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USEFULNESS OF MOVEMENT ABC-2 CHECKLIST AND DEVELOPMENTAL COORDINATION DISORDER QUESTIONNAIRE'07 FOR PARENTS AS SCREENING TOOLS TO IDENTIFY DEVELOPMENTAL COORDINATION DISORDER IN GRADE 1 LEARNERS

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ABSTRACT

Developmental coordination disorder (DCD) is a neuro-motor developmental disorder that interferes with a child's ability to perform daily tasks. The aim of the study was to examine the convergent validity of motor difficulties by a movement specialist using the MABC-2 Performance Test and the identification of motor difficulties by parents when completing the MABC-2 Checklist and DCDQ'07. The purpose was to determine if parents possess the competency to identify Grade 1 learners with motor difficulties and to determine which screening tool yields the best results. Grade 1 learners (n=281; 160 girls and 121 boys) in Bloemfontein, South Africa between the ages of five and eight years participated. Furthermore, the parents (n=281) took part in the evaluation of their own child in their home environment. The MABC-2-Checklist for parents yielded a kappa coefficient of 0.159, and thus had a small effect size (r=0.15). There was only a 16% convergent validity. The DCDQ'07 for parents indicated a kappa coefficient of 0.175 with a small effect size (r=0.18). There was only a 17.5% convergent validity. Therefore, it can be reported that parents using the MABC-2-Checklist and the DCDQ'07 could not identify learners with DCD.

***Keywords*:** Developmental Coordination Disorder; Movement Assessment Battery for Children-2 Performance Test (MABC-2); Movement Assessment Battery for Children-2 Checklist; Developmental Coordination Disorder Questionnaire'07.

INTRODUCTION

The Diagnostic and Statistical Manual of Mental Disorders (5th ed.) (APA, 2013) states that the fundamental features of Developmental Coordination Disorder (DCD) include a significant impairment in the development of coordination and interferes with academic performance and daily activities. The difficulties are not due to a general medical condition (such as mental retardation or cerebral palsy). Thus, DCD can be seen as a disorder that influences learners' academic , as well as activities of daily living.

Developmental Coordination Disorder (DCD) affects learners all over the world (APA, 2013). Researchers in the United Kingdom estimated the prevalence of DCD to be between 4%-5% (Lingam *et al.*, 2009). According to Hamilton (2002), 6% of learners in the United

States of America are diagnosed with DCD. Junaid *et al.* (2000) found that approximately 8% to 15% of Canadian learners have some form of coordination problems. America and Europe have a higher prevalence than the United Kingdom and New Zealand, as between 5% and 19% of learners have been found in these countries to have motor problems (Miller *et al*., 2001). Studies conducted in South Africa also indicate much higher prevalence's according to De Milander *et al.* (2014a) in Bloemfontein, Free State Province, where the researchers came to the conclusion that 15% of the learners had moderate to severe motor difficulties. It is of concern that Pienaar (2004) along with Wessels *et al.* (2008) in the North West Province found significantly higher prevalence's of motor difficulties, 61.2% and 52% respectively, when tested by the MABC. The real prevalence of DCD among younger developing learners might even be higher, since medical, as well as educational systems, frequently fail to identify this disorder in young learners (Gaines & Missiuna, 2006; Missiuna *et al*., 2007; Miyahara *et al*., 2008). Differences in the prevalence between boys and girls are also found in the literature (Gallahue & Ozmun, 2006; Wessels *et al*., 2008; De Milander *et al*., 2014a).

Gender plays a role in the prevalence of DCD. The literature indicates that boys experience more problems compared to girls, with a boy-girl ratio of 1.6:1 (De Milander *et al*., 2014a) and 2:1 (Wright & Sugden, 1996). These prevalences are lower compared to the De Milander *et al.* (2014a) and Wright and Sugden (1996), since Wessels *et al.* (2008) found the ratio to be 2-3:1. Furthermore, Rivard *et al.* (2007) estimated that the gender difference could even be as high as 3-4:1. Hoare and Larkin (1991) also found that more boys than girls attend remedial programmes for DCD (9:1), supporting the belief that more boys experience motor difficulties compared to their female counterparts.

Although gender-related differences do occur, researchers need to take into consideration that it is a normal phenomenon in learners' attainment of motor skills (Gallahue & Ozmun, 2006). In this regard, literature indicates that girls perform better in fine motor skills, while boys are better at gross motor skills (Gallahue & Ozmun, 2006). Junaid and Fellowes (2006) mention that, when using the MABC-2, girls outperform the boys with regard to manual dexterity items and the boys were superior in the ball skills items. No differences between the balancing skills of boys and girls were noted. Junaid and Fellowes (2006) also argue that these differences are due to the disparity between the attainment of motor skills among boys and girls.

According to the South-African Pocket Oxford Dictionary (2005:472), 'assessment' can be defined as: "*to evaluate or estimate the value, importance, or quality of*". Assessments can therefore evaluate motor proficiency levels or determine the quality of these movements. Assessments for DCD can be done by means of several assessments, such as questionnaires for screening purposes, namely the Developmental Coordination Disorder Questionnaire (DCDQ'07) and the Movement Assessment Battery for Children-2 Checklist (MABC-Checklist); and norm-referenced test (Movement Assessment Battery for Children-2; MABC-2 Performance Test) to measure the degree of movement difficulties (Barnett, 2008). The main problem with norm-referenced tests, is the fact that there are high costs involved in addition to being a time consuming process with long waiting periods (Piek & Edwards, 1997; Junaid *et al*., 2000; Loh *et al*., 2009). However, screening tools can be used in order to identify learners who might have motor difficulties (Junaid *et al*., 2000; Loh *et al*., 2009).

Barnett (2008) argues that the validity and reliability in assessments are crucial for assessments to be useful. Therefore, validity implies that the assessment instrument measures what it claims to measure and reliability indicates that similar results will be obtained across

time and between different examiners (Barnett, 2008). Test developers are responsible for the validity and reliability of their assessment instruments.

The DCDQ is valid, as well as reliable, and can be used for boys and girls (Wilson *et al.*, 2000; Schoemaker *et al.*, 2008). In this regard, Wilson and colleagues indicated that learners as young as 5 years of age can be screened (Wilson *et al*., 2009). In addition, the DCDQ was adapted by Brazilian researchers, translating the language along with altering two of the items in the questionnaire due to cultural differences. Still the questionnaire was found to be equivalent to the original DCDQ. According to Prado *et al*. (2009), the DCDQ-Brazil also demonstrated good validity and reliability. In contrast, Loh *et al*. (2009) found that the DCDQ had a low sensitivity in detecting learners with mild motor difficulties.

With regard to the reliability and validity of the MABC-Checklist, Junaid *et al*. (2000) found that in comparison with the MABC PerformanceTest, the MABC-Checklist showed a lack of sensitivity. A similar finding was reported by Schoemaker *et al*. (2003), who stated that it was only applicable to learners up to 6 years of age. In the age group 7 to 9 years, there was a limitation with regard to either the sensitivity or specificity, resulting in a large percentage of false positives. Although these limitations were observed by Schoemaker and colleagues, they still recommend the use of the 15th percentile as the cut-off criterion for screening purposes.

In order to gain more information with regard to a child's motor development, it would be wise to make use of questionnaires, such as the DCDQ and the MABC-Checklist by means of the parents and teachers (Missiuna & Pollock, 1995; Wright & Sugden 1998). Information obtained from the questionnaires can indicate if young learners need further assessments from professionals via normative assessment tools. However, limitations and advantages in the use of questionnaires.

Some of the limitations of these questionnaires have been conveyed. A study conducted by Wilson *et al*. (2000) found that there was only a 27% convergent validity between the therapist and the DCDQ. This implies the DCDQ could not identify all the learners with motor difficulties. Results from a study by Loh *et al*. (2009), also specify that the DCDQ was inadequate in distinguishing learners with motor difficulties from learners who did not experience any motor difficulties. In a study conducted by Junaid *et al*. (2000), they indicated that learners at risk for motor difficulties according to the MABC Performance Test were not identified by the MABC-Checklist. Thus, the independent use of the MABC-Checklist is not recommended. Green *et al*. (2005) came to the same conclusion, indicating that it was not valuable to use teachers with the intention of identifying learners with motor difficulties. An important limitation that needs to be considered before questionnaires are used by parents to determine motor difficulties, are those parents with learners experiencing attention deficit/hyperactivity disorder (ADHD). The reason was due to the fact that the questionnaire indicated motor difficulties, but it could not differentiate the ADHD symptoms, while the norm-reference test indicated the opposite (Kroenke, 2001; Loh *et al.*, 2009).

An advantage of the DCDQ was the positive results obtained from a study of Green *et al*. (2005). The researchers concluded that parents could identify DCD, if no other developmental problems were present. Another advantage is that the limitations (subtests needed to be changed and different cut-off scores for various ages need to be established) were revealed. The questionnaire (DCDQ'07) was revised in order to improve its ability to identify learners with motor difficulties (Wilson *et al*., 2007). Furthermore, the DCDQ was taken by Brazilian researchers who made cross-cultural adaptations, found similar results (Prado *et al.*, 2009). Another alternative was established for the MABC-Checklist, using physical education teachers instead of the class teachers, since the physical education teachers could be more

experienced in observing learners in a changing environment (Piek & Edwards, 1997). The results of the study of Piek and Edwards (1997) conclude that the physical education teachers identified more learners with motor difficulties compared with the class teachers when using screening tools for DCD.

Screening tools for DCD include the DCDQ'07 (Wilson & Crawford, 2007) and the MABC-Checklist (Henderson *et al.*, 2007). Norm-referenced instruments that can be used are the Bruininks-Oseretsky Test of Motor Proficiency or the Movement Assessment Battery for Children-2 (MABC-2 Test) (Henderson *et al.*, 2007). Therefore, it is important to investigate the use of screening tools used by the parents, with the purpose to determine if the parents have the competency to identify learners with DCD. Moreover, the identified learners can undertake norm-referenced tests in order to undergo remedial programmes from movement specialists immediately (Peens *et al.*, 2008; De Milander *et al.*, 2014b; De Milander *et al.*, 2015).

PURPOSE OF THE STUDY

The aim of the study was to examine the convergent validity of the classification of motor difficulties by Kinderkineticists (further on will be referred to as a movement specialist) using the MABC-2 Performance Test and the identification of motor difficulties by their parents when completing the MABC-2- Checklist, as well as the DCDQ'07. This will be done to conclude if parents possess the capability to identify Grade 1 learners with motor difficulties and in addition to determine, which screening tool yields the best results.

METHODOLOGY

Study design

This study used the quantitative data approach. The study made use of one testing procedure by means of the MABC-2 Performance Test in order to identify motor difficulties among Grade 1 learners at the school. Prior to the testing procedure the lead investigator (movement specialist) with extensive and professional experience with learners, gave an intense training programme to the research staff involved. Each of the research assistants received a minimum of eight hours of preparatory training, and at least six hours of in-field observation/supervision. Each movement specialist had to oversee one subtest with the purpose of consistency across the study. Furthermore, a parent of each participant completed the MABC-Checklist and the DCDQ'07, which are both screening tools that parents can use in order to determine if their child might have motor difficulties. The parents received the MABC-2-Checklist and the DCDQ'07 in either Afrikaans or English and had to observe their own child. The results obtained by the research staff by means of the MABC-2 Performance Test was not available to the parents and consequently it could not have influenced the screening tools in any manner. The results of the MABC-2 Performance Test were compared to the results of the parents of the MABC-2-Checklist and the DCDQ'07 separately to determine the convergent validity between the two measuring instruments.

Ethical clearance

The Department of Education of the Free State Province, in addition to the principal of each school, gave consent for the research to be conducted on the school premises. Authorisation 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 of each learner completed an informed consent form. Additionally, the learners signed an assent form. Furthermore, the parents gave consent to participate in the study by means of completing the MABC-Checklist and DCDQ'07 without any compensation.

Participants

Initially 13 schools were randomly selected and invited to take part in the study. Only seven mainstream schools (six Afrikaans- and one English school) agreed to take part. The schools that agreed to take part were located within a 30-km radius of the University of the Free State. A total of 806 recruitment letters containing the participant information sheet, parent/guardian consent form, a child assent form and a reply envelope were distributed to prospective participants between the ages of six and eight years from the seven consenting schools. Of these, 281 learners returned the relevant documents to the school and were recruited for participation. This indicates a 35% response rate. There were 160 girls and 121 boys (Table 1). The mean age for the learners was six years and seven months with a standard deviation of 0.4. The minimum age was five years and eight months and the maximum age was eight years.

***Table 1*. NUMBER OF PARTICIPANTS**

Gender	Total
Boys	121 (43.1%)
Girls	160 (56.9%)
Total	281 (100%)

All Grade 1 learners from the partaking schools were considered for inclusion. Exclusion criteria was if a child did not fall in the age group, namely five to eight years, where parental permission was not obtained or the informed consent form was not completed fully. Additionally, the Diagnostic and Statistical Manual of Mental Disorders (fifth edition) (DSM-5) (APA, 2013) was used to exclude learners who had associated symptoms according to the criteria for DCD. Learners with motor difficulties should 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 learners met the criteria and all of the learners were included for further data analysis.

A total of 281 parents were involved in the study. A parent, either the mother or father of each learner, was asked to complete the MABC-Checklist and DCDQ'07. There was no specification since researchers believe that mothers and fathers may have various perspectives to the answers. However, there are no research studies available on how the various perspectives of the parents influence the scores (Wilson & Crawford, 2010).

Measuring instruments

Movement Assessment Battery for Learners-2 (MABC-2 Performance Test)

According to Henderson *et al*. (2007), the MABC-2 Performance Test entails learners to complete a series of motor tasks in a specified manner. Furthermore, the MABC-2 Performance Test has age-related norms, as well as qualitative information on how learners should approach and perform the tasks. The MABC-2 Performance Test is used to assess the motor proficiency levels of the subject and to diagnose DCD in learners. The first assessment component of this test battery contains 24 items organised into three sets of eight tasks. Each set is designed to use with learners of a different age band. For the current study, age band 1 and age band 2 were used. The eight tasks are grouped under three 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 three 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-15th percentile). The red zone is an indication of definite motor impairment (≤5th percentile). Thus, high standard scores on the MABC-2 Performance Test represent good performance.

The MABC-2 Performance Test is a standardised test (Henderson *et al*., 2007) and the reliability coefficient for the total test scores was 0.80 (Henderson *et al.*, 2007; Mayson, 2007). Unfortunately, research on validity is only available with regard to the original MABC (Mayson, 2007). Henderson *et al*. (2007) state that the original MABC Performance Test is a valid test to use. The authors observed the correlations between the test components, which ranged between 0.25 and 0.36, indicating a relatively low correlation. Still, a moderate to good correlation was established by Mayson (2007) between the test components (0.65) and the total test score (0.73). In another study conducted by Ellinoudis *et al*. (2009) the researchers found Cronbach's alpha coefficient values were 0.51 (manual dexterity), 0.70 (aiming and catching) and 0.66 (balance). Furthermore, the researchers established that the correlation coefficients between each test item and the total score were moderate (Ellinoudis *et al*., 2009). These results indicate that the MABC-2 Performance Test is a reliable and valid tool in order to assess motor difficulties amongst learners.

Movement Assessment Battery for Learners Checklist (MABC-2-Checklist)

The MABC-2-Checklist is designed to identify learners with movement difficulties (Henderson *et al*., 2007). The MABC-2-Checklist can be completed by parents, teachers and professionals, and consists of three sections. Sections A and B address complex interactions between the child and his or her physical environment. Section C concentrates on non-motor factors that may affect the child's movement (Henderson *et al*., 2007). Section A focuses on movement in a static and/or predictable environment, for example fastening a button whereas Section B focuses on dynamic movement and/or unpredictable environment, for example a ball coming towards you, as well as running among others on the playground (Henderson *et al*., 2007).

For each of the statements in each section there are four alternative responses that describe how well the child deals with the task (very well=0, just OK=1, almost=2 and not close=3). If there is an item not completed in section A and section B, the remaining four items in that section will determine the score. For example, if the scores are consistently positive (0 or 1) the child gets a 1 and if it is negative (2 or 3) the child gets a 2. If the scores are mixed, you give the benefit of the doubt and give a 1 (Henderson *et al*., 2007). The scores are summed to

a total score and placed on a traffic light system. The green zone indicates "no motor difficulty" (>15th percentile), amber indicates "at risk or moderate motor difficulty" (5th-15th percentile) and red shows "definite motor difficulty" (≤5th percentile). In contrast to the MABC-2 Performance Test, high scores represent poor performance. For this study the parents completed the MABC-2-Checklist for each child.

According to Schoemaker *et al*. (2003), the original MABC-Checklist is a valid and reliable tool to use with a reliability coefficient of 0.96 for all 48 items. Since their study made use of the new version of the MABC-2-Checklist, Henderson *et al*. (2007) argued that they had been unable to collect reliability data on the new MABC-Checklist. Henderson *et al*. (2007) considered the overlap in content of the old and the new checklist to be sufficient.

Developmental Coordination Disorder Questionnaire'07 (DCDQ'07)

The DCDQ'07 is a brief questionnaire intended for parents to screen for DCD in learners 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. 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 Likert 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 three 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 the MABC-2 Performance Test, as well as the MABC-Checklist and 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 difficulty and motor difficulty) of the MABC-2 Performance Test and the classification of motor difficulties by the parents of the participants using the MABC-2-Checklist and the DCDQ'07, the kappa (k-) coefficient was used. This coefficient provides information with regard to the interjudge agreement with regard to the convergent validity of the classification between the two measuring instruments. The higher the coefficient (whether it is a negative or a positive value), the greater the convergent validity between the two 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 Performance Test and MABC-Checklist was adapted to two 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 two 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 examined. As standard of practical significance, the effect size was calculated. In order to interpret the effect size the following guideline values need to be used (Steyn, 1999), namely r=0.1 small effect; r=0.3, medium effect and r=0.5, large effect. A probability level of 0.05 or less was accepted as indication of statistical significance.

RESULTS

Table 1 indicates the frequency distribution of the participants according to gender. The participants were learners (n=281) between the ages of five and eight years. This sample consisted of boys (n=121) and girls (n=160). The minimum age was five years and eight months and the maximum age was eight years. The mean age for the learners was six years and eight months with a standard deviation of 0.4.

Frequency procedure of the MABC-2 Performance Test

To determine the motor performance of the Grade 1 learners, the movement specialist used the MABC-2 Performance Test. The total score of the MABC-2 Performance Test was categorised into a traffic light system, red zone and amber zone combined indicate motor difficulties and the green zone indicate no motor difficulties. The distribution of the learners according to the various categories with regard to motor performance is presented in Figure 1 according to the MABC-2 Performance Test assessed by the movement specialist, MABC-2 Checklist and the DCDQ'07 according to the parents.

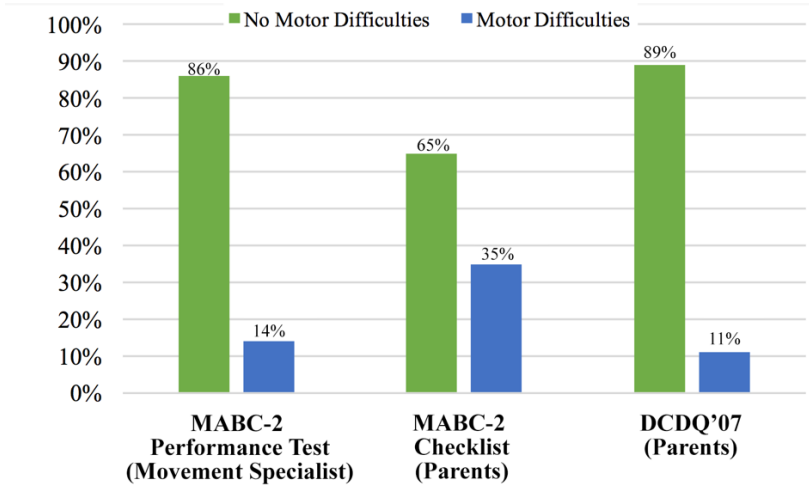

Figure 1. **PREVALENCE OF MOTOR DIFFICULTIES ACCORDING TO MABC-2 PERFORMANCE TEST (Movement Specialist), MABC-2 CHECKLIST AND DCDQ'07 (Parents)**

Figure 1 indicates that 86% of the learners are in the green zone and displayed no motor difficulties, with 14% showing motor difficulties. In Figure 1 parents identified 65% of the learners having no motor difficulties, however, alarmingly 35% with motor difficulties. Of the 281 DCDQ'07 completed by the parents, 89% were identified with no motor difficulties while only 11% were identified with motor difficulties. This coefficient provides information with regard to the convergent validity between the two measuring instruments. The higher the coefficient (whether it is a negative or a positive value), the greater the convergent validity between the two measuring instruments. In order to understand the results in Figure 1, it is important to understand the term specificity and sensitivity as used in this study.

Specificity refers to the ability of the parents using the DCDQ'07 and MABC-2-Checklist to correctly identify learners with no motor difficulties, which was also identified by the MABC-2 Performance Test (Ellinoudis *et al.*, 2009). The preferred specificity according to the APA is preferably 90% (APA, 1985 cited in Schoemaker *et al*., 2012). *Sensitivity* refers to the ability of the parents using the DCDQ'07 and MABC-2-Checklist to correctly identify learners with motor difficulties, which was also identified by the MABC-2 Performance Test (Schoemaker *et al*., 2003; Ellinoudis *et al*., 2009). High sensitivity indicates that the DCDQ'07 and MABC-2-Checklist consistently identifies learners with motor difficulties whereas a low sensitivity indicates that the DCDQ'07 and MABC-2-Checklist fail to identify learners with motor difficulties (Junaid, 1998). According to the norms of the APA, 80% sensitivity is preferable (APA, 1985 cited in Schoemaker *et al*., 2003).

Table 2 presents the convergent validity between the classifications of motor difficulties by means of the MABC-2 Performance Test conducted by the movement specialist and the identification of motor difficulties by the parents using the DCDQ'07 and the MABC-2 Checklist for the total group.

***Table 2*. CONVERGENT VALIDITY BETWEEN MABC-2 PERFORMANCE TEST AND DCDQ'07 (left column) AND MABC-2 CHECKLIST (right column)**

	MABC-2 Performance Test – movement specialist				**MABC-2 Performance Test – movement specialist**		
DCDQ'07 Parents	NMD	MD	Total	**MABC-2 CL Parents**	NMD	MD	Total
NMD	221 (90.9%) Specificity	29	250	NMD	159 (64.4%) Specificity	13	172
MD	22	9 (23.7%) Sensitivity	31	MD	84	25 (65.8%) Sensitivity	109
Total	243	38	281	Total	243	38	281
	(k)-Coefficient = 0.159 p=0.007, Effect size r=0.15 Small 16.0% Convergent Validity				(k)-Coefficient = 0.175 p=0.000, Effect size r=0.18 Small 17.5% Convergent Validity		

NMD= No Motor Difficulties MD= Motor Difficulties CL=Checklist

Note: Totals of DCDQ'07 and MABC-2 Checklist are displayed across the row and totals for MABC-2 Performance test are displayed down the column.

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

The specificity between the MABC-2 Performance Test and the parent-completed DCDQ'07 (Table 2), was 90.9% for the total group.

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

Of the 38 learners identified with motor difficulties by the movement specialist, parents were only able to identify 9 (23.7%) of these learners according to the DCDQ'07. In addition, of the 38 learners with motor difficulties according to the movement specialist, the parents identified 29 (76.3%) as learners without motor difficulties. The sensitivity for the group was 23.7%, indicating that the parents could not identify the learners with motor difficulties.

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

The calculated k-coefficient for the total group of 0.159 is on the significance level of $p<0.01$ and provides a small effect size, which means that the findings for the group is of insignificant practical importance (Table 2). There was, however, a significant difference ($p=0.007$). The results indicated that there was only a 16% convergent validity between the two measuring instruments after correcting for chance.

Specificity of MABC-2 Performance Test and Parent-Completed MABC-2 Checklist

The specificity, between the MABC-2 Performance Test and the parent-completed MABC-2 Checklist (Table 2) was 64.4% for the group.

Sensitivity of MABC-2 Test and parent-completed MABC-2-Checklist

The results in Table 2 further indicate that 243 learners do not have motor difficulties according the MABC-2 Performance Test, 159 (64.4%) of these learners were also identified by the MABC-2-Checklist (completed by parents) as learners without motor difficulties. Alarmingly of the 243 learners, 84 (34.6%) of these learners were identified by the parents as learners with motor difficulties. Furthermore, Table 2 indicates that 38 learners were identified with motor difficulties according to the MABC-2 Performance Test, in addition 25 were also identified as learners with motor difficulties by the parents. The sensitivity was 65.8%.

Convergent validity of MABC-2 Test and parent-completed MABC-2 Checklist

The calculated k-coefficient of 0.175 is on the 1% significance level and provides a small effect size, which means that the findings are of insignificant practical importance (Table 2) for the group, although there was a significant difference ($p=0.000$). The results indicate that there was only a 17.5% convergent validity between the two measuring instruments after correcting for chance.

Sensitivity of the DCDQ'07 versus the MABC-2-Checklist

Although the convergent validity of the two measuring instruments of 16% (DCDQ'07) and 17.5% (MABC-2-Checklist) respectively, were found to be low, it is interesting to note the differences with regard to the sensitivity of the two measuring instruments. The results indicated the ability to identify learners with motor difficulties as compared to the MABC-2

Performance Test. The DCDQ'07 had a 23.7% sensitivity compared to 65.8% of the MABC-2-Checklist. The results clearly indicated that the MABC-2-Checklist gave a much better indication pertaining to learners with motor difficulties when compared to the DCDQ'07.

DISCUSSION

The aim of the study was to examine the convergent validity of the classification of motor difficulties by a movement specialist using the MABC-2 Performance Test and the identifying of motor difficulties by their parents when completing the DCDQ'07 and the MABC-2-Checklist. This was done to determine if parents possess the competency to identify Grade 1 learners with motor difficulties and in addition to determine, which screening tools yield the best results.

MABC-2-Performance Test and the parent-completed DCDQ'07

The current study set out to provide possible answers relating to the specificity and sensitivity of the DCDQ'07 when completed by parents. According to Schoemaker *et al*. (2006), this is an area in which only a limited amount of research has been done. It is important to take into consideration that that the current study made use of the revised DCDQ'07, however, previous findings on the original DCD-Q will also be discussed.

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

The study succeeded in presenting that the parents could identify a large percentage of learners without motor difficulties, a specificity of 90.9% (221 out of 243), when using the age-related cut-off scores for the three adjusted age groups. A majority of previous research also reported high specificity rates while using the original DCD-Q, such as Wilson *et al*. (2000) reported an even higher specificity of 95% (20 out of 21). However, Schoemaker *et al*. (2006) conducted two separate studies, a clinic-referred sample consisting of a 110 learners and a population-based sample of 322 learners. Both these studies found high specificity rates of 84% (42 out of 50) for the clinic-based sample and 89% (218 out of 246) for the population-based sample respectively. Additionally, the DCD-Q was adapted for Brazilian learners by Prado *et al*. (2009) where the researchers found a 87% specificity, which also correlates with the current study.

In contrast to the current study, several researchers have proposed lower specificity rates on the original DCD-Q. This includes Wilson *et al*. (2000) who reported a lower specificity on the original DCD-Q (71%). Alarmingly, Green *et al*. (2005) found a 19% specificity. It is interesting to note that the lower specificity was established by countries who adapted the original DCD-Q. This includes Civetta and Hillier (2008) who tested 460 learners in Australia and the specificity rate was only 62%. In addition, Tseng *et al*. (2010), who adapted the DCD-Q for the Chinese population, found an even lower specificity of only 54%.

Comparing the current study with results from the revised DCDQ'07, the results indicate that Wilson *et al*. (2009) established a lower specificity of 71% when compared to the current study. However, a higher specificity rate (92%) was established by Parmar *et al*. (2014). In addition, Caravale *et al*. (2014) adapted the DCDQ'07 for Italian learners (n=26) and found a specificity of 96%. The results clearly indicate that contradictory results are found between various researchers. The researchers suggest that the DCDQ'07 should be adapted according to the need of each country with the intention of adjusting for cultural differences that may

arise and the variety of sports that the learners participate in which is unique to specific countries. Furhetrmore, larger samples should be tested.

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

This study indicates that a large percentage of learners with motor difficulties could be identified by the parents, showing a sensitivity of 65.8% (25 out of 38) (Table 2) indicating a relative high convergent validity. The results of the current study are in contrast to research done by Schoemaker *et al*. (2006) who found a much lower sensitivity of only 29% (22 out of 76) with regard to a population-based sample (n=322) and Loh *et al*. (2009), who reported that the original DCD-Q had a low sensitivity in detecting specifically learners with mild motor difficulties.

In contrast to the current study, various researchers found much higher sensitivity rates while using the original DCD-Q. Civetta and Hillier (2008) established 72% sensitivity on the original DCD-Q. Wilson *et al*. (2000) found that the original DCD-Q had an even higher sensitivity of 86%. On the other hand, Schoemaker *et al*. (2006) conducted research on a clinic-referred sample of 110 learners and established a sensitivity of 82% (49 out of 60). The highest sensitivity was reported by Green *et al*. (2005), 93% among a sample of 98 learners. Moreover, Prado *et al*. (2009) who adapted the DCD-Q for the Brazilian population and Tseng *et al*. (2010) who adapted the DCD-Q for the Chinese population, the researchers found high specificity rates of 87% and 73% respectively.

Taking the revised DCDQ'07 into consideration, the results of Wilson *et al*. (2009) vary from the current study and established a higher sensitivity of 85%, as did Caravale *et al*. (2014), who found a 88% sensitivity. Conversely, Parmar *et al*. (2014) recently conducted a study and found a very low sensitivity of 21% on the DCDQ'07, which is also in contrast with the findings of the current study. Comparable to the results pertaining to specificity, the results for sensitivity also vary for the various authors and inconsistent results occur. Therefore, the same recommendation is made as stipulated in the specificity section.

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

An overall analysis of the convergent validity between the MABC-2 Performance Test and the DCDQ'07 was only 16%, and therefore the convergent validity is low (small effect). Other researchers, such as Wilson *et al*. (2000), Crawford *et al*. (2001) and Parmar *et al*. (2014) also established the convergent validity to be low, indicating that the norm-reference test conducted by the movement specialist still provides the best results when compared to questionnaires.

In contrast to the current study, Schoemaker *et al*. (2006) conducted their study on a clinic-referred sample and a population-based sample. The researchers came to the conclusion that there was a high convergent validity of 83% (91 out of 110) for the clinic-referred sample, and for the population-based sample, the convergent validity was lower, but at 75% (240 out of 322) it was still higher than in the current study.

MABC-2 Performance Test and the MABC-2-Checklist

It is important to note that literature and research on the MABC-Checklist-2 when completed by parents, is limited. No research was found on the sensitivity, specificity and convergent validity between the parents completed MABC-2-Checklist and the MABC-2 Performance Test. Thus no differences and comparisons could be made regarding previous research when

the MABC-2-Checklist is completed by the parents. The sensitivity of the present study is 65.8% and the specificity is 65.4%, which demonstrate a relative high convergent validity from the parents to identify learners with motor difficulties.

CONCLUSIONS

To our knowledge, this is the first study of its kind in South Africa that assess the competency of the parents to use the MABC-2-Checklist and DCDQ'07 to correctly identify learners with motor difficulties. This study showed only a 23.7% sensitivity between the MABC-2 Performance Test and the DCDQ'07 as completed by the parents. The ability of parents in the Bloemfontein area, Free State Province, to use the DCDQ'07 to correctly identify learners with motor difficulties was found to be low. Thus, the DCDQ'07 is useful to screen learners without motor difficulties, although the purpose of a screening tool is to identify learners 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 learners with motor difficulties and that the DCDQ'07 may not be the best screening tool for parents to identify motor difficulties in learners at home. Also, there was a much higher sensitivity between the MABC-2 Performance Test and the MABC-2-Checklist (65.8%). This indicates that the MABC-2-Checklist was able to identify more learners with motor difficulties and, therefore, might be a better screening tool to use by parents to help identify learners with possible motor difficulties. In addition, it is recommended that specific norms should be established for South African learners due to the diversity of the country.

LIMITATIONS AND RECOMMENDATIONS

The parents who participated in the current study were not taught specifically how to complete the DCDQ'07 or the MABC-2-Checklist. The large number of parents may have affected the reliability of the scores of the DCDQ'07and the MABC-2-Checklist. Furthermore, since this was a population-based sample, Criterion B of the diagnostic criteria for DCD, which states that the academic performance of the learners should also be considered (APA, 2013), was not used. It should be recognised that the current study recruited learners 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 (DCDQ'07) in a South African population, and the Canadian item development including specific sports, which may not be applicable to South African learners.

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