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THE ABILITY OF PARENTS TO IDENTIFY GRADE 1-LEARNERS WITH DEVELOPMENTAL COORDINATION DISORDER AT HOME

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ABSTRACT

Developmental Coordination Disorder (DCD) is recognised as one of the most common developmental dysfunctions during childhood and a large number of children between 6 and 12 years of age are identified with DCD. The aim of the study was to examine the convergent validity of the classification of motor difficulties by Kinderkineticists-in-training, using the Movement Assessment Battery for Children-2 (MABC-2 Test), and the classification of motor difficulties by the parents of the participants, using the DCD Questionnaire '07 (DCDQ'07), to determine if parents possess the competency to identify DCD at home. Grade 1-learners (N=410) between the ages of 5 to 8 years participated (girls: n=226 [55%]; boys: n=184 [45%]). The ethnic groups represented were 67% Caucasian and 33% Black children. The results indicated 91% specificity for the DCDQ'07. In contrast, the sensitivity was only 23%. The kappa coefficient of 0.151 indicated a 15% convergent validity between the two assessment tools. Therefore, the parents in this study, who used the DCDQ'07, could not identify children with DCD at home.

Key words: DCD (Developmental Coordination Disorder); MABC-2 Test (Movement Assessment Battery for Children-2); Developmental Coordination Disorder Questionnaire'07 (DCDQ'07); Grade 1-learners.

INTRODUCTION

DCD is recognised as one of the most common developmental dysfunctions during childhood (Ellinoudis *et al*., 2009). The literature indicates wide debate regarding the prevalence of DCD (Giagazoglou *et al*., 2011) and varies in relation to the diagnostic criteria that are used (Carslaw, 2011). According to the American Psychiatric Association (APA, 2013), DCD affects 5 to 6% of school-age children between five and 11 years of age, while Wilmut *et al*. (2007) indicated the prevalence of DCD to be between 5 to 10%. In South Africa (Bloemfontein metropolitan area), the prevalence of DCD was even higher, as it was found that 15% of learners had DCD (De Milander *et al*., 2014). Alarmingly, Pienaar (2004) and Wessels *et al*. (2008) reported that children in the North-West Province of South Africa had a significantly higher prevalence of DCD. They reported 61 and 52% respectively. Pienaar (2004) concluded that the norms of the Movement Assessment Battery for Children should be adjusted for South African children.

DCD can be defined as a marked impairment in the development of motor coordination that is not explicable in terms of general intellectual retardation or in terms of any specific congenital or acquired neurological disorder (APA, 2013). It is diagnosed in children who experience significant difficulties in motor learning and in the performance of functional motor tasks that are critical for success in their daily lives, such as activities at home (dressing themselves), school (handwriting), and during play (ball skills) (Edwards *et al*., 2011; Asonitou *et al*., 2012). These difficulties could be viewed as clumsiness, for example, dropping objects, in addition to the slow and inaccurate performance of motor skills, such as catching objects, using scissors or taking part in sport (APA, 2013).

Zwicker *et al*. (2012) argue that one of the major concerns regarding children with DCD is that often they are not diagnosed formally, but rather described by their parents and teachers as lazy or awkward. Furthermore, they state that the reason for not diagnosing these children is the lack of awareness of the disorder. The use of questionnaires is encouraged by Missiuna and Pollock (1995), as well as Wright and Sugden (1998), who state that numerous tools should be used to gather information from parents and teachers. Questionnaires may be used to identify young children in need of further assessment by professionals, who would use the normative assessment tools. However, the use of these questionnaires has both limitations and advantages.

In an attempt to identify children with DCD, several research tools, such as questionnaires for screening purposes and norm-referenced tests to measure the degree of movement difficulties, can be used (Barnett, 2008). In view of the high costs of norm-referenced tests, time-consuming processes and long waiting periods, screening tools are a cost-effective way of identifying children who might have DCD (Loh *et al*., 2009). Several screening tests and questionnaires have been developed to gather information, specifically from parents and teachers, concerning children's functional motor performance, for example, the Movement Assessment Battery for Children Checklist (MABC-C) and the Developmental Coordination Disorder Questionnaire'07 (DCDQ'07) (Schoemaker *et al*., 2012).

The validity and reliability of the original DCD-Q has been investigated. It was found that this questionnaire is a valid and reliable tool and can be used for boys and girls (Schoemaker *et al*., 2008). It has been recommended that the test can be used with confidence for children between the ages of eight and 14 years and six months (Wilson *et al*., 2000). In 2009, Wilson and colleagues conducted another study using the same instrument and concluded that children as young as five years of age can be screened (Wilson *et al*., 2009). Brazilian researchers adapted the language and two of the items in the questionnaire due to cultural differences. The resulting questionnaire was found to be equivalent to the original DCD-Q. The DCDQ-Brazil also demonstrates acceptable validity and reliability (Prado *et al*., 2009). In contrast, Loh *et al*. (2009) found that the DCD-Q had a low sensitivity in detecting children with mild motor difficulties.

Regarding the limitations of the original DCD-Q, Wilson *et al*. (2000) indicated a 27% convergent validity between the therapist and the DCD-Q, demonstrating that the questionnaire did not identify children with motor difficulties as frequently as a therapist. Loh *et al*. (2009) also indicated that the DCD-Q was insufficient in distinguishing children with motor difficulties from those who did not experience any difficulties. Additionally, studies

using parents' reports have produced conflicting results (Faught *et al*., 2008). Another limitation arising from using questionnaires are that parents with attention deficit/hyperactivity disorder (ADHD) children tend to indicate that their children experienced motor problems, while norm-referenced standardised tests indicated the opposite (Wilson *et al*., 2009). Loh *et al*. (2009) obtained similar findings in a study conducted among Australian children, as the questionnaire does not differentiate the ADHD symptoms.

Relating to advantages of the DCD-Q, positive results were obtained from a study done by Green *et al*. (2005). The researchers concluded that parents could identify DCD if no other developmental problems were present. An additional advantage of the questionnaire is that children might be identified before they enter school. This would thus prevent secondary impairments associated with DCD (Missiuna *et al*., 2006), such as physical health problems due to lower activity levels (Tsiotra *et al*., 2009), social problems, emotional problems (withdrawal or exclusion from peers), as well as academic problems (difficulties with tracing, writing and learning) (Wilmut *et al*., 2007). The DCD-Q was revised to improve the ability to identify children with motor difficulties and is now known as the DCDQ'07 (Wilson *et al*., 2007). Changes included lowering the age range to children between the ages of five and seven years, modifying the items to ensure a better understanding of the activity and developing a new scoring method (Wilson *et al*., 2009). According to Wilson *et al.* (2009), the validity of the DCDQ'07 was also found to be good. Although the DCDQ'07 was developed originally in Canada, cross-cultural adaptations of this questionnaire have been made and similar results were obtained as those in Canada (Prado *et al*., 2009).

Although there are a few advantages, the independent use of questionnaires by researchers is not recommended (Junaid *et al*., 2000; Schoemaker *et al*., 2003). Schoemaker *et al*. (2003) are of the opinion that it is more beneficial to identify all the children with potential DCD, even if some children present false positives. Using a norm-referenced standardised test after the screening process will correct the false positive diagnoses. They argue that it is ethically more responsible to over-identify children than to fail to identify the children who need interventions (Schoemaker *et al*., 2003).

PURPOSE OF THE STUDY

The aim of the study was to examine the convergent validity of the classification of motor difficulties by Kinderkineticists-in-training using the MABC-2 Test and the classification of motor difficulties by the parents of the participants using the DCDQ'07, in order to determine if parents possess the competency to identify Grade 1-learners with DCD at home. The DCDQ'07, used in the current study, has only had limited testing on South African children.

METHODOLOGY

Study design

This comparative study made use of quantitative data. The study involved 1 testing procedure by means of the Movement Assessment Battery for Children-2 (MABC-2 Test) in order to identify DCD among Grade 1-learners (N=410). The participants were tested at their schools during the Life Orientation classes by Kinderkineticists-in-training who had been trained to

use the instrument. Each Kinderkineticist-in-training was responsible for 1 subtest in order to have consistency across the study. In addition, a parent of each participant completed the DCDQ'07.

The next step was to compare the specificity and the sensitivity of the 2 measuring instruments. According to Ellinoudis *et al*. (2009), *specificity* refers to the ability of the parents using the DCDQ'07 to identify correctly children with no motor difficulties (green zone), as identified by the MABC-2 Test. *Sensitivity* refers to the ability of the parents, using the DCDQ'07, to identify correctly children with moderate (amber zone) and severe (red zone) motor problems (Ellinoudis *et al*., 2009). The results of the MABC-2 Test scores were compared to the results of the DCDQ'07 in order to determine the convergent validity between the 2 measuring instruments and to establish the competency of parents to identify DCD in children at home, thereby aiding professionals in early identification.

Participants

Initially 13 schools in the Bloemfontein area were targeted to take part in the research project, but only 7 schools eventually agreed to participate. Thus, the study made use of an availability sample. The Department of Basic Education of the Free State Province, as well as the principal of each school granted permission for the research to be conducted on the school premises during the Life Orientation class periods. Approval had been obtained from the Ethics Committee of the Faculty of Health Sciences, University of the Free State (ECUFS57/2012). The participants were treated in accordance with the ethical guidelines outlined by the Ethics Committee of the Faculty of Health Sciences. The parents/legal guardians of the participants completed an informed consent form for each child participating in this study. In addition, the children signed an assent form.

Recruitment was targeted at children with and without DCD via the 7 participating schools who had permission to take part in the study (inclusion criteria). Exclusion criteria included a child in the age group outside the expected range (younger than 5 and older than 8 years), parental permission not obtained, the informed consent form not fully completed, or parents indicating that they would be relocating during the study. Children who were absent during the testing procedure were also excluded due to incomplete testing. Additionally, the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5), (APA, 2013) was used to exclude children who had associated symptoms according to the criteria for DCD as stated in the DSM-5. Children with motor difficulties should not meet criterion C (disturbance is not due to a general medical condition, for example, cerebral palsy, hemiplegia, or muscular dystrophy and does not meet criteria for a Pervasive Developmental Disorder), or criterion D (if mental retardation is present, the motor difficulties are in excess of those usually associated with it). None of the children met the criteria and, therefore, all of them were included for further data analysis.

Measuring instruments

Movement Assessment Battery for Children-2 (MABC-2 Test)

According to Henderson *et al*. (2007), the MABC-2 Test requires children to perform a series of motor tasks in a specified manner. In addition to age-related norms, the test also provides

qualitative information on how children should approach and perform the tasks. The MABC-2 Test is used to assess the motor proficiency levels of the subject and to diagnose DCD in children. The first assessment component of this test battery contains 24 items organised into 3 sets of 8 tasks. Each set is designed to use with children of a different age band. For the current study, age band 1 and age band 2 were used.

The 8 tasks are grouped under 3 headings, namely manual dexterity (MD), balance (B) and aiming and catching (AC) (Henderson *et al*., 2007). Age-adjusted standard scores and percentiles are provided, as well as a total test score for each of the 3 components of the test. The total test score can be interpreted in terms of a "traffic light" system. The green zone indicates performance in a normal range (>15th percentile), while the amber zone indicates that a child is at risk and needs to be carefully monitored (5th to 15th percentile). The red zone is an indication of definite motor impairment (≤5th percentile). Thus, high standard scores on the MABC-2 Test represent good performance. The MABC-2 Test is a valid and reliable tool to use with a reliability coefficient for the total test scores of 0.80 (Henderson *et al*., 2007).

DCD Questionnaire '07 (DCDQ'07)

The DCDQ'07 is a brief questionnaire intended for parents to screen for DCD in children between 5 and 15 years of age (Wilson & Crawford, 2007; Loh *et al*., 2009). The questionnaire consists of 15 items divided into 3 different categories (Wilson & Crawford, 2007). According to Wilson and Crawford (2007), the first category is "control during movement" and contains items relating to motor control while either the child or an object is in motion. The second category refers to "fine motor and handwriting" and the third category relates to "general coordination". The parent, on a scale rating from 1 to 5, rates a child's performance on each item. A rating of '1' indicates "not at all like your child", whereas a '5' indicates "extremely like your child" (Wilson *et al*., 2007). The ratings are calculated to provide a total score. The interpretation of the total score, as well as the cut-off scores, differs for the 3 different age groups specified. The DCDQ'07 is a valid and reliable tool to use with a reliability coefficient of 0.89 (Wilson *et al*., 2009).

Analysis of data

Microsoft Excel was used to capture the data from both the MABC-2 Test and the DCDQ'07 electronically. A statistician using the Statistical Package for the Social Sciences (SPSS) for Windows (SPSS version 16.0), performed the data analysis. In order to determine the convergent validity of the classification of motor problems (no motor difficulties or motor difficulties), of the MABC-2 Test and the classification of motor difficulties by the parents of the participants using the DCDQ'07, the kappa (k-) coefficient was used. This coefficient provides information with regard to the convergent validity between the 2 measuring instruments. The higher the coefficient (whether it is a negative or a positive value), the greater the convergent validity between the 2 measuring instruments.

A decision was made in an arbitrary way to assign a code 1 for the group identified with motor difficulties and a code 2 for no motor difficulties. This was done as the DCDQ'07 has only a "yes" or a "no" option and thus, the MABC-2 Test was adapted to 2 categories, namely the green zone (no motor difficulties) and the amber zone (at risk) and red zone (severe difficulties) grouped together for motor difficulties presented. Further analysis was

done on these 2 categories only. Whether the correlation coefficient is a positive or a negative value can be ignored due to the codes that have been chosen in an arbitrary way. A negative correlation only indicates that the average of the group with code 2 is lower than that of the group with code 1, while a positive correlation indicates the opposite.

The practical importance of the results was also investigated. As standard of practical significance, the effect size was calculated. Effect sizes (r) were calculated to determine the practical significance of the results according to Cohen (1988), by dividing the differences in the mean by the largest standard deviation of the test results. For the interpretation of practical significance, the following guideline values need to be used when the effect size is interpreted, namely r= 0.1 is a small effect; r= 0.3 a medium effect; and r= 0.5 a large effect (Steyn, 1999). A probability level of $p<0.05$ or less was taken to indicate statistical significance.

RESULTS

Table 1 indicates the frequency distribution of the participants according to gender and race. Children (N=410) between the ages of 5 and 8 years took part in the study. The study consisted of boys (n=184) and girls (n=226), as well as an ethnic group distribution of Caucasian (n=273) and Black (n=137).

The mean age for the children was 6 years and 7 months with a standard deviation of 0.4. The minimum age was 5 years and 8 months and the maximum age was 8 years. The majority of the participants consisted of Caucasian children (66.6%), with a greater representation of girls (55.1%) than boys (44.9%) for the whole group. The gender distribution is more or less equal between the 2 ethnic groups.

TABLE 1. **DISTRIBUTION OF PARTICIPANTS FOR GENDER AND RACE**

	Race		**Total**
Gender	Caucasian	Black	
Boys	128 (46.9%)	56 (40.9%)	184 (44.9%)
Girls	145 (53.1%)	81 (59.1%)	226 (55.1%)
Total	273 (66.6%)	137 (33.4%)	410 (100.0%)

Table 2 presents the convergent validity between the classifications of motor difficulties by means of the MABC-2 Test and the identification of motor difficulties by the parents using the DCDQ'07 for the total group, the 2 gender and 2 race groups (Caucasian and Black) independently. Finally, the convergent validity between the 2 measuring instruments with regard to Caucasian boys and girls, as well as Black boys and girls was established.

Specificity of MABC-2 Test and parent-completed DCDQ'07

The specificity, between the MABC-2 Test and the parent-completed DCDQ'07 (Table 2), was 91% for the total group.

TABLE 2. **CONVERGENT VALIDITY BETWEEN MABC-2 TEST AND DCDQ'07**

T0TAL GROUP				**Caucasian children**				**Black children**			
	MABC-2				MABC-2				MABC-2		
DCD	MD	NMD	Total	DCD	MD	NMD	Total	DCD	MD	NMD	Total
MD	12 (23.1%)	32	44	MD	6 (21%)	16	22	MD	6 (25%)	16	22
NMD	40	324 (91.0%)	364	NMD	22	227 (93%)	249	NMD	18	97 (86%)	115
Total	52	356	408	Total	28	243	271	Total	24	113	137
k-coefficient= 0.151, p=0.002 Effect size (r)= 0.151 (small)				k-coefficient = 0.164, p=0.006 Effect size (r)= 0.165 (small)				k-coefficient= 0.112, p=0.189 Effect size (r)= 0.112 (small)			

BOYS				**GIRLS**			
	MABC-2				MABC-2		
DCD	MD	NMD	Total	DCD	MD	NMD	Total
MD	10 (32.3%)	12	22	MD	6 (21%)	16	22
NMD	21	139 (92.1%)	160	NMD	22	227 (93%)	249
Total	31	151	182	Total	28	243	271
k-coefficient= 0.275, p=0.000 Effect size (r)= 0.280 (medium)				k-coefficient= 0.002, p=0.973 Effect size (r)= 0.001 (small)			
Caucasian Boys				**Caucasian Girls**			
	MABC-2				MABC-2		
DCD	MD	NMD	Total	DCD	MD	NMD	Total
MD	5 (31.3%)	5	10	MD	1 (8.3%)	11	12
NMD	11	105 (95.5%)	116	NMD	11	122 (91.7%)	133
Total	16	110	126	Total	12	133	145
k-coefficient= 0.318, p=0.000 Effect size (r)= 0.329 (medium)				k-coefficient= 0.001, p=0.994 Effect size (r)= 0.001 (small)			
Black Boys				**Black Girls**			
	MABC-2				MABC-2		
DCD	MD	NMD	Total	DCD	MD	NMD	Total
MD	1 (8.3%)	11	12	MD	1 (11.1%)	9	10
NMD	11	122 (91.7%)	133	NMD	8	63 (87.5%)	71
Total	12	133	145	Total	9	72	81
k-coefficient= 0.174, p=0.189 Effect size (r)= 0.175 (small)				k-coefficient= 0.013, p=0.905 Effect size (r)= 0.013 (small)			

MD= Motor difficulties NMD= No Motor difficulties DCD= DCDQ'07 MABC= MABC-2 Test

Similar findings with regard to a high specificity were established for boys (92%) and girls (90%). The specificity for Caucasian children (93%) was higher than for Black children (86%) and higher for Caucasian boys (96%) than for Black boys (83%). The results for the girls also indicated a higher specificity for the Caucasian girls (92%) than for the Black girls (88%).

Sensitivity of MABC-2 Test and parent-completed DCDQ'07

The sensitivity for the total group (Table 2) was 23%, indicating that the parents could not identify the children with motor problems. With regard to the boys, a higher sensitivity (32%) was established than for their female counterparts (10%). The results indicate similar findings comparing the Caucasian children (21%) with the Black children (25%). It is interesting to note that a higher sensitivity was found for the Caucasian boys (31%) and the Black boys (33%) than for the Caucasian girls (8%) and the Black girls (11%).

Convergent validity of MABC-2 Test and parent-completed DCDQ'07

The calculated k-coefficient of 0.151 is on the 1% significance level and provides a small effect size, which means that the findings were of insignificant practical importance (Table 2). There was, however, a significant difference (p=0.002). The results indicate that there was only a 15% convergent validity between the 2 measuring instruments after correcting for chance for the *total group*.

The results for the *boys* indicate that the calculated k-coefficient of 0.275 is on the 1% level providing a medium effect size. This implies that the findings were of average practical importance with a significant difference (p=0.000). The convergent validity was only 28%. In contrast, for the *girls* a much lower k-coefficient of 0.002 was found, which is not significant on the 5% level, and no significant difference occurred (p=0.973). The calculated k-coefficient for the *Caucasian children* was 0.164 with a significant difference (p=0.006). Although the significance is on the 1% level, it provides a small effect size, which means that the findings were of insignificant practical importance. In contrast, the convergent validity in the case of the *Black children* was 16%, which is not significant on the 5% level and indicates a k-coefficient of 0.112 with no significant difference (p=0.189).

The calculated k-coefficient of 0.318 for *Caucasian boys* was on the 1% level and provides a medium effect size, which reveals that the findings were of average practical importance. In this case, the k-coefficient indicates that there was a 32% convergent validity between the 2 measuring instruments after correcting for chance and indicated a significant difference (p=0.000). These results provide evidence that the convergent validity of these 2 measuring instruments was reasonably high for Caucasian boys. For the *Black boys*, the results indicate that the k-coefficient of 0.174 was not significant on the 5% level and, therefore, no significant difference occurred (p=0.189). Furthermore, the results of the girls indicate that the k-coefficient of 0.001 for the *Caucasian girls* and the k-coefficient of 0.013 for the *Black girls* were not significant on the 5% level for both groups. No significant differences were observed for the *Caucasian girls* (p=0.994) or for the *Black girls* (p=0.905). It could be concluded that there was also no significant convergent validity between the 2 measuring instruments (MABC-2 Test and the DCDQ'07) for the various variables, except for *Caucasian boys*.

DISCUSSION

The purpose of the study was to examine the convergent validity of the classification of motor difficulties by Kinderkineticists-in-training using the MABC-2 Test and the classification of motor difficulties by the parents of the participants using the DCDQ'07 in

order to determine if parents have the competency to identify Grade 1-learners with DCD at home. This convergent validity was determined for the total group (N=410) and for the genders and the specific race groups (Caucasian and Black) independently. Finally, the convergent validity between the two measuring instruments with regard to Caucasian boys and girls as well as Black boys and girls was established.

The research set out to provide possible answers to the questions pertaining to the specificity and sensitivity of the DCDQ'07 when completed by parents – an area in which only a limited amount of research has been done (Schoemaker *et al*., 2006). No other studies have been conducted to compare the specificity and sensitivity between the parent-completed DCDQ'07 and the MABC-2 Test in order to determine the convergent validity of the identification of DCD among different ethnic groups (Caucasian and Black), thus no comparisons could be made with previous research.

Although the design of this study used the revised DCDQ'07, previous findings on the original DCD-Q are discussed also, but are limited to the findings for the total group. As seen in Table 2, the current study indicates that the convergent validities for the boys and girls were 32% and 10% respectively, indicating that the boys had a convergent validity of average practical importance and the girls showed no convergent validity at all. According to the original DCD-Q, gender did not influence the scores in older age groups (nine to 14 years and six months) (Wilson *et al*., 2000; Schoemaker *et al*., 2006). However, for the younger age groups (four to eight years), boys scored significantly lower than girls. Nakai *et al*. (2011) and Rivard *et al*. (2014) reported similar findings, where the researchers found significant differences between gender groups with the girls constantly scoring higher than the boys. In contrast, a study on Brazilian children (N=30) concluded that there were no significant differences in the total scores of the different genders when the original DCD-Q was used (Prado *et al*., 2009). In order to correct this discrepancy, separate impairment scores by age and gender were developed for the revised DCDQ'07.

Specificity of MABC-2 Test and parent-completed DCDQ'07 for the total group

The study succeeded in showing that the parents could identify a large percentage of children without motor difficulties, a specificity of 91% (324 out of 356), when using the age-related cut-off scores for the three adjusted age groups. Similar to the results of this study, the majority of previous research reported a high specificity on the original DCD-Q. The current study correlates with the findings of Wilson *et al*. (2000), who reported an even higher specificity of 95% (20 out of 21) and with that of Schoemaker *et al*. (2006), who tested a clinic-referred sample (N=110) and found an 84% (42 out of 50) specificity on the original DCD-Q. Schoemaker *et al*. (2006) also conducted a study on a population-based sample (N=322) and found a higher specificity of 89% (218 out of 246). Prado *et al*. (2009) adapted the DCD-Q for Brazilian children and found an 87% specificity, which correlates with the current study.

However, several authors have proposed lower specificity on the original DCD-Q. Wilson *et al*. (2000) reported lower specificity on the original DCD-Q (71%) than the current study for the DCDQ'07. Civetta and Hillier (2008) indicated that the specificity of the original DCD-Q on a total of 460 children in Australia was only 62%. Tseng *et al*. (2010) indicated a lower

specificity of 54% on the Chinese version of the original DCD-Q, while Green *et al*. (2005) found an even lower specificity of only 19%.

With reference to the revised DCDQ'07, Wilson *et al*. (2009) established a specificity of 71% with the DCDQ'07, while Parmar *et al*. (2014) established a higher specificity of 92%. In another recent study, Caravale *et al*. (2014) adapted the DCDQ'07 for Italian children (N=26) and found a specificity of 96%. It is clear that conflicting results still occur and, therefore, it is recommended that the DCDQ'07 should be adapted to each country in order to adjust for cultural differences; in addition, larger samples should be tested.

Sensitivity of MABC-2 Test and parent-completed DCDQ'07 for the total group

The current study indicated that a large percentage of children with motor difficulties could not be identified by the parents, showing a sensitivity of only 23% (Table 2), which correlates with Loh *et al*. (2009), who reported that the original DCD-Q had a low sensitivity in detecting children with mild motor difficulties. Schoemaker *et al*. (2006) also found a low sensitivity of 29% (22 out of 76) with regard to a population-based sample (N=322).

However, several authors have proposed higher sensitivity when using the original DCD-Q. Civetta and Hillier (2008) established 72% sensitivity for the original DCD-Q, while Tseng *et al*. (2010) found similar results of 73%. Wilson *et al*. (2000) found that the original DCD-Q had a high sensitivity of 86%. This correlates with research conducted by Schoemaker *et al.* (2006), who established a sensitivity of 82% (49 out of 60) on the clinic-referred sample (N=110), and with the research reported by Prado *et al*. (2009) with the Brazilian version, where a sensitivity of 87% was reported. The highest sensitivity was reported by Green *et al*. (2005), who found an even higher sensitivity of 93% among a sample of 98 children.

With reference to the revised DCDQ'07, Wilson *et al*. (2009) differ from the current study and found a higher sensitivity of 85%, as did Caravale *et al*. (2014), who established 88% sensitivity. However, a recent study conducted by Parmar *et al*. (2014) found a very low sensitivity of 21% on the DCDQ'07, which correlates with the findings of this study. Similar to the results with regard to specificity, the results for sensitivity differ between various authors since conflicting results occur. It is recommended, therefore, that more research should be conducted on this topic. In addition, the researchers propose that the norms might be adapted in order to address the specific needs of each country.

The k-coefficient for the present study (0.151) differs from Schoemaker *et al*. (2006), who established a k-coefficient of 0.65 for the clinic-referred sample and 0.21 for the population-based sample, while Green *et al*. (2005) found a lower k-coefficient of 0.14.

Convergent validity of MABC-2 Test and parent-completed DCDQ'07 for total group

An overall analysis of the convergent validity between the MABC-2 Test and the DCDQ'07 indicates that the DCDQ'07 completed by the parents has a convergent validity of 15% (8 out of 52) with the MABC-2 Test in identifying children with motor difficulties and, therefore, the convergent validity is low (small effect). These results correlate with research conducted by Wilson *et al*. (2000), who established 27% convergent validity (4 out of 15) and Crawford *et al*. (2001), who demonstrated that the questionnaire did not identify children with motor

difficulties as frequently as a therapist. These results also correlate with the study by Parmar *et al.* (2014), who also used the revised DCDQ'07 and performed an ROC analysis, concluding that the convergent validity between the MABC-2 Test and the DCDQ'07 was low.

The findings of Schoemaker *et al*. (2006) are in contrast with the current study, with a convergent validity of 83% (91 out of 110), for the clinic-referred sample. For the population-based sample, the convergent validity was lower, but at 75% (240 out of 322), still higher than in the current study.

CONCLUSIONS

The aim of the study was to examine the convergent validity of the classification of motor difficulties by Kinderkineticists-in-training using the MABC-2 Test and the classification of motor difficulties by the parents of the participants using the DCDQ'07, in order to determine if parents possess the competency to identify Grade-1 children with DCD at home. To our knowledge, this is the first study in South Africa to assess the competency of the parents to use the DCDQ'07 to identify correctly children with motor difficulties.

This study showed only a 15% convergent validity between the MABC-2 Test and the DCDQ'07. The ability of parents in the Bloemfontein area, Free State Province, to use the DCDQ'07 to identify correctly children with motor difficulties was found to be low. Thus, the DCDQ'07 is useful to screen children without DCD, although the purpose of a screening tool is to identify children with a specific condition. The findings of the current study demonstrate the need for further research in identifying efficient and effective assessment screening tools for parents to help professionals in the early identification of motor difficulties. It is clear from the research that a screening tool alone rarely will identify all children with DCD and that the DCDQ'07 may not be the best screening tool for parents to identify DCD in children at home. In addition, it is recommended that specific norms should be established for South African children.

LIMITATIONS AND RECOMMENDATIONS

This study had some limitations. A comparison between the DCDQ'07 and the MABC-2 Checklist, which can be completed by the parents also, could have been conducted to determine which screening questionnaire yields the best results. The parents who took part in the current study were not taught specifically how to complete the DCDQ'07. The large number of parents may have affected the reliability of the scores according to the DCDQ'07. Furthermore, since this was a population-based sample, criterion B of the diagnostic criteria for DCD, which states that the academic performance of the children should also be considered (APA, 2013), was not used. Moreover, it should be recognised that the current study recruited children from the Bloemfontein metropolitan area only. Hence, a replication of this study in different provinces and regions in South Africa is recommended to provide more robust results that can be generalised. Other limitations are the use of Canadian norms in a South African population, and the Canadian item development including specific sports, which may not be applicable to South African children.

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