Translation of Revised Version of Developmental Coordination Disorder Questionnaire (DCDQ'07) into Kannada – Results of Validation

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ABSTRACT

Purpose: *The revised version of Developmental Coordination Disorder Questionnaire (DCDQ'07) is a widely used parent-reported screening tool for DCD. The tool is not available in any Indian language. This article reports on the results of the cross-cultural validation of DCDQ'07 into Kannada, a South Indian language.*

Methods: *The questionnaire was first translated into Indian English to overcome differences in phraseology between Canadian and Indian English (DCDQ'07-IE). Following this, forward translation, synthesis, back translation, expert committee review, and pre-testing of the translated version were conducted to obtain the Kannada version of the questionnaire (DCDQ'07-K). Minor examples, in keeping with local usage, were added. 160 parents were recruited, among whom 80 were parents of children with motor difficulties and 80 were parents of children without motor difficulties. They rated their children on DCDQ'07-IE. After a washout period of 2 weeks, the same parents once again rated their children on DCDQ'07-K. Statistical analysis for reliability, construct validity, and Rasch diagnostics (person and item reliability, fit statistics, category functioning of scores and person-item map) were conducted.*

Results: *Internal consistency (Cronbach's Alpha>0.8), parallel form test-retest reliability (ICC=0.95 at 95% CI) and floor and ceiling were acceptable. Principal component analysis (PCA) showed three factors accounting for total variance of 59.29% and 58.80% in DCDQ'07-IE and DCDQ'07-K respectively. Item reliability (<0.8) and separation index (<2) were poor in both versions. Category*

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functioning was effective. Person-item map represented inconsistency in spread of items in difficulty and person's abilities. Qualitative review of the parents revealed that they were unfamiliar with the performance of their children on sports-related items and hence scored their child on the basis of conjecture.

Conclusion: *Translation into Kannada was fairly successful. Although traditional tool properties produced satisfactory results, Rasch analysis demonstrated problems with the tool. This could be due to cultural reasons. Hence DCDQ'07-K should be interpreted with caution when rated by parents in the local context.*

Key words: *Developmental coordination disorder, cross cultural validation, screening tools, motor skill disorders*

INTRODUCTION

Developmental coordination disorder (DCD) is a minor childhood disorder that is under- reported in India. DCD refers to the unaccountable failure of children to acquire age-appropriate motor skills, having significant negative effect on activities of daily living and academic achievement (American Psychiatric Association, 2013), and thereby leading to a potentially disabling effect on multiple components of quality of life of the child (Miller et al, 2001; Missiuna et al, 2008; Wang et al, 2009; Sylvestre et al, 2013; Zwicker et al, 2013).

The prevalence rate of DCD ranges from 1.37%- 21.33 %, according to reports from several parts of the world (Wright and Sugden, 1996; Kourtessis et al, 2008; Lingam et al, 2009; Sankar and Saritha, 2011; Valentini et al, 2012; Komal and Sanjay, 2014). DCD is noted when there is marked impairment in the performance of motor skills. Long-term prognosis of individuals with DCD varies, with a small proportion showing improvement. More often, motor difficulties tend to persist, adding to the individual's social, emotional and behavioural challenges that continue into adolescence and adulthood (Hill et al, 2011;Kirby et al, 2011; Tal-Saban et al, 2014).

Research into the effectiveness of varied intervention approaches for children with DCD, in order to improve skilled action during home and school activities, is strongly supported by a growing body of literature (Hillier, 2007; Morgan and Long, 2012; Smits-Engelsman et al, 2013; Camden et al, 2015). Adequate intervention is necessary for an individual to counter the disadvantages that might occur when functioning in society.

The American Psychological Association (APA) recently published the updated criteria for diagnosis of DCD (American Psychiatric Association,2013).They are as follows:

- Criterion A: The acquisition and execution of coordinated motor skills is substantially below that expected, given the individual's chronological age and opportunity for skill learning and use.

- Criterion B: The motor skills deficit in Criterion A significantly and persistently interferes with activities of daily living appropriate to chronological age and impacts academic /school productivity and vocational activities , leisure and play.

- Criterion C: Onset of symptoms is in the early developmental period.

- Criterion D: The motor skills deficits are not better explained by intellectual or visual impairment and are not attributable to neurological conditions affecting movement.

The first step commonly followed for identification of a child with possible DCD is the parent report. For this purpose, a questionnaire has been developed in Canada – the Developmental Coordination Disorder Questionnaire (DCDQ). The revised version of DCDQ (DCDQ'07), considered to have strong psychometric properties (Alpha=0.94, Sensitivity=85%, Specificity=71%), is a short, easy to use and low cost parent-reported questionnaire for identifying children with DCD between 5 and15 years of age. DCDQ-07 consists of 15 items which are scored on a five- point Likert scale, in which the parents compare the motor coordination of their child with other children of the same age. The total score ranges from 15-75, with cut-off score provided to support an "indication of DCD" or "probably not DCD" (Schoemaker et al, 2006; Wilson et al, 2009; Rivard et al, 2014).

For a questionnaire to be valid in a particular cohort, stringent cross-cultural validation techniques must be applied. The process involves translating the original to the target language and making cultural adaptations in order to maintain the content validity of the instrument at optimal level (Herdman et al,1998; Beaton et al, 2000; Stevelink and van Brakel, 2013).

To ascertain validation, there are two different approaches in testing the psychometric properties of quality of life instruments: Classical test theory (CTT) and Item response theory (IRT).

CTT focusses on total test score, that is, it works on the summary of items which is often described in terms of reliability and validity. IRT is a probabilistic model on how the examinee responds to any given item(s). It is generally agreed that CTT responses may be inadequate to establish psychometric properties of a questionnaire, and comprehensive validation must include both CTT and IRT methods (Hays et al, 2000; DeVellis, 2006; De Champlain, 2010).

Objective

DCDQ'07 has not been formally translated into Indian languages.This might possibly be a reason for under-reporting the condition in India. A study done in Dharwad, in Karnataka State, used an informal translation of the questionnaire in Kannada for estimating prevalence of DCD (Komal and Sanjay, 2014). The process of appropriate cross-cultural validation of DCDQ'07 into Kannada would help in the process of identifying and supporting children with DCD in Karnataka, and would facilitate collaborative epidemiological studies to compare the motor skills of children in Karnataka with other populations. This becomes even more important within the context of the current educational policies of inclusivity, where more children with difficulties attend mainstream schools. Identification of a child with possible DCD would equip the teacher to better deal with the child's academic and co-curricular programme.

Therefore, the objective of this study is to cross-culturally validate the revised version of DCDQ'07 into Kannada.

METHOD

To attain the study's objective, a 7-step procedure was planned (Herdman et al, 1998; Beaton et al, 2000; Stevelink and van Brakel, 2013). Ethical clearance was obtained from the Institutional Ethical Committee of Kasturba Medical College and Hospital, Manipal.

Step 1: Preparation – Permission for translation and cross-cultural validation of the questionnaire was obtained from the primary author of DCDQ'07. To identify the semantic differences in phraseology, DCDQ'07 was given to a person familiar with both Canadian and Indian English language usage. The questionnaire was then translated into Indian English, thus obtaining the Indian English version of DCDQ'07 (DCDQ'07-IE).

Step 2: Forward translation - Three native speakers of the Kannada language, who were also fluent in English, were recruited. Translator 1 was aware of the concept being translated, Translator 2 was the parent of a school-going child, and Translator 3 was not aware of the concept. Each person was requested to translate the DCDQ'07- IE questionnaire into Kannada language, at the level of understanding of a primary school educated person. Translators were requested to complete the translation individually and achieve colloquial, compatible, replicable comprehensible equivalence. They were instructed to avoid the use of active voice and words with vague meanings. This resulted in the production of three First Kannada versions (DCDQ'07-K1) of DCDQ'07-IE.

Step 3: Synthesis - All three DCDQ'07-K1 translations were reviewed by the principal researcher. Items that were interpreted differently by even one translator were kept aside. These items were discussed at a meeting between the three translators and the researcher, using the same instructions as were issued in Step 2. Words were chosen after consensus, and thus DCDQ'07-K1 was finalised.

Step 4: Back translation - A new set of three volunteers, fluent in both English and Kannada languages, were recruited. A procedure similar to the earlier one was followed to translate DCDQ'07-K1 back into English.

Step 5: Expert committee review - A new bilingual recruit who was not involved in the previous stages, was requested to review the translations of both DCDQ'07-K1 and DCDQ'07-IE with respect to construction of sentences, colloquialism, compatibility, replicability and comprehensibility. Questions that were translated differently were discussed at a meeting between the three members of the back translation team and the new reviewer. If there was confusion on construction, colloquial, compatible, replicable and comprehensible equivalence, the original team of forward translators of DCDQ'07-IE to DCDQ'07-K1 were invited to the meeting and consensus achieved on the best Kannada word/ phrase. Thus, the pre-final version of DCDQ'07-K1 was finalised (DCDQ'07-KPF).

Step 6: Pre-testing - To test the face validity of DCDQ'07-KPF, 50 parents of children between 6 and 15 years of age, who were fluent in Kannada, were invited to complete DCDQ'07-KPF. They were asked to rate each item on a 7-point scale for clarity (1= not at all clear, and 7= extremely clear). It was arbitrarily decided that any item receiving less than a score of 4 from more than 20 % of the volunteers would be subjected to review as mentioned in Step 5.Thus, the final version of the questionnaire was produced (DCDQ'07-K).

Step 7: Validation - Parents who were fluent in both English and Kannada, with children of either gender,were recruited. The children, between 6 and 15 years of age, were attending mainstream private schools of Udupi district. The required sample size of 160 was determined according to international guidelines for cross-cultural validation of the questionnaire, with equal distribution in clinical and control groups (Liu and Kalman, 2010). The clinical group consisted of 80 parents of children who had difficulties in any aspect of motor skills as identified by their respective class /craft / physical education teachers. The control group consisted of 80 parents of children with no difficulties in motor skills as reported by the same teachers. Forty parents each from the clinical and control groups were asked to rate their child on DCDQ'07-IE, and the remaining 40 parents each from the clinical and control groups were requested to rate their child on DCDQ'07-K. After a washout period of two weeks, the questionnaire in the other language was given to the parents, and they were requested to complete it with respect to the same child as before. In order to prevent recall, the order of questions was changed. In addition, unstructured qualitative interview of each of the parents was conducted to identify the parent's familiarity with the performance of their child on items of the questionnaire.

Statistical Analysis

Two methods were used to note the difference in psychometric properties of DCDQ'07-IE and DCDQ'07:the Classical test theory (CTT) and the Item response theory (IRT).

CTT Analysis: CTT was conducted using SPSS 16.0.Reliability and validity of both the versions of DCDQ'07 (Indian English and Kannada) were assessed using the traditional CTT approach.

1. Internal consistency was assessed using Cronbach's Alpha coefficient for each version. It was considered as satisfactory if Cronbach's Alpha was ≥0.7 (Bruton et al, 2000; Gadotti et al, 2006; Portney, 2015).

2. Intraclass correlation coefficient (ICC), two-way random effect model was used to assess the parallel form test-retest reliability of DCDQ'07.ICC of ≥ 0.7 is said to be acceptable (Bruton et al, 2000; Gadottiet al,2006; Portney, 2015).

3. Floor and ceiling effects of both the versions of DCDQ'07 were assessed by calculating the percentage of respondents scoring at the lowest and highest scale levels respectively(Bruton et al, 2000; Gadotti et al,2006; Portney, 2015).

4. Construct validity was assessed by principal component analysis (PCA). Sampling adequacy for PCA was determined if Kaiser-Meyer-Olkin (KMO) measure for overall data set value was >0 .8, KMO measure for individual items with values >0.5 and Bartletts's test of sphericity being statistically significant (i.e. p<.05). Selection of the number of components to be retained in the questionnaire was based on Kaiser rule (Eigen value>1), inspection of screen plot (components before the inflection point of the graph), total amount of variability in the items accounted by the solution (at least 5% of total variance), and correlation of 0.4 between an item and component loading on rotated component matrix giving simple structure (each item has only one component loading strongly on it and each component loading strongly on at least three variables) (Field, 2013).

IRT Analysis: In order to examine the validity of DCDQ'07-IE and DCDQ'07-K questionnaires as a screening tool measure for coordination trait for the sample population, Rasch model measurement analysis was performed using Rating Scale Model (RSM) in WINSTEP 3.74 software (Linacre, 2014).

1. Reliability was assessed for testing questionnaire functioning using item and person reliability and separation indices. The acceptable value of separation indices is 2.0, which leads value of >0.8 for corresponding item and person reliabilities considered as ideal (Bond and Fox, 2001;Linacre, 2014).

2. Rasch Likert-scale category functioning analysis was conducted to identify effectiveness of the 5-point response scale employed. Category frequency, Step measure (Rasch-Andrich threshold), average measure and category fit statistics were used as diagnostic tools for assessing category functioning. The presence of at least 10 observations in each category is considered to be ideal. The step measure parameter defines the boundaries between categories which should increase monotonically with categories. Average person measure for each step should be higher than the average person measures of the previous step. Outfit means square should be less than 2 (Bond and Fox, 2001;Linacre, 2014).

3. Two fit indices including the infit and outfit mean square (MNSQ) statistics were used to investigate whether all items contributed adequately to the scale construct. Infit MNSQ is information-weighted mean square residual which is more sensitive to unexpected response of person whose abilities are near item difficulty, while outfit is unweighted mean square residual being more

sensitive to unexpected outlying observation. A MNSQ value in the range of 0.6-1.4 is considered as ideal. A MNSQ value greater than 1.4 indicates that the item fails to define the same construct as other items do. MNSQ values lower than 0.6 may be an indication of item redundancy (Bond and Fox, 2001; Linacre, 2014).

4. The person-item map was generated to visually inspect targeting of item difficulty to the parent-reported child's ability. Optimal targeting occurs when a set of items in the questionnaire covers full range score in the population (Bond and Fox, 2001; Linacre, 2014).

RESULTS

Step 1: During this phase, examples of colloquial usage were added to Canadian DCDQ'07, thus producing DCDQ'07-IE (Table 1).

Table 1: Changes made in DCDQ'07-IE

Question number	Changes made in DCDQ'07-IE
2	Tennis ball was replaced by cricket ball
3	Birdies was replaced by shuttle cock, and racquet was removed
6	Fort was replaced by hut, and motor by movement
7,8,9	Printing was removed
12	Roller blading was replaced by skating
14	'Bull in China shop' was replaced by 'Bull in banana grove'
15	Fatigue was replaced by tired, and fall out by slip out

Steps 2 and 3: In forward translation, DCDQ'07-K1 differed in sentence construction for all the items, but not in the meaning; hence a consensus meeting was convened to decide on the best translation and DCDQ'07-K1 was finalised.

Steps 4 and 5: When DCDQ'07-K1 was back translated, questions 6, 14, 15 retained the meaning but differed in sentence construction; hence a consensus meeting was convened and DCDQ'07-KPF was produced.

Step 6: When DCDQ'07- KPF was tested for clarity, questions 4 and 6 scored below score 4; hence a consensus meeting was called and DCDQ'7-K was produced.

Step 7:

Sample Characteristics - The clinical group had 80 children (43 boys and 37 girls) with mean age of 9.8 years (SD=3.13). The control group had 80 children (34 boys and 46 girls) with mean age of 11.36 years (SD=2.95). No missing values were found.

CTT Analysis - No difference was noted in internal consistency of DCDQ'07-IE and DCDQ'07-K versions. Cronbach's Alpha coefficient for the 15-item DCDQ'07-IE and DCDQ'07-K was 0.896 and 0.892 respectively, which is ideal. The Alpha coefficient of each item, if that item was systematically deleted, ranged from 0.885-0.895 and 0.881 - 0.892 respectively for DCDQ'07-IE and DCDQ'07-K; thus deletion of any item in both the versions did not increase Cronbach's Alpha. The total score of the DCDQ'07-IE and DCDQ'07-K significantly correlated with each of the items of the test, a measure of individual contribution to the entire questionnaire. The item-total correlation ranged from 0.418 - 0.673 for DCDQ'07-IE and 0.380 - 0.661 for DCDQ'07-K.

ICC was found to be 0.95 for the total score between DCDQ'07-IE and DCDQ'07-K, with each item ranging from .758-.944 (95% CI) indicating adequate parallel form test- retest reliability.

When distribution of the responses for each item of the DCDQ'07 was assessed, it was found that in both versions the respondents' score was minimal in scores 1 and 2. Cronbach's Alpha of DCDQ'07-IE between the clinical group and control group was found to be 0.795 and 0.830 respectively. Cronbach's Alpha of DCDQ'07-K between the clinical group and control group was found to be 0.793 and 0.859 respectively. No floor and ceiling effect was found, as the score ranged between 31 and 70.

After testing the assumption for PCA (variables, linearity and presence of outliers within 3 SD), PCA was run on both the versions of DCDQ'07. In both versions, inspection of correlation matrix showed that all variables had at least one correlation coefficient greater than 0.4. The overall Kaiser-Meyer-Olkin (KMO) measure was 0.888 for DCDQ'07-IE and 0.883 for DCDQ'07-K, with individual KMO measures for all items greater than 0.7. Bartlett's test of sphericity was statistically significant (p<0.0005), indicating that the data was possibly factorable in both versions. Three components emerged with Eigen values greater than 1 in both versions, explaining total variance of 59.29% in DCDQ'07-IE and 58.81% in DCDQ'07-K. Visual inspection of the screen plots in either version indicated

that three components should be retained. A Varimax orthogonal rotation was employed to aid interpretability. The rotated solution exhibited complex structure. In DCDQ'07-IE, item 1 loaded on more than one component, whereas in item1 of DCDQ'07-K, 4 and 10 loaded on more than one component giving complex structure. In both DCDQ'07-IE and DCDQ'07-K, items in component 1 were academic- related activities (items 6,7,8,9 and 10), items in component 2 were sports- related activities (items 1,2,3,4,5,11 and 12) and items in component 3 were general activities (items 13, 14 and 15) (Table 2).

Table 2: Factor Loadings of items on Varimax Rotated Factor Analysis for DCDQ'07-IE and DCDQ'07-K

Item	Rotated Component Coefficient(DCDQ'07-IE)			Rotated Component Coefficient (DCDQ'07-K)		
	Component 1	Component 2	Component 3	Component 1	Component 2	Component 3
1	.542	.504		.400	.531	
2		.698			.700	
3		.788			.775	
4		.593			.614	.467
5		.625			.657	
6	.686			.711		
7	.668			.562		
8	.846			.853		
9	.678			.647		
10	.709			.601		.437
11		.634			.584	
12		.666			.693	
13			.626			.643
14			.800			.800
15			.834			.815

Note: Major components of each item are depicted

IRT Analysis: This analysis was done to explore Rasch derived item and person separation indices and reliability of both the versions of DCDQ'07. Although no difference was noted in reliability (person and item) and separation index (person and item) in both versions of DCDQ'07, item reliability and separation index were below the accepted level for both the versions (Table 3).

Table 3: Reliability and Separation Indices of DCDQ'07-IE and DCDQ'07-K

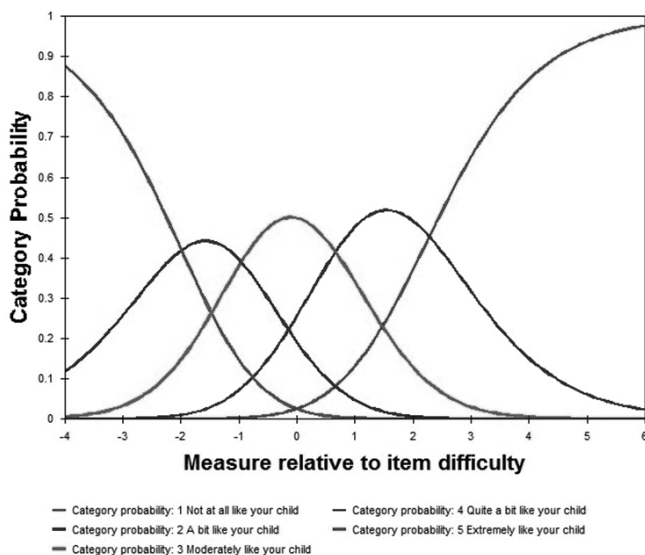|	DCDQ'07-IE		DCDQ'07-K	
	Person	**Item**	**Person**	**Item**
Reliability	.86	.78	.86	.79
Separation	2.47	1.90	2.47	1.94

Note: Item separation indices in both versions are < 2

First and second category attracted only 1% and 5 % respectively in both versions, but frequency was more than 10. Moreover, infit and outfit MNSQ statistics were acceptable for all the categories. The average measure increased monotonically across rating scale categories and there were no disordered threshold values (Table 4). Ordering of the threshold could also be observed in the corresponding category probability curve. For instance, intersection of categories 1 and 2 is located to the left side of that of categories 2 and 3, thereby indicating no disordering of threshold values (Graph 1.1 and 1.2).

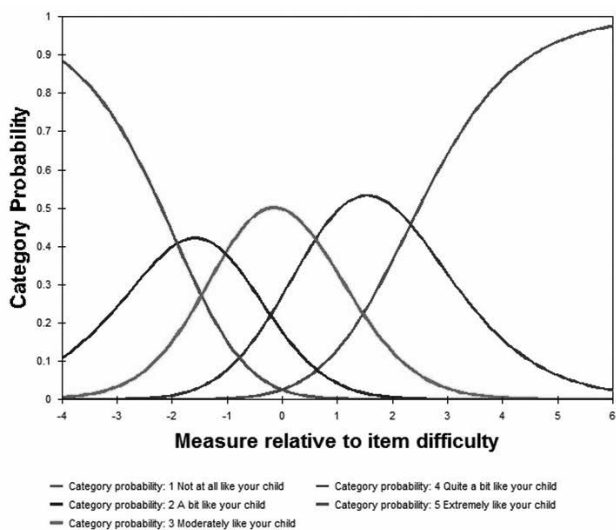**Table 4: Rating Scale Diagnostics of DCDQ'07-IE and DCDQ'07-K**

	Observed Count	Observed Percentage	INFIT MNSQ	OUTFIT MNSQ	Average Measure	ANDRICH THRESHOLD
DCDQ'07-IE						
1	20	1	1.49	1.63	.14	NONE
2	127	5	1.05	1.08	.20	-1.99
3	558	23	.86	.89	.75	-.96
4	933	39	.88	.95	1.58	.67
5	762	32	1.04	1.03	2.56	2.28
DCDQ'07-K						
1	18	1	1.41	1.55	.22	NONE
2	116	5	1.03	1.03	.26	-1.91

3	558	23	.89	.94	.76	-1.03
4	958	40	.93	.96	1.52	.61
5	750	31	1.03	1.02	2.68	2.33

Graph 1.1: Category Probability Curve of DCDQ'07-IE

Category probability: 1 Not at all like your child
Category probability: 2 A bit like your child
Category probability: 3 Moderately like your child
Category probability: 4 Quite a bit like your child
Category probability: 5 Extremely like your child

Graph 1.2: Category Probability Curve of DCDQ'07-K

Category probability: 1 Not at all like your child
Category probability: 2 A bit like your child
Category probability: 3 Moderately like your child
Category probability: 4 Quite a bit like your child
Category probability: 5 Extremely like your child

There was not much difference noted in the item fit statistics of both the versions of DCDQ'07. For DCDQ'07-IE, mean square INFIT value ranges from 0.65 to 1.47, and OUTFIT mean square value ranges from 0.63 - 1.40 for all items. For DCDQ'07-K, INFIT mean square value ranges from 0.65 - 1.43 and OUTFIT mean square value ranges from 0.63 - 1.59 for all items. For both versions of DCDQ'07, items 14 and 11 exceed 1.4 (Table 5).

Table 5: Item fit statistics of DCDQ'07-IE and DCDQ'07-K

Item	DCDQ'07-IE		DCDQ'07-K		DCDQ'07-IE		DCDQ'07-K	
	INFIT MNSQ	INFIT ZSTD	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
1	.65	-3.5	.65	-3.4	.63	-3.6	.65	-3.4
2	.79	-2.0	.79	-1.9	.76	-2.2	.76	-2.1
3	1.13	1.2	1.02	.2	1.12	1.1	1	.1
4	.91	-.8	.77	-2.1	.93	-.6	.74	-2.3
5	.90	-.8	.95	-.4	.95	-.3	1.02	.2
6	.89	-1.0	1	.1	.84	-1.4	.96	-.3
7	.87	-1.2	.84	-1.4	.95	-.3	.89	-.9
8	.99	.0	1.05	.5	.98	-.1	1.01	.1
9	.81	-1.8	.73	-2.2	.81	-1.6	.73	-2.3
10	.99	.0	.99	-.1	.96	-.3	.90	-.7
11	1.27	2.2	1.37	2.9	1.40	2.9	1.59	3.9
12	1.00	.0	1.08	.7	1.01	.2	1.13	1.1
13	1.07	.6	1.05	.5	1.10	.8	1.18	1.3
14	1.47	3.7	1.43	3.3	1.36	2.6	1.31	2.2
15	1.25	2.1	1.28	2.2	1.32	2.4	1.33	2.3

Note: Items 11 and 14 in both versions exceed 1.4 which could be improved or dropped.

The person item map shows the distribution of the children coordination ability score (left side) and item difficulty (right side) for each item of DCDQ'07-IE (Graph 2.1) and DCDQ'07-K (Graph 2.2). Children with higher coordination ability and items with more difficulty were located at the top of the map. Optimal targeting was not observed since the majority of school children with higher coordination score found no corresponding items, suggesting that the school children in the present study had higher coordination score than the average difficulty of

Graph 2.1: Person Item map of DCDQ'07-IE

Graph 2.2: Person Item map DCDQ'07-K
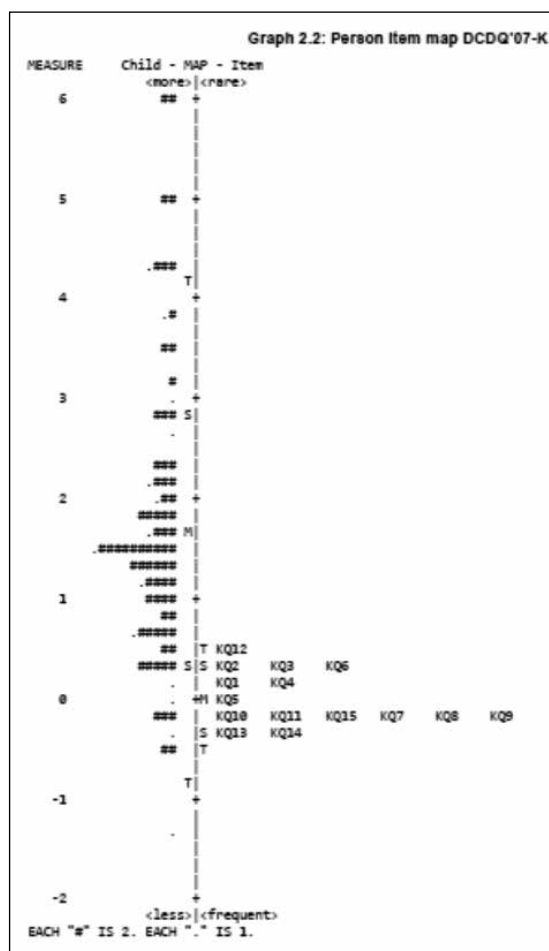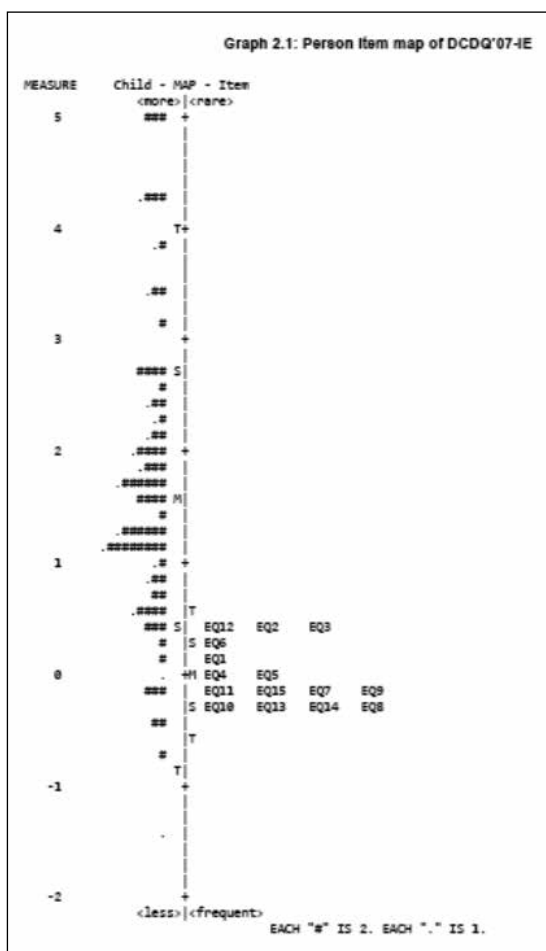
the DCDQ'07 items and they could not be well targeted by the items. This was noticed in both versions.

Thus the two versions, DCDQ'07-IE and DCDQ'07-K, showed equivalence in all analyses undertaken in CTT and IRT measures.

DISCUSSION

Translation and cross-cultural validation of this study was undertaken with the most stringent research design. The original DCDQ'07 was developed using terms and phrases that are understood by the North American population. The terms were not familiar to Indian translators. Certain phrases like "bull in a China shop" are not commonly used in India. Hence, a culturally responsive equivalent was substituted in its place in the first step of translation into DCDQ'07-IE.

Parents of children participated voluntarily and filled out the questionnaires. To minimise effect recall, a washout period of two weeks was given and the order of questionnaire administration was randomised so that some parents received the DCDQ'07-IEversion first and others got the DCDQ'07-K version first. Additionally, the order in which the questions appearedwas changed in the two versions. The researchers believe these measures were satisfactory.

CTT method showed that there was no difference found between DCDQ '07-IE and DCDQ'07-K and there was acceptable internal consistency, parallel form test-retest reliability and floor and ceiling effects (Bruton et al, 2000; Gadotti et al, 2006; Portney, 2015). Internal consistency is in agreement with DCDQ'07 (Canadian Children Cronbach's Alpha =0.94). Parallel form test- retest reliability and floor and ceiling effects are not determined for the DCDQ'07; hence no comparison could be made (Wilson et al, 2009).

Although similar to the original DCDQ'07 (Canadian English version), principal component analysis of DCDQ'07-IE and DCDQ'07-K indicated emergence of three factors solution but the accounting variance was low (DCDQ'07=79%, DCDQ'07-IE= 59.29% and DCDQ'07-K=58.80 of variance). Moreover DCDQ'07 (Canadian English) differed in distribution and type of items in each component (Component 1(items 1,2,3,4,5)= 'control during movement'; Component 2 (items 7,8,9,10)='Fine motor/handwriting' ; Component 3 (items 11,12,13,14,15)='General coordination') from the translated versions (DCDQ'07-IE and DCDQ'07-K) (Wilson et al, 2009). The researchers attribute these differences to the parents' unfamiliarity with their child's sporting and craft performance. This hypothesis was confirmed by parents and their comments to the same effect.

Acceptable values of person reliability (>.8) and separation index (>2) of both DCDQ'07-IE and DCDQ'07-K indicate adequate person ordering (if the sample of persons were given another parallel set of items that would measure the same construct) and greater spread of sample (well discrimination of sample based on their ability) along continuum respectively. However, poor values of item reliability (<.8) and separation index (<2) indicate inadequacy of item placement and redundancy in item spread across continuum respectively.

Although all the steps of category functioning and category probability curves in both DCDQ'07-IE and DCDQ'07-K were well within the criterion stating effectiveness, the 5-point Likert scale attraction of categories 1 and 2 were on the lower side, possibly because of the higher level of coordination in the general

population. It may also be due to the parents' level of perception of their child's motor performance, as stated earlier.

There was a significant discordance in item 11 (liking sports) and item 14 (bull in grove) between the two versions, indicating that the questions may have been interpreted differently in different languages. This difference in interpretation did not emerge during the interview with parents and should be investigated in future.

The study also found inadequate targeting of items in the questionnaire, as shown in the person-item map. This could be due to parents' being unfamiliar with their children's motor performance, thereby altering the response choices, or an artifact of a mostly healthy population. This must also be investigated in future.

There is usually uncertainty regarding the exact manner in which the rating scale will be used by a particular sample, hence investigation of the functioning of the rating scale is always merited. Rasch analysis provides an effective framework within which to verify and perhaps improve the functioning of the rating scale categorisation. However, item response functioning has not been done on the DCDQ'07. Hence the study results could not be compared with the DCDQ'07.

The parents were interviewed in order to assess their familiarity with their child's performance on the items. Most parents were mothers who reported that they rarely had an opportunity to watch their child's performance during leisure activities. Some parents reported that leisure activities were generally ignored as the focus was on academics. Hence the researchers suggest that in rural and semi-rural Karnataka, teachers may be better able to complete the DCDQ'07-K. It is suggested that class teachers, and craft and physical education teachers must be the respondents to DCDQ'07-K as they are likely to be more familiar with a child's motor ability. A further suggestion is that a motor ability questionnaire that has a greater representation of household chores and activity of daily living tasks may be more suitable as a parent-completed screening tool for DCD in this population.

DCDQ'07 developers have suggested that the questionnaire can be completed by parents or teachers, but cut-off scores were available only for parents. Future research must focus on developing norms for the tool when completed by teachers. These are potential limitations of this study. The developers of the questionnaire permitted only translation and validation. Since modification of the tool was not

the objective of this study, the researchers did not manipulate anything within the existing questionnaire. The only changes made were the addition of examples that could be understood within the cultural context. Although traditional tool properties were satisfactory, results of Rasch analysis indicate that if it is completed by parents, the DCDQ'07-K must be interpreted with caution. However, until a more sensitive tool is developed for this population, DCDQ'07-K is a relevant and adequate screening tool. In keeping with diagnostic criteria, further evaluation of children must be conducted prior to a diagnosis of DCD.

Other psychometric properties like sensitivity, specificity responsiveness, etc., could not be attempted in this study. These are objectives for future research.

CONCLUSION

The objective of the study to complete cross-cultural validation was met, and the DCDQ'07-K has been produced.

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