ-NP	Corrected Item-total Correlation	Cronbach's alpha if item deleted ICC	Test retest reliability
1. Throw ball	0.64	0.91	0.59
2. Catches ball	0.65	0.91	0.61
3. Hits ball or Cock	0.63	0.91	0.80
4. Jumps over	0.59	0.91	0.57
5. Runs	0.68	0.91	0.65
6. Plans activity	0.63	0.91	0.75
7. Writing fast	0.67	0.91	0.74
8. Writing legibly	0.72	0.90	0.88
9. Effort and pressure	0.66	0.91	0.84
10. Cuts	0.70	0.91	0.65
11. Likes sports	0.59	0.91	0.75
12. Learning new skills	0.50	0.91	0.75
13. Quick and competent	0.59	0.91	0.63
14. Clumsy child	0.52	0.91	0.47
15. Doesn't get tired	0.51	0.91	0.53
Subset	Cronbach's alpha	ICC	
1. Control during Movement	0.852	0.832	
2. Fine motor/ hand-writing	0.864	0.907	
3. General Coordination	0.701	0.846	
4. Total score	0.912	0.903	

DCDQ-NP: Developmental Co-ordination Disorder Questionnaire Nepali version; ICC: Intraclass Correlation Coefficient

Test-retest reliability

Intraclass Correlation Coefficient (ICC) value of the total score was 0.90 for 50 sample where test retest time interval was of 2 weeks. The ICC for individual item ranged from 0.47 to 0.88. One item showed poor reliability < 0.50, eight item showed moderate reliability 0.50 to 0.75 and six items showed good to excellent reliability 0.75 to 0.9 (table 2).

Floor and ceiling effect

The floor and ceiling effects of the DCDQ-NP was found to 0.61% and 7.88% respectively. With a reference value of 15%, DCDQ-NP demonstrated no floor and ceiling effects.

Construct Validity

A PCA was conducted on the 15 items with varimax rotation. The KMO measure was 0.89 for DCDQ-NP. Bartlett’s test of sphericity, Chi square was 1211.12, p < 0.001, indicated that

correlations between items were sufficiently large for PCA. Three components had eigenvalues > 1 and in combination explained 62% of the variance which was also supported with the screen plot. The Varimax orthogonal rotation was employed to aid interpretability. The rotated solution exhibited complex structure. In the DCDQ-NP subset factor loading on 'Control during movement' were on item 1-5, 12, 'Fine motor / handwriting' on items 6-11 and 13 and 'General coordination' on item 14 and 15 (table 3).

Table 3. Factor loading of items on Varimax Rotated factor analysis for DCDQ-NP

Item of DCDQ-NP	Rotated Component Coefficient (DCDQ-NP)		
	Control During Movement	Fine Motor / Handwriting	General Coordination
1. Throws ball	0.571		
2. Catches ball	0.669		
3. Hits ball or cock	0.732		
4. Jumps over	0.686		
5. Runs	0.569		
6. Plans activity	0.688		
7. Writing fast		0.737	
8. Writing legibly		0.720	
9. Effort and pressure		0.712	
10. Cuts		0.690	
11. Likes sports		0.623	
12. Learning new skills	0.619		
13. Quick and competent		0.777	
14. Clumsy Child			0.815
15. Doesn't get tired			0.842

DCDQ-NP: Developmental Co-ordination Disorder Questionnaire Nepali version

DISCUSSION

We cross culturally adapted DCDQ'07 to Nepali version (DCDQ-NP) and demonstrated good to excellent psychometric properties for its application in population-based sample. We followed a rigorous cross-cultural adaptation procedures using multistage forward and backward translation with pre testing of questionnaire to attain appropriate language and socio-cultural adaptations.¹² The item accuracy and conceptual accuracy of DCDQ- NP and the original questionnaire was maintained. The original DCDQ'07 was developed originally for North American population certain term and phrase are not commonly used in Nepal for example, 'Birdie', 'fort', 'motor activity' and 'A Bull in china shop'. Therefore, a culturally appropriate word was purposed that was easily understandable 'cock', 'house' and 'physical activity'

respectively. Adaptation of the Likert scoring from 'Not at all like your child; A bit like you child...' to 'Not at all like other child; A bit like other child...' was done as it was easy for the Nepalese parents to compare their child with others and the original tool also encourage a comparison with other normal child of same age.¹⁰ During the final pretesting phase, all the items in the questionnaire and Likert scale measurement were further interviewed and asked for their preference and understanding. The questionnaire was understood by > 90% of participants and it was confirmed.

Parents of children participated voluntarily and filled out the questionnaires. The return rate of the distributed questionnaire with completion was around 47.96% among Nepali parents which is more than the original research (16%) but less than in population based Canadian research which executed 97.4% completion and return.^{18,19} Though studies support the efficacy of parent reported tool in identifying the early motor disorder, the return rate may be low in countries like Nepal where the parents abstain to fill up the form and are ignorant about the actual developmental status of the child.^{20,21} The results of our study show sound reliability which is comparable replication of the result of the original as well as other adapted versions. The Internal consistency of 0.91 suggest the homogeneity in the questionnaire which is consistent with original DCDQ'07 and other translated version.^{18,21-25} The original version that tested internal consistency on population based sample larger than this study (n=287) demonstrates the same value of Cronbach's alpha.¹⁸ The Polish version which have a comparable sample to our study (n=152) shows alpha value of 0.92 which is greater than that of our study.²⁵ The only other version that demonstrated better internal consistency is Italian version with 78 sample that showed alpha value of 0.94.²² The Chinese version that included even larger population than original (n=1082) demonstrated less Cronbach's alpha value of 0.84.^{21,26} The Hindi version that considered the sample size of 955 presented the internal consistency of 0.86.²¹ Despite the pattern suggests the lesser consistency with the larger sample size, German version with lesser sample size (n=94) demonstrated comparatively lower Cronbach's alpha of 0.89.²³

The item total correlation was moderate to high, item 12 'learning new skills' demonstrates the lowest score. This could be explained with the lack of primary presence of the parents while the child learns a new set of skills like swimming or rollerblading. Similarly, these sets of skill in our cultural context are not general and not every parents may have seen their child perform during leisure activities and learn these skills.²⁵ Some parents reported that leisure activities consisted of indoor activities and were generally ignored as the focus was on academics. Item 14 'Bull in china shop' and item 15 'does not fatigue' also demonstrates comparatively lower item total correlation, similar difficulties were noted in Hindi translation.²¹ The

feedback by parents in the pretesting could support this lower diagnostic value where the transition to the negative sentence structure in item 14 and item 15 was not received correctly by many parents and seemed to be more difficult for the parents to judge, which most likely reflected a cultural difference in usage and understanding of the term creating difficulty in absolute scoring. The attempt to further changes were ceased because making the structural change to affirmation, would not make the question true to its original version and the developers of the questionnaire permitted only translation and validation. Despite the minor issues, the scores of item total correlation in our study is still higher than the Hindi version and comparable to the original and other translated versions.^{18,22-26} Overall, the Nepali version appears to be a reliable tool taking into account, its internal consistency.

The test retest reliability was excellent for the total score and the subset score indicating the minimal difference in the answers between two weeks interval. However, the ICC score for the individual item was moderate to good except for the item 14 that demonstrated a lower ICC value. The similar results were reciprocated in the Hindi version that showed good score in subset but moderate reliability in item based ICC score with poor score for item 14 and 15.²¹ This could be explained through cultural insignificance of the item and the transition of the sentence structure to negation.²¹ The original version did not look into this reliability and there are only few other versions that had studied the test retest reliability.¹⁸ The item-based ICC in our study is inconsistent to most of the other adapted versions. While the Chinese version demonstrates an excellent coefficient value of 0.94, it has no mention of the individual item ICC score.²⁶ Another study in China that included large population of 4-6 year age, looked into the item based ICC and it demonstrated excellent to good ICC values, with reduced stability for item 12 'learning new skills' and 13 'quick and competent' that revealed comparatively lower score.²⁴ Similarly, Italian version with good to excellent reliability, altered in the stability of item 10 'Cuts' while the Polish version with excellent score of 0.93 has no mentions of item-based scores.^{22,25} Therefore, the stability of the answer is excellent for the subsets and the total scores making the tool acceptably reliable with consideration of discrepancy in item-based correlation coefficient.

Several recent studies have examined the factor structure of the DCDQ'07 our study showed difference in factor loading in items 11 to 13 which was deviated from 'General co-ordination' subset.^{18,19,26,27} Examining those items more

closely the differences in loading could be based on parents' interpretation of the examples provided. For instance, in item 12, examples provided for parent to consider when scoring this item (i.e. swimming, rollerblading) seems to fit well on 'Control during movement' while example like putting on shoes, tying shoes and dressing mentioned in item 13 fits in 'Fine Motor' subset. In addition the larger population based study (n=3070) conducted using original version of DCDQ'07 demonstrates the discrepancies in item 11-13 which is similar to our study.¹⁹ Another reason to loading discrepancies could be due to the perception of parents to their child's motor performance while scoring in the Likert scale as stated in Indian English and Kannada version and showed discrepancies in item 11 and 12.²⁷

Though our study follows the COSMIN (COnsensus-based Standards for the selection of health status Measurement INstruments) guidelines for testing the patient reported outcome measure, as mentioned earlier, there are many studies that included larger size of the population based sample.^{13,19,24,26} So, the adequate but comparatively smaller population could be the limitation of our study. The second major limitation is the absence of clinical sample with the cases of DCD. To the best of our knowledge, there is unavailability of the records with the identification of cases with DCD and the lack of culturally validated tools for appropriate diagnosis in Nepal. This attributes to the shortfall of clinical sample. So, we recommend the future studies to consider a heterogeneous, larger population size and improvise the limitation of clinical sample.

CONCLUSION

This study has successfully adapted and established DCDQ-NP as a culturally reliable and valid tool for its use in screening DCD in large population group. In the near future, this tool when used alongside the clinical observation by medical professional assists in further diagnosis and planning of interventions in children with DCD in Nepal.

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