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IDENTIFICATION OF DEVELOPMENTAL COORDINATION DISORDER IN GRADE 1 LEARNERS: A SCREENING TOOL FOR PARENTS AND TEACHERS

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ABSTRACT

Developmental Coordination Disorder (DCD) is a motor disorder of unclear etiology that severely affects a child's everyday motor abilities. The study examined the convergent validity of the Movement Assessment Battery for Children-2, Checklist (MABC-Checklist) completed by parents and teachers, with the Movement Assessment Battery for Children-2, Performance Test (MABC-2 Performance Test) completed by a movement specialist. The purpose was to determine if parents and teachers were competent to identify learners with motor difficulties. A total of 323 5–8-year-old Grade 1 learners (183 girls, 57.7%; 140 boys, 43.3%); 193 Caucasian, 59.8%; 130 Black, 40.2%) participated in the study. The MABC-Checklist for parents demonstrated a specificity of 71.4%. The convergent validity between the two assessment tools when completed by the parents indicated a kappa coefficient of 0.143, with medium effect size (r=0.240). The MABC-Checklist for teachers demonstrated a specificity of 72.6%. The convergent validity between the two assessment tools when completed by the teachers indicated a kappa coefficient of 0.161, with a medium effect size (r=0.228). In conclusion, it is clear that parents and teachers using the MABC-Checklist could not identify movement difficulties in children.

***Keywords*:** Developmental Coordination Disorder (DCD); Movement Assessment Battery for Children-2; Checklist; Learners, parents, teachers.

INTRODUCTION

Developmental Coordination Disorder (DCD) is defined as a serious and persistent impairment in the motor coordination development of these learners, which impedes the functional performances and are not due to intellectual retardation, pervasive developmental disorders or any other neurological disorders (APA, 2013). Lingam *et al*. (2009) define DCD as learners who experience motor coordination difficulties that interfere with their academic achievement, physical- and psychological development, as well as activities of daily living. Therefore, DCD refers to motor difficulties that lead to negative long-term consequences in activities of daily living.

A rapid increase of DCD and motor performance difficulties among learners have been a major concern for the past decade (Schoemaker *et al*., 2006). Dewey *et al*. (2011) and Wuang *et al*. (2012) found that 5% of school-aged learners fail to perform motor skills adequately and 1.8% of 7-year-old learners have been diagnosed with DCD. The literature indicates that more

boys than girls experience motor difficulties, with a boy-girl ratio difference of 2:1 (Wright & Sugden, 1996) and 3-4:1 (Rivard *et al*., 2007). The prevalence of DCD in learners confirms the major concern in modern society and includes various problems that will be discussed.

Learners with DCD specifically have problems with dressing themselves (home activities), writing and reading (school activities), as well as play activities (ball skills, balance etc.) (Missiuna, 2003; Edwards *et al*., 2011; Asonitou *et al*., 2012). According to Lingam *et al*. (2009), DCD interferes with academic achievement and activities of daily living. Secondary impairments associated with DCD are physical aspects, such as poorer strength and flexibility, withdrawal from physical activity and potential obesity (Missiuna *et al*., 2003; Wuang *et al*., 2012). These factors lead to emotional and social problems, including low self-esteem and poor social acceptance (Missiuna *et al*., 2006).

One of the challenges associated with DCD is finding the appropriate method of identifying motor skill difficulties (Rodger *et al*., 2003). Developmental Coordination Disorder is identified with motor competence tests, such as the Movement Assessment Battery for Children – second edition Performance Test (MABC-2 Performance Test) and the Bruininks-Oseretsky Test of Motor Proficiency-2 (BOT-2) (Missiuna *et al*., 2011). However, these tests are time-consuming and expensive. This led Faught *et al*. (2008) to conclude that questionnaire-based assessments may be more practical for screening purposes.

Several screening tests and questionnaires have been developed to gather information regarding functional motor performance of learners, specifically from parents and teachers. Examples include the Movement Assessment Battery for Children-2 making use of the Checklist (MABC-Checklist) and the Developmental Coordination Disorder Questionnaire (DCDQ'7) (Schoemaker *et al*., 2012). However, studies using reports from teachers and parents have produced conflicting results (Faught *et al*., 2008). Thus, it is still not clear which screening tool is best suited to use and whether parents and teachers both need to be involved in screening a learner.

A contributing factor to poor motor proficiency levels amongst South African learners may be a result of the absence of Physical Education (PE) in the school curriculum. PE was removed from South African schools as a stand-alone subject and combined with Life Orientation (LO) as part of a learning area (Rajput & Van Deventer, 2010; Cleophas, 2014). The majority of South African learners did not have the opportunity to take part in PE prior to the new regime and it was further argued that the post-apartheid regime was more concerned with encouraging mass participation (Rajput & Van Deventer, 2010; Cleophas, 2014).

During the period 1994 to 2011, PE was discarded from the school curriculum. The Curriculum Assessment Policy Statements (CAPS) according to the Department of Basic Education with regard to PE states that teachers should develop learner's gross- and fine motor skills in addition to perceptual development (DBE, 2011). The teachers should focus on aspects, such as locomotor, rhythm, balance and laterality. However, currently most of South African learners still do not receive purposeful PE in their schools (Cleophas, 2014). According to a study conducted by De Milander *et al*. (2015), the researchers concluded that a perceptual-motor intervention only improved balance. However, participation in PE classes presented by teachers also proved to be beneficial.

The results of this study will be made available to the Department of Education in the Free State province in order to indicate the importance of PE in South African schools. Therefore, it is important to investigate the use of screening tools by the parents and teachers to determine if the parents and teachers have the competency to identify learners with DCD. In addition, the identified learners can undergo norm reference tests and, if necessary, remedial

programmes from a movement specialist as soon as possible (Peens *et al.*, 2008; De Milander *et al.*, 2014; 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 identifying of DCD with the MABC-Checklist-2 when completed by their parents, as well as their teachers. This will be done to determine if parents and teachers possess the competency to identify Grade 1 learners with motor difficulties.

METHODOLOGY

Study design

This study used the quantitative data approach. The study involved one testing procedure by means of the MABC-2 Performance Test in order to identify DCD among Grade 1 learners. The learners were tested at their school by research staff (movement specialist) who were trained to use the relevant instrument. All research staff underwent a rigorous training program created by the lead investigator and reviewed by a movement specialist with extensive training and professional experience with learners. In total, each movement specialist received a minimum of 8 hours of preparatory training, and at least 6 hours of in-field observation/supervision. Each movement specialist was responsible for one subtest in order to have consistency across the study.

A parent and teacher of each participant completed the MABC-Checklist. The parents and teachers received the MABC-2-Checklist in either Afrikaans or English. The principal researcher explained the procedure for the completion of the MABC-Checklist to each head of department. The head of department explained the procedure in detail to the teachers responsible for teaching Grade 1 learners at the schools. The teachers observed the learners in their classrooms for a period of six months and had two months to complete the MABC-Checklist.

Since there were seven schools involved, each teacher had to observe her own class and assess each learner. The number of learners per class ranged between 25 and 32. The parents and teachers were not informed of the results from the MABC-2 Performance Test obtained by the movement specialist, therefore, they could not have been influenced in any manner. The results of the MABC-2 Performance Test were compared to the results of the MABC-C of the parents and teachers respectively to establish the ability of parents and teachers to identify motor difficulties in learners and aid professionals in early identification.

Ethical clearance

The Department of Education of the Free State province and the principal of each school granted permission for the research to be conducted on the school premises during the Life Orientation periods. Approval had been obtained from the Ethics Committee of the Faculty of Health Sciences, University of the Free State (ECUFS 57/2012). The learners were treated in accordance with the ethical guidelines outlined by the Ethics Committee of the Faculty of Health Sciences. The parents of the learners completed an informed consent form for each child participating in this study. In addition, the learners signed an assent form. Furthermore, the

parents and teachers gave consent to take part in the study by means of completing the MABC-C without any compensation.

Participants

The selection of the seven mainstream schools (six Afrikaans-medium and one English-medium school) was part of a larger randomly selected sample of 13 schools who were invited to participate. The participating schools form part of the high socio-economic status, indicating that the schools were all Quintile 5 schools. The schools 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, 323 learners returned the relevant documents to the school and were recruited for participation. This represents a 40% response rate. There were 183 girls and 140 boys. 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.

All the Grade 1 learners in the participating primary schools were considered for inclusion in the study. Exclusion criteria included a child in the age group outside the expected range of five to eight years, parental permission not obtained or the informed consent not completed fully, or parents indicating that they would be relocating during the study.

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 therefore all of them were included for further data analysis.

A total of 28 teachers were involved in this study. As stated earlier, PE was discontinued with in South African schools in 1994. Thus, there was a difference in the training of the different teachers on their way to becoming a pre-school or foundation phase teacher. From the 28 teachers, 13 had received training where they completed a higher professional educational diploma over a period of four years, with PE included in the curriculum. The remaining 15 teachers were in possession of a four-year Baccalaureus Educationis degree (pre-school and foundation phase). This curriculum included two modules addressing motor development (developmental games and developmental play), however, they did not receive formal training in PE.

Measuring instruments

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

According to Henderson *et al*. (2007), the MABC-2 Performance Test requires learners 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 learners should approach and perform the tasks. The MABC-2 Performance Test is used to assess the motor proficiency levels of a learner and to identify 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 and 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 valid and reliable tool to use with a reliability coefficient for the total test scores of 0.80 (Henderson *et al*., 2007).

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. 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 Children-2 Checklist (MABC-Checklist-2)

The MABC-Checklist-2 is designed to identify learners with movement difficulties (Henderson *et al*., 2007). The MABC-Checklist-2, consisting of three sections, can be completed by parents, teachers and professionals. 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 focus on movement in a static and/or predictable environment for example fastening a button whereas Section B focus 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 is allotted '1' and if it is negative ('2' or '3'), the child is allotted '2'. If the scores are mixed, the benefit of the doubt is given and '1' is allotted (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", amber indicates "at risk or moderate motor difficulty" and red shows "definite motor difficulty". In contrast to the MABC-2 Performance Test, high scores represent poor performance. For this study, the parents and teachers completed the MABC-Checklist-2 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-Checklist, Henderson *et al*. (2007) argued that they had

been unable to collect reliability data on the new MABC-Checklist. The researchers considered the overlap in content of the old and the new checklist to be sufficient.

Analysis of the data

The lead investigator captured the data from the MABC-2 Performance Test, as well as the MABC-C electronically using Microsoft Excel. Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) for Windows (SPSS version 16.0, SPSS Inc., Chicago, IL). In order to achieve the aim of this study, namely to examine the convergent validity of the classification of motor difficulties using the MABC-2 Performance Test and the classification of motor difficulties by the parents and teachers of the learners using the MABC-C, the kappa (k-) coefficient was used. 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.

The practical importance of the results was also investigated. As standard of practical significance, the effect size was calculated. The following guideline values need to be used when the effect size is interpreted (Steyn, 1999): r=0.1 is small effect; r=0.3 is medium effect and r=0.5 is large effect. A probability level of 0.05 or less was accepted as an indication of statistical significance.

RESULTS

Table 1 indicates the frequency distribution of the participants according to gender and race. Learners (N=323) between the ages of 5 and 8 years took part in the study. The study consisted of boys (n=140) and girls (n=183). The mean age for the learners was 6 years and 8 months with a standard deviation of 0.4. The minimum age was 5 years and 8 months and the maximum age was 8 years.

Table 1. **NUMBER OF PARTICIPANTS**

Gender	Total
Boys	140 (43%)
Girls	183 (57%)
Total	323 (100%)

The MABC-2 Performance Test was conducted by the movement specialists to determine the motor performance of the Grade 1 learners. The total score of the MABC-2 Performance Test was categorised into a traffic light system where the red zone indicates severe motor difficulties, the amber zone indicates moderate motor difficulties and the green zone indicates no motor difficulties. The distribution of the learners in the various categories with regard to motor performance is presented in Figure 1 according to the movement specialists, the parents and teachers.

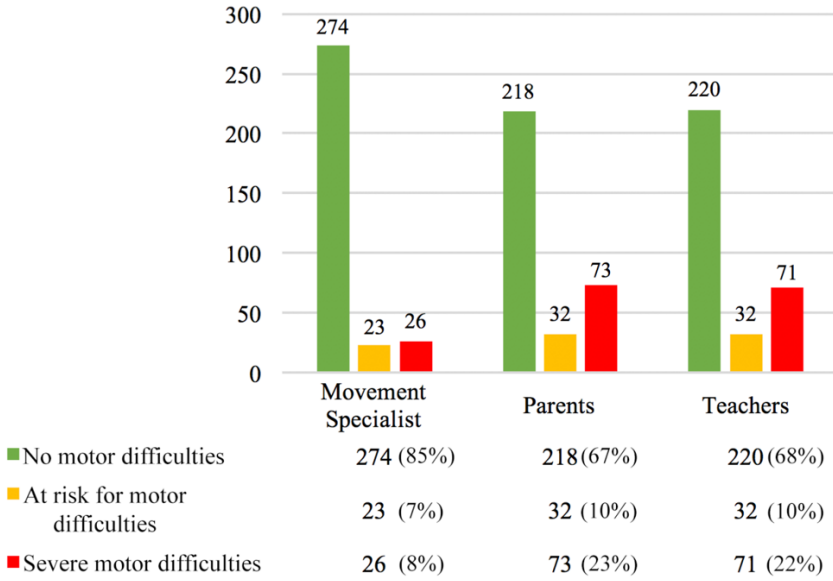

Figure 1. **PREVALENCE OF MOTOR DIFFICULTIES ACCORDING TO MOVEMENT SPECIALIST, PARENTS AND TEACHERS**

Figure 1 indicates that 85% of the learners are in the green zone and show no motor difficulties while 15% show motor difficulties with 7% in the amber zone (moderate motor difficulties) and 8% in the red zone (severe motor difficulties).

Table 2. **CONVERGENT VALIDITY BETWEEN MABC-2 PERFORMANCE TEST AND MABC-CHECKLIST PARENTS (Left column) AND TEACHERS (Right column)**

MABC Checklist Parents	**MABC-2 Performance Test**				**MABC Checklist Teachers**	**MABC-2 Performance Test**			
	NMD	MMD	SMD	Total		NMD	MMD	SMD	Total
NMD	197 (71.4%)	11	9	217	NMD	193 (72.6%)	11	9	213
MMD	27	2 (9.5%)	4	33	MMD	24	4 (19%)	3	31
SMD	52	8	13 (50%)	73	SMD	49	6	12 (50%)	67
Total	276	21	26	323	Total	266	21	24	311
(k)-coefficient = 0.143; p=0.000; Effect size = 0.240 (medium)					(k)-coefficient = 0.161; p=0.000) Effect size = 0.228 (medium)				

NMD= No Motor Difficulties MMD= Moderate Motor Difficulties SMD: Severe Motor Difficulties

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

Parents identified 67% of the learners having no motor difficulties, 23% with severe motor difficulties and 10% with moderate motor difficulties. Of the 311 MABC-Checklists-2 completed by the teachers, 68% were categorised with no motor difficulties, 22% with severe motor difficulties and 10% with moderate motor difficulties.

Table 2 presents the convergent validity between the classifications of motor difficulties by means of the MABC-2 Performance Test by the movement specialists and the identification of motor difficulties by the parents using the MABC-C for the total group. Also included is the convergent validity between the classifications of motor difficulties by means of the MABC-2 Performance Test by the movement specialists and the identification of motor difficulties by the teachers using the MABC-Checklist for the total group.

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-C (Table 2-left column), was 71.4% for the total group.

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

The results in Table 2 firstly indicate that 21 of the learners were identified with moderate motor difficulties by the MABC-2 Performance Test, while 2 (9.5%) of these learners were also identified by parents using the MABC-Checklist-2. Secondly, the results show that of the 26 learners who were identified with severe motor difficulties by the MABC-2 Performance Test, 13 (50.0%) were also identified with severe motor difficulties by the parents using the MABC-Checklist-2. In Table 2, the 15th percentile as the cut-off point indicates that out of the 47 learners identified with motor difficulties (moderate motor difficulties, n=21 and severe motor difficulties, n=26) by the MABC-2 Performance Test, a total of 15 of these learners were also identified with motor difficulties (moderate motor difficulties n=2 and severe motor difficulties n=13) by the parent-completed MABC-Checklist-2 indicating a sensitivity of 31.9% (15/47).

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

The calculated (k)-coefficient of 0.143 is significant on the 1%-level and provides a small effect size, which indicates that the findings are of small practical importance. The (k)-coefficient of 0.143 indicates that only 14.3% convergent validity between the two identifications is present after correcting for chance. These findings indicate that the convergent validity of the two assessments is low. This can especially be observed within the two moderate motor difficulty groups where an inadequate agreement is present between the two assessments. Out of the 21 learners identified with moderate motor difficulty (according to the MABC-2 Performance Test), the parents identified 11 (52.4%) of the learners with no motor difficulties and 8 (38.1%) of the learners with severe motor difficulties according to the MABC-Checklist-2.

Specificity of MABC-2 Performance Test and teacher-completed MABC-Checklist

The specificity, between the MABC-2 Performance Test and the teacher-completed MABC-Checklist (Table 2 – right column), was 72.6% for the total group.

Specificity and Sensitivity of MABC-2 Performance Test and teacher-completed MABC-Checklist

Table 2 shows that 21 of the learners were identified with moderate motor difficulties by the MABC-2 Performance Test, while 4 (19.0%) of these learners were also identified with moderate motor difficulties with the MABC-Checklist as completed by the teachers. The results further indicate that out of the 24 learners identified with severe motor difficulties, 12 (50.0%) were also identified with severe motor difficulties by the teacher-completed MABC-Checklist. The 15th percentile as the cut-off shows that out of the 45 learners identified by the MABC-2 Performance Test with motor difficulties (moderate motor difficulties n=21 and severe motor difficulties n=24), a total of 16 of these learners were also identified with motor difficulties (moderate motor difficulties n=4 and severe motor difficulties n=12) by the teacher-completed MABC-Checklist-2, indicating a sensitivity of 35.6% (16/45).

Specificity of MABC-2 Performance Test and teacher-completed MABC-Checklist-2

Analysis of the results in Table 2 shows that when using the MABC-2 Performance Test, there were 266 learners identified with no motor difficulties, whereas 193 (72.6%) of these learners were also identified without motor difficulties by the MABC-Checklist when completed by the teachers. Therefore, the specificity between the MABC-2 Performance Test and the teacher-completed MABC-Checklist is 72.6% (193/266) which indicate a good agreement with regard to the identification of no motor difficulties.

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

The calculated (k)-coefficient of 0.161 is on the 1%-level of significance and the value provides a small effect size, which means that the findings are of small practical importance. The (k)-coefficient of 0.161 reveals that there is only 16.1% agreement between the two identifications after correcting for chance. This finding shows that the agreement between the two assessments is low. As observed by the parents-completed MABC-Checklist, the teacher-completed MABC-Checklist also indicates an inadequate agreement in the moderate motor difficulty category for the two assessments. Of the 21 learners identified with moderate motor difficulty (according to the MABC-2 Performance Test), the teachers identified 11 (52.4%) of the learners with no motor difficulties and 6 (28.6%) of these learners with severe motor difficulties by using the MABC-Checklist-2.

DISCUSSION

The aim of this study was to determine the agreement between identifying motor difficulties with the MABC-2 Performance Test and the identifying of motor difficulties with the MABC-Checklist when completed by their parents and their teachers.

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 agreement between the parent-completed MABC-Checklist and the MABC-2 Performance Test. Thus, comparisons could be made regarding previous research when the MABC-Checklist is completed by the parents. The sensitivity of the present study is 31.9% and the specificity is 71.4%, which demonstrate a low ability from the parents to identify learners with motor difficulties and a higher ability to identify learners with no motor difficulties. The present

study findings indicate that the agreement between the MABC-Checklist when completed by the parent and the MABC-2 Performance Test is low (14.3%).

There are, however, previous findings on the sensitivity, specificity and agreement of the MABC-Checklist when completed by the teachers where limited research is available. It is important to take note that the current study used the second edition 2007 of the MABC. However, previous findings on the original 1992 MABC are also discussed. The second edition will be referred to as MABC-2 Performance Test and MABC-Checklist 2. Findings with regard to the teacher-completed MABC-Checklist-2 are discussed in the following paragraphs.

Sensitivity of MABC-2 Performance Test and teacher completed MABC-Checklist-2

The results in the current study indicated that the teacher-completed MABC-Checklist-2 identified 16 of the 45 learners acknowledged by the MABC-2 Performance Test with moderate- and severe motor difficulties (under the 15th percentile). This demonstrates a sensitivity of 35.6%. In addition, a previous study by Piek and Edwards (1997) using the original MABC found a lower sensitivity of 25.0%. This means that the teacher-completed MABC-Checklist only identified moderate and severe motor difficulties in 8 out of 32 learners detected by the MABC Performance Test.

Ellinoudis *et al*. (2009) also found a lower sensitivity (27.1%) than the current study, indicating that the teacher-completed MABC-Checklist-2 in their study identified 16 of the 59 learners observed by the MABC-2 Performance Test with moderate- and severe motor difficulties. In contrast with the current study, a study by Junaid (1998) on the original MABC found an even lower sensitivity of 14.3%, implying that the MABC-Checklist failed to identify learners with poor scores on the MABC Performance Test.

Compared to the mentioned studies, Henderson and Sugden (1992) found a higher sensitivity of 43.8% on the original MABC, which means that the MABC Performance Test in their study identified 16 learners with moderate- and severe motor difficulties and the teacher identified 7 of the 16 with moderate- and severe motor difficulties using the MABC Checklist. Green *et al*. (2005) used the original MABC in their study and support the findings of Henderson and Sugden (1992), indicating a sensitivity of 44%. A more recent study in Germany using the second edition MABC found similar results with a sensitivity of 41% (Schoemaker *et al*., 2012). In contrast with the mentioned studies that found low to medium sensitivity of the MABC-Checklist ranging from 14.3%-44%, Schoemaker *et al*. (2003) found an extremely high sensitivity of 80% in their study in the Netherlands with the original MABC-Checklist.

It is clear that the low sensitivity found in the present study evidences that teachers using the MABC-Checklist did not identify all the learners with motor difficulties. Ellinoudis *et al*. (2009) also agree with these findings, indicating that the MABC-Checklist-2 completed by teachers fail to identify all the learners who have motor difficulties. Junaid *et al*. (2000) also emphasise the lack of sensitivity when the original MABC-Checklist was compared to the MABC Performance Test in their study. It can therefore be concluded that the MABC-Checklist-2 according to this study is not a suitable tool for teachers to use in screening learners for DCD.

Specificity of MABC-2 Performance Test and teacher-completed MABC-Checklist-2

Results of the present study with regard to the MABC-Checklist-2 of the teachers to identify correctly learners without motor difficulties (specificity) show high agreements. There were

27.4% learners incorrectly identified with motor difficulties by the teacher-completed MABC-Checklist-2, which the MABC-2 Performance Test did not support. This result indicates a specificity of 72.6% between the MABC-Checklist-2 of the teachers and the MABC-2 Performance Test when viewing the no motor difficulty category, and is in agreement with findings on the original MABC by Green *et al*. (2005) with a specificity of 74%.

Ellinoudis *et al*. (2009) found a higher specificity indicating a percentage of 81.6% while Schoemaker *et al*. (2012) established an even higher specificity of 88% using the second edition MABC. A study in the Netherlands found a very high specificity of 90% on the original MABC indicating a substantially good agreement between the MABC Performance Test and MABC-Checklist when specifically identifying learners with no motor difficulties (Schoemaker *et al*., 2003). This is meaningful in a way that if the teacher identifies the child with no motor difficulty using the MABC-Checklist, he/she can almost be sure that the MABC Performance Test would agree. These results show that the MABC-Checklist-2 of the teacher has a high specificity agreement to identify an average percentage of learners with no motor difficulties, if compared to the MABC-2 Performance Test.

Convergent validity of MABC-2 Performance Test and teacher-completed MABC-Checklist-2

An overall analysis of the agreement between the MABC-2 Performance Test and the MABC-Checklist-2 showed that the MABC-Checklist-2 completed by teachers has a low agreement of 16.1% with the MABC-2 Performance Test in identifying the same learners with and without motor difficulties. Comparing the present study with the research by Ellinoudis *et al*. (2009) and Green *et al*. (2005), the agreement between the MABC-2 Performance Test and the MABC-Checklist-2 of the teachers in all three studies is low, with a (k)-coefficient of 0.16 in the present study and 0.14 in studies by Ellinoudis *et al*. (2009) and Green *et al*. (2005) respectively. Another study in a Dutch and Flemish sample by Shoemaker *et al*. (2012) also indicated a low agreement with a Kappa value of 0.28 using the MABC-2.

However, numerous previous studies found higher agreement percentages between the teacher-completed MABC-Checklist-2 and the MABC-2 Performance Test. Research conducted by Schoemaker *et al*. (2012) found a high percentage agreement of 80%, whereas a previous study on the original MABC test by Schoemaker *et al*. (2003) observed an average percentage of 69% for 6-year-old learners, a lower percentage of 35% for 7-year-old learners and a high percentage of 63% for 8-year old learners. Junaid (1998) on the other hand found a higher average agreement on the original MABC with an agreement of 51%. Piek and Edwards (1997) demonstrated a 50% agreement between the original MABC Performance Test and the MABC Checklist.

The lack of agreement between the MABC-2 Performance Test and the MABC-Checklist-2 in the present study has been found to be an on-going problem. According to Junaid *et al*. (2000), the independent use of the original MABC Checklist is inadvisable, as the Checklist does not identify a child with motor difficulties based on the MABC Performance Test. Faught *et al*. (2008) indicate that previous studies using teacher-reports have produced conflicting results. Schoemaker *et al*. (2008) previously argued whether teachers and clinicians would identify the same group of learners, and Missiuna *et al*. (2011) indicate that teachers using screening tools differ from each other and from the clinicians. The original and revised MABC-Checklist are not the most adequate screening tool for teachers to identify learners with motor difficulties. The MABC-Checklist-2 therefore is not the ideal method to help in early

identification of learners with DCD to enable early intervention and to help the child to overcome some of the difficulties (Gibbs *et al*., 2007).

CONCLUSION

The findings in the present study show a 14.3% agreement between the MABC-2 Performance Test and the MABC-Checklist-2 completed by parents and at the same time a 16.1% agreement when completed by teachers. Therefore, the ability of the parents and teachers using the MABC-Checklist-2 to identify correctly learners with motor difficulties was found to be low. It is clear that the MABC-Checklist-2 completed by the teachers has a slightly higher agreement with the MABC-2 Performance Test than the MABC-Checklist-2 completed by parents. Consequently, it is too premature to conclude that the teachers are better able to rate motor performance than parents are when using the MABC-Checklist-2.

It is also unclear in previous studies, due to limited findings, whether parents play a role in identifying learners with motor difficulties when specifically completing the MABC-Checklist-2. Therefore, using a parent-completed MABC-Checklist-2 prior to assessment, as means of identifying motor difficulties is still unknown. The low agreement found in the study places the sensitivity of the MABC-Checklist-2 for identifying learners with motor difficulties into question.

In conclusion, the MABC-Checklist-2, when completed by parents and teachers, is not a suitable screening tool to use in identifying learners with motor difficulties. Therefore, it is suggested that both the MABC-2 Performance Test and the MABC-Checklist-2 should be used. Only when the child fails both, can the child be identified with motor difficulties and possible DCD. Another interesting aspect to take note of was that the scores between the checklists completed by the parents and teachers showed similarity. Further research should be conducted with regard to this similarity. The debate continues regarding the most suitable screening tool to identify learners with DCD and to find the most accurate instrument.

LIMITATIONS AND RECOMMENDATIONS

This study had some limitations. A comparison between the DCDQ'07 and the MABC-2 Checklist, which can also be completed by the parents, 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 MABC-2-Checklist, however, the Movement ABC-2-Checklist was available in either Afrikaans or English. The large number of parents may have affected the reliability of the scores according to the MABC-2-Checklist. Moreover, it should be recognised that the current study recruited learners from the Bloemfontein metropolitan area only. Hence, it is recommended that a replication of this study in different provinces and regions in South Africa be conducted to provide more robust results that can be generalised. Other limitations are the use of European norms for a South African population.

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