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Teachers' ability to identify children with developmental coordination disorder

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Abstract

Developmental coordination disorder (DCD) is a motor disorder of unclear etiology which severely interferes with a child's ability to perform daily motor tasks. The aim of the study was to examine the convergent validity of the Movement Assessment Battery for Children – Checklist (MABC-C) when completed by teachers with the Movement Assessment Battery for Children – Test (MABC-2) when completed by Kinderkineticists, in order to determine if teachers possess the competency to identify grade 1 children with DCD in the classroom. Five hundred and forty five (N = 545) grade 1 children in South Africa between the ages of five and eight years took part in this study. There were 234 girls and 311 boys. The ethnic groups that took part consisted of 321 Caucasian and 224 Black learners. The MABC-C demonstrated a specificity of 70.3% and a sensitivity of 46.5%. The convergent validity between the two assessment tools when completed by teachers indicated a kappa coefficient of 0.110 (11%), and thus had a small effect size (r = 0.125). Therefore, it can be argued that teachers using the MABC-C could not identify children with DCD in the classroom.

Keywords: Developmental coordination disorder, movement assessment battery for children-2, movement assessment battery for children-2, checklist, children.

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Introduction

Developmental coordination disorder (DCD) is a neurodevelopmental disorder affecting approximately 1.8%–6% of school-aged children (Parmar, Kwan, Rodriguez, Missiuna & Cairney, 2014). Children with DCD will execute coordinated motor skills significantly below the level expected based on the child's chronological age. This is not accounted for by their age, intellect or neurological disorders, and the impact is evident in their daily activities at home (self-care tasks), during play (running, riding a bike, swimming and ball games), and in academic performance in school (writing and cutting activities). According to Parmar et al. (2014), it is important to identify DCD early in a child's life to allow for proper and timely intervention and support, and to reduce the negative consequences associated with this condition.

In an attempt to identify children with DCD, several instruments, such as motor questionnaires for screening purposes and norm-referenced tests to measure the degree of movement difficulties (Barnett, 2008), can be used. Due to the high costs of norm-referenced tests, the time-consuming process, and long waiting periods in order for children to be assessed (Junaid, Harris, Fulmer & Carswell, 2000; Loh, Piek & Barrett, 2009), screening tools can be used in order to identify children who might have DCD (Loh et al., 2009; Junaid et al., 2000). In this regard, several screening tests and questionnaires have been developed to gather information, specifically from parents and teachers, concerning functional motor performance of children, for example the Movement Assessment Battery for Children-2 Checklist (MABC-C) and the Developmental Coordination Disorder Questionnaire '07 (DCDQ'07) (Schoemaker, Niemeijer, Flapper & Smits-Engelsman, 2012).

South-Africa is a very diverse country and, according to Gallahue and Ozmun (2006), motor development can be influenced by the individual, the task and the environment. Pienaar (2004), noted that South Africa consists of an assortment of different population groups, as well as children from a variety of socio-economic statuses (SES). Furthermore, Pienaar (2004) argues that the diversity can impact the use of assessment tools standardized on populations from different backgrounds, particularly with regard to the child's socio-economic influences and how this factor can affect the development of children in South Africa. The socio-cultural context in which a child is reared forms certain demands for his/her motor development, favoring specific aspects of motor development and impairing others (Venetsanou & Kambas, 2010). Robinson and Goodway (2009) stated that children who grew up in disadvantaged environments showed deficits mostly due to a lack of opportunities. Pienaar (2004) conducted a study on 688 children from a low SES, and the results revealed that more than half of the participants had motor difficulties. Another study by Pienaar, Labuschagne and Peens (2007) showed that 5- to 6-year-old South African children from low SES displayed developmental deficits of up to 12 months in comparison with children of the same age from more privileged environments.

A contributing factor to poor motor proficiency levels amongst South African children, may be a result of the lack of Physical Education (PE) in the school curriculum. Physical Education had been discarded from South African schools as a stand-alone subject and integrated with Life Orientation (LO) as part of a learning area (Rajput and Van Deventer, 2010; Cleophas, 2014). The majority of South African children 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 promoting mass participation (Cleophas, 2014; Rajput & Van Deventer, 2010). However, currently most of South African children still do not receive purposeful PE in their schools (Cleophas, 2014).

A wide range of percentages exists with regard to the prevalence of DCD across the globe in the literature (Gaines & Missiuna, 2007; Wilmut, Brown & Wann, 2007; Wessels, Pienaar & Peens, 2008; de Milander, Coetzee & Venter, 2014). The difference in prevalence might be due to the assessment tool used, the population and age being research for a specific topic. Research indicates that DCD affects 5%–6% of school-age children (Gaines & Missiuna, 2007). According to Wilmut et al. (2007), the prevalence of DCD is 5%–10%. Hamilton (2002) found that 5%–15% of school-aged children had coordination difficulties serious enough to interfere with social integration as well as academic performance. In the Free State province of South-Africa the prevalence is even higher, as it was found that 15% of children had moderate to severe motor difficulties (de Milander et al., 2014). Surprisingly, Pienaar (2004), as well as Wessels, Pienaar, and Peens (2008), also used the MABC and reported a significantly higher prevalence of DCD in the North West province of South Africa—61.2% and 52% respectively. This clearly indicates that South African children appear to have more motor difficulties compared to children in other parts of the world.

It is clear from the literature that discrepancies exist between the results from other parts of the world with regard to the prevalence of DCD and the results from South-Africa. This may be due to the diversity of the South African people as well as the lack of Physical Education (PE) between 1994 and 2011 in schools. The Curriculum Assessment Policy Statements (CAPS) according to the Department of Basic Education with regard to PE states that teachers should develop children’s gross- and fine motor skills in addition to perceptual development (Department of Basic Education, 2011). The personnel should focus on perceptual activities which include aspects such as locomotor, rhythm, balance and laterality. According to a study conducted by de Milander, Coetzee and Venter (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 Physical Education in our schools. It is therefore important to investigate the use of screening tools by the teachers with the purpose to determine if the teachers have the competency to identify children with DCD in the classroom. In addition, the identified children can undergo norm reference tests and, if necessary, remedial programs from Kinderkineticists as soon as possible (Peens, Pienaar & Nienaber, 2008; de Milander, du Plessis & du Randt, 2014; de Milander et al., 2015)

The aim of the study was to examine the convergent validity of the Movement MABC-C when completed by teachers with the MABC-2 when completed by Kinderkineticists, in order to determine if teachers possess the competency to identify grade 1 children with DCD in the classroom.

Methodology

Study design

This study used the quantitative data approach. The study involved one testing procedure by means of the MABC-2 Test in order to identify DCD among grade 1 children. The participants were tested at their school by research staff (Kinderkineticists) 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 Kinderkineticist with extensive training and professional experience with children. In total, each of our research assistants received a minimum of 8 hours of preparatory training, and at least 6 hours of in-field observation/supervision. Each Kinderkineticist was responsible for one subtest in order to have consistency across the study. In addition, each participant's teacher completed the MABC-C. The principal researcher explained the procedure for the completion of the MABC-C to each head of department (HOD). The HOD explained the procedure in detail to the grade 1 teachers at each school they were responsible for. The teachers observed the children in their classrooms for a period of six months and had two months to complete the MABC-C. Since there were seven schools involved, each teacher had to observe her own class and assess each child. The number of children per class ranged between 25 and 32. The teachers were not informed of the results from the MABC-2 Test obtained by the Kinderkineticists and therefore could not have been influenced in any manner. The results of the MABC-2 Test were compared to the results of the MABC-C to establish the ability of teachers to identify DCD in children and aid professionals in early identification.

Ethical clearance

The Department of Education of the Free State province as well as the principal of each school gave 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 (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 the participants completed an informed consent form for each child participating in this study. In addition, the children signed an assent form. Furthermore, the teachers gave consent to take part in the study by means of completing the MABC-C.

Participants

The selection of the seven mainstream schools was part of a larger randomly selected sample of 13 schools who were invited to participate. The participating 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, 545 children returned the relevant documents to the school and were recruited for participation. This indicates a 68% response rate. There were 234 girls and 311 boys. The ethnic groups that took part consisted of 321 Caucasian and 224 Black learners. The mean age for the children 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.

The assessment of learners with and without motor difficulties was based on the cut-off scores of the MABC-2 Test (Henderson, Sugden & Barnett, 2007). Children who had a performance in the normal range (> 15th percentile) were classified as children without motor difficulties, while children at risk (5$^{th–}$15th percentile) as well as those with an indication of definite motor impairment (≤ 5th percentile) were grouped together as children with motor difficulties. The results indicated that 71 children (38 boys and 33 girls) were identified as children with motor difficulties. On the MABC-C, children who scored up to the 85th percentile were considered as children with no motor difficulties. Children with results between the 85th and 94th percentile were at risk and were combined with the definite motor impairment group, who obtained scores of at or above the 95th percentile, as the children with motor difficulties (Henderson et al., 2007). Based on the cut-off scores, 33 children (20 boys and 13 girls) were identified as children with motor difficulties. Thus, the current study had two categories: no motor difficulties and motor difficulties. The children were grouped accordingly and the results of the MABC-2 Test were compared to the findings of the MABC-C to determine the convergent validity.

All children 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) (American Psychiatric Association, 2013) was used to exclude children who had associated symptoms according to the criteria for DCD. Children 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 children 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. It is compulsory for all teachers in South Africa to register at the South African Council of Education.

Measuring instruments

The Movement Assessment Battery for Children-2 (MABC-2 Test) was developed by Henderson, Sugden and Barnett (2007) and 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 participants motor proficiency levels and to diagnose DCD in children. The first assessment component of this test battery contains 24 items organized into three sets of eight tasks. Each set is designed for use with children of a different age band. The eight tasks are grouped under three headings, namely manual dexterity (MD), balance (B) as well as 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).

The MABC-2 Test is a standardized 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, Evaggelinou, Kourtessis, Konstantinidou, Venetsanou and Kambas (2011) the researchers found Cronbach's alpha coefficient values were .51 (manual dexterity), .70 (aiming and catching) and .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 is a reliable and valid tool in order to assess motor difficulties amongst children.

The Movement Assessment Battery for Children-2 Checklist (MABC-C). As stated by Henderson et al. (2007), the MABC-C is designed to identify primary school children likely to have movement difficulties. The MABC-C consists of three sections. Sections A and B address progressively more complex interactions between children and their physical environment. Section C concerns non-motor factors that may adversely affect children’s movement. The checklist contains a list of specific motor behaviors that can be observed in an everyday setting such as a classroom or playground. The children’s performance in each item in the MABC-C is rated by an adult observer in terms of how proficiently it is executed. The ratings are summed to provide a total score, which is then mapped onto a traffic light system indicating whether children fall into the age-expected normal range (green zone), show signs of some minor movement problems that need to be monitored (amber zone) or is highly likely to have more serious movement problems (red zone).

According to Schoemaker, Smits-Engelsman and Jongmans (2003), the original MABC-C 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-C, Henderson et al. (2007) argued that they had been unable to collect reliability data on the new MABC-C. The researchers considered the overlap in content of the old and the new checklist to be sufficient.

Data analysis

The principal researcher captured the data from the MABC-2 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 problems (no motor difficulties/motor difficulties) using the MABC-2 Test and the classification of motor difficulties (no motor difficulties/motor difficulties) by the teachers of the participants using the MABC-C, the kappa (k-) coefficient was used. This coefficient supplies 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): $r = 0.1$: small effect; $r = 0.3$: medium effect and $r = 0.5$: large effect. A probability level of 0.05 or less was taken to indicate statistical significance.

Results

Table 1 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 teachers using the MABC-C for the total group, gender and 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.

Table 1: Convergent validity between the MABC-2 Test and the MABC-C

TOTAL GROUP				**Caucasian children**				**Black children**			
	MABC-2 Test				MABC-2 Test				MABC-2 Test		
MABC	MD	NMD	Total	MABC	MD	NMD	Total	MABC	MD	NMD	Total
MD	306 (70.3%)	38 (53.5%)	344	MD	183 (65.1%)	12 (37.5%)	195	MD	123 (79.9%)	26 (66.7%)	149
NMD	129 (29.7%)	33 (46.5%)	162	NMD	98 (34.9%)	20 (62.5%)	118	NMD	31 (20.1%)	13 (33.3%)	44
Total	435	71	506	Total	281	32	313	Total	154	39	193
k-coefficient=0.110, p=0.005 Effect size (r)=0.125 (small)				k-coefficient = 0.126, p = 0.002 Effect size (r) = 0.173 (small)				k-coefficient = 0.126, p = 0.079 Effect size (r) = 0.126 (small)			

BOYS				**GIRLS**			
	MABC-2 Test				MABC-2 Test		
MABC	MD	NMD	Total	MABC	MD	NMD	Total
MD	125 (69.8%)	18 (47.4%)	143	MD	181 (70.7%)	20 (60.6%)	201
NMD	54 (30.2%)	20 (52.6%)	74	NMD	75 (29.3%)	13 (39.4%)	88

TOTAL GROUP		**Caucasian children**			**Black children**		
Total	179	38	217	Total	256	33	289
k-coefficient = 0.164, p = 0.008 Effect size (r) = 0.180 (medium)				k-coefficient = 0.002, p = 0.973 Effect size (r) = 0.001 (small)			
Caucasian Boys				**Caucasian Girls**			
	MABC-2 Test				MABC-2 Test		
MABC	MD	NMD	Total	MABC	MD	NMD	Total
MD	79 (63.2%)	5 (27.8%)	84	MD	104 (66.7%)	7 (50%)	111
NMD	46 (38.8%)	13 (72.2%)	59	NMD	52 (33.3%)	7 (50%)	59
Total	125	18	143	Total	156	14	170
k-coefficient = 0.179, p = 0.004 Effect size (r) = 0.239 (medium)				k-coefficient = 0.068, p = 0.210 Effect size (r) = 0.096 (small)			
Black Boys				**Black Girls**			
	MABC-2 Test				MABC-2 Test		
MABC	MD	NMD	Total	MABC	MD	NMD	Total
MD	46 (85.2%)	13 (65%)	59	MD	77 (77%)	13 (68.4%)	90
NMD	8 (14.8%)	7 (35%)	15	NMD	23 (23%)	6 (31.6%)	29
Total	54	20	74	Total	100	19	119
k-coefficient = 0.219, p = 0.050 Effect size (r) = 0.223 (small)				k-coefficient = 0.071, p = 0.425 Effect size (r) = 0.073 (small)			

MD = Motor difficulties; NMD = No Motor difficulties

Specificity and Sensitivity of the MABC-2 Test and the Teacher-completed MABC-C

According to Ellinoudis et al. (2009), specificity refers to the ability of the teachers using the MABC-C to correctly identify children with no motor difficulties (green zone) as identified by the MABC-2 Test. Sensitivity refers to the ability of the teachers using the MABC-C to correctly identify children with motor difficulties (Ellinoudis et al., 2009) as identified by the MABC-2 Test.

As shown in Table 1, the specificity between the MABC-2 Test and the teacher-completed MABC-C is 70.3% (306/435) for the total group. It is interesting to note that almost one third (29.7%) of these children were incorrectly identified by the MABC-C as children with motor difficulties. The sensitivity for the motor difficulties group was 46.5% (33/71) for the total group, indicating that the teachers could not identify the learners with motor difficulties, or that the instrument is not sensitive enough.

Although the specificity for boys (69.8%, 125/179) and girls (70.7%, 181/256) was high, the sensitivity (52.6%, 20/38) for boys was higher than for their female counterparts (39.4%, 13/33). As far as race was concerned, the specificity was high, although somewhat lower for Caucasian learners (65.1%, 183/281) than for the Black learners (79.9%, 123/154), even though the reverse was true for sensitivity (Caucasian learners: 62.5%, 20/32, Black learners: 33.3%, 13/39. The same trend is evident when comparing Caucasian and Black learners by gender.

Convergent Validity of the MABC-2 Test and the Teacher-completed MABC-C

The agreement was also investigated by calculating the percentage of convergent validity between the MABC-2 Test and the MABC-C in classifying children as those with motor impairment and those without motor impairment, and by calculating the sensitivity and the specificity of the two measuring instruments. Cohen's kappa was calculated to evaluate the proportion of convergent validities.

The calculated k-coefficient for the various groups that were investigated, namely the total group (11% convergent validity), boys (16.4% convergent validity), girls, Caucasian learners and Black learners (12.6%), Black boys, Caucasian girls as well as Black girls, was on the 1%-level and provides a small effect size, which means that the findings are of insignificant practical importance. The k-coefficient indicates that there was only an 11.0% convergent validity between the two measuring instruments after adjusting for the proportion of convergent validities that take place by chance (Cohen, 1960). For Caucasian boys, the results indicate a k-coefficient of 0.179 and provide a medium effect size, which means that the findings are of average practical importance. In this case the k-coefficient indicates that there is an 18.0% convergent validity between the two measuring instruments after correcting for chance.

Discussion

The aim of the study was to examine the convergent validity of the classification of motor difficulties by trained Kinderkineticists using the MABC-2 Test and the classification of motor difficulties by the teachers of the participants using the MABC-C, in order to determine if teachers possess the competency to identify Grade 1-learners with DCD in the classroom. The results of the MABC-2 Test were compared to the MABC-C to determine the convergent validity of the two instruments.

One should note that two different groups of people were used with two different measuring instruments. Furthermore, the Kinderkineticists and teachers are all from different backgrounds and experiences. This can influence the results due to the fact that some of the teachers have years of experience with regard to developing children. It is recommended that the Kinderkineticist should have done the testing with the MABC-2 Tests well as the MABC-C, in order to have the same background and experience to determine if the results would have been different.

Limited studies have been conducted in South Africa (Lombard & Pienaar, 2003) to compare the specificity and sensitivity between the teacher-completed MABC-C and the MABC-2 Test by Kinderkineticists in order to determine convergent validity of the identification of DCD among different race groups (Caucasian and Black) as well as with regard to gender. For this reason, no comparisons could be made to previous research.

Although the design of this study made use of the revised MABC-C, previous findings on the original MABC-C will also be discussed, but are limited to the findings for the total group.

Specificity of the MABC-2 Test and the Teacher-completed MABC-C for the Total Group

The study succeeded in showing that the teachers could identify a large percentage of children without motor difficulties, specificity of 70.3% (306/435), when using the age-related cut-off scores. The current study correlates with the findings of Green et al. (2005), who reported an even higher specificity of 75%.

However, several authors have proposed higher specificity on the original MABC-C. Reported specificity using either the original or revised MABC, ranged between 80-90% (Ellinoudis et al., 2009; Schoemaker et al., 2003 Schoemaker et al., 2012). From the results of the current study, it is clear that the teachers were able to identify a large percentage of children without motor difficulties correctly using the revised MABC-C. The relative lower specificity amongst South African teachers might be due to the fact that the majority of the teachers who participated in this study have not been trained in the field of P.E.

Sensitivity of the MABC-2 Test and the Teacher-completed MABC-C for the Total Group

This study found that teachers could not identify a large percentage of learners with motor difficulties, with a sensitivity of 46.5% (33/71). The findings of several authors using the original MABC-C correlate well with the findings of the current study. Henderson and Sugden (1992) found a sensitivity of 43.8%. Green, Bishop, Wilson, Crawford, Hooper, Kaplan and Baird (2005) reported a sensitivity of 44% and Shoemaker et al. (2012), using the revised MABC-C, found a low sensitivity of 41%, similar to the current study. Some researchers, using the original MABC-C reported even lower sensitivity levels, ranging from 14-27% (References With the exception of Schoemaker et al. (2003), who reported a sensitivity of 80% using the revised MABC-C, the literature clearly indicates that the majority of researchers found a low sensitivity when using the MABC-C. This may represent an inherent characteristic of this instrument, rather than the skills of the persons using them.

Convergent Validity of the MABC-2 Test and the Teacher-completed MABC-C for the Total Group

An overall analysis of the convergent validity between the MABC-2 Test and the MABC-C indicates that the MABC-C completed by the teachers had a convergent validity of 11% (k-coefficient of 0.110) with the MABC-2 Test in identifying learners with motor difficulties, and therefore the convergent validity was low (small effect) for the total group. With reference to the original MABC-C similar results were found. These results correlate well with Green et al. (2005), as well as Ellinoudis et al. (2009), who also reported low convergent validities with a k-coefficient of 0.14. In a recent study by Schoemaker et al. (2012) on the revised MABC-C, the researchers also established that the convergent validity was low, with a k-coefficient of 0.28.

However, several authors have found an average convergent validity when using the original MABC-C. Piek and Edwards (1997) found a 50% convergent validity where severe motor difficulties could be identified by the classroom teachers (7/14), compared to PE teachers who could only identify 36% (5/14). In addition, Junaid (1998) also reported an average convergent validity of 51%. With reference to the revised MABC-C, Schoemaker et al. (2012) found the highest convergent validity (80%), in marked contrast to the current study. However, Shoemaker et al. (2012) also reported that low rates for either sensitivity or specificity are a common finding in population-based samples, irrespective of which questionnaire measuring functional motor impairment is used and irrespective of whether teachers or parents are asked to rate motor performance.

Reasons for the low convergent validity in South Africa might be that some of the items on the MABC-C were inappropriate for this population due to the lack of facilitations and apparatus including playgrounds. With regard to classroom activities some of the children used a scissors for the first time when they entered school. In addition, some schools do not have balls, bats or bicycles for recreational activities, nor climbing apparatus for children to develop their gross motor abilities. Furthermore, not all schools provide opportunities for sport activities because children have to go home immediately after school for transport reasons.

It can be concluded that, using the MABC-C, teachers are better at identifying children who do not have DCD, than those who do have in Grade 1-learners. It might be due to the fact that one fifth of the teachers in South Africa are presently not appropriately qualified for the classes they are responsible for (Pienaar, 2004). Furthermore, the norms of the MABC-C might have to be adapted in order to make provision for the diversity in cultures amongst various countries (Pienaar, 2004). From the results of this study it cannot be recommended that the MABC-C is used by teachers to identify learners with DCD. This finding contributes to the dialogue regarding the fact that children are not identified in a timely manner so that earlier intervention can be initiated in order to help these learners overcome their motor difficulties. Further research should be conducted to explore the value of other DCD screening questionnaires in an attempt to identify those whereby children with motor difficulties would be easier identified by the teachers.

Conclusion

To our knowledge, this is the second study in South Africa to assess the competency of teachers to use the MABC-C to correctly identify children with motor difficulties. This study showed only an 11% convergent validity between the MABC-2 Test and the MABC-C as completed by the teachers. Therefore the ability of teachers in the Bloemfontein area, Free State province, South Africa to use the MABC-C to correctly identify children with motor difficulties was found to be low. Thus, the MABC-C is useful to screen children without DCD, although the purpose of a screening tool is to identify children with a specific condition.

Wilson, Crawford, Green, Roberts, Aylott and Kaplan (2009) state that the degree of accuracy in identifying children with possible DCD (sensitivity) must be compared to the accuracy in correctly identifying children who do not have the condition (specificity). This “trade-off” is common to all diagnostic tests, because when one of these predictive values increases, the other decreases. The current study demonstrates the need for further research in identifying efficient and effective assessment screening tools for teachers to help professionals in the early identification of motor difficulties. It is clear from the research that a screening tool alone will rarely identify all children with DCD and that the MABC-C may not be the best screening tool for identifying DCD in primary school children in South Africa.

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Influence of HeartMath quick coherence technique on psychophysiological coherence and feeling states

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Abstract

This small scale study used mixed, quantitative and qualitative methods to investigate whether HeartMath practice of at least five consecutive sessions would be associated with higher psychophysiological coherence levels, decreases in negative feeling state, and increases in positive feeling state, ratings and experiences. A convenience sample of six participants, four women and two men, with a mean age of 38.3 years, recorded low, medium and high psychophysiological coherence scores achieved after each HeartMath practice session. Before and after each session, participants also rated negative feeling states involving anger, anxiety, boredom and sadness, as well as positive feeling states of contentment, peacefulness, happiness and excitement. After all five sessions, participants provided written descriptions of their experiences of the HeartMath practice. Quantitative data were analysed using non-parametric Spearman rank order correlations, Wilcoxon Z and Friedman's X^2 statistics for collective changes, as well as parametric Analysis of Variance with repeated measures for longitudinal, individual, dependent variable changes over time. Qualitative data in the form of participants' phenomenological descriptions were analysed into individual, experiential summaries and then synthesized into a group profile. Integral findings converged in consistently supporting the research hypothesis of significant changes in psychophysiological coherence, negative feeling states and positive feeling state clusters. There were also significant changes in specific, dependent variables such as increased percentages of high psychophysiological coherence, decreased feelings of sadness and increased feelings of peacefulness. Psychophysiological and emotional state findings are discussed in relation to health and sport psychology, theory and practice.

Keywords: Biofeedback, physiological coherence, Quick Coherence Technique, feeling states.

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Introduction

The HeartMath Institute refers to an international scientific research and educational organization, with central vision and mission of promoting personal, social and global coherence (Institute of HeartMath, 2014). The HeartMath system refers to self-regulation techniques that can be used in the moment to relieve stress, improve resilience and health and well-being, as well as sport performance, while promoting what athletes describe as zone experiences. These techniques are informed by a large body of scientific research indicating that neural signals from the heart affect the brain centres involved in emotional self-regulation (McCraty & Shaffer, 2015). Skill acquisition of HeartMath techniques is facilitated through the use of heart rate variability (HRV) and heart rhythm coherence feedback training, heart focussed breathing and intentional generation of associated positive emotional feelings, emotional imagery, and remembered wellness (McCraty & Zayas, 2014). Based on Pribram's (2011) pattern recognition theory of emotion, it is hypothesized that HeartMath techniques use the heart as point of entry to facilitate neural identification of changes in the pattern of afferent cardiac signals sent to the brain and its associated cortical electrophysiological activity respectively. Related research has revealed associated dynamic, systemic activity at various levels; neurochemical, bio-electromagnetic, hormonal and cognitive (McCraty, Atkinson, Tomasino & Bradley, 2009).

A practical energetics approach underlies the techniques. Emphasis is on awareness of energy depletion, renewal and resilience in preparing for challenges, as well as shifting and resetting feelings after challenges, through sustained, regular HeartMath practice. Although research has revealed that positive emotions are associated with psychophysiological coherence independently of respiration, heart focussed breathing at about 5-7 breath cycles per minute and/or 10 second cardio-respiratory rhythm remains a practical, first step in most tools. This conscious step facilitates respiratory sinus arrhythmia (RSA), a dynamic, naturally occurring, physiological mechanism, whereby heart rate increases during inhalation and decreases during exhalation. In addition to modulating the heart's rhythmic activity, slower breathing facilitates identification and focus on a particular positive emotion (McCraty & Zayas, 2014). For example, the Quick Coherence technique chosen for the present study essentially involves heart focused, breathing and feeling. The technique can be practised in relation to a visualized graph of the autonomic nervous system along the vertical axis and hormonal system along the horizontal axis. On the vertical, breath axis, sympathetic activation yields high heart rates and parasympathetic relaxation rate yields low heart rates, while along the horizontal, feeling axis, depleting, negative emotions are associated with stress hormone, cortisol, and renewing positive emotions with growth hormone, dehydroepiandrosterone or DHEA (Childre & Martin, 1999; Institute of HeartMath, 2014; McCraty & Zayas, 2014). For example, HeartMath biofeedback tools, such as Inner Balance and emWave2, were specifically developed to facilitate emotional insight, shift consciousness and transform negative angry, anxious, bored and sad feelings into excited, happy, peaceful and/or contented feelings respectively.

Various studies have indicated that HeartMath practice is associated with improved positive emotional states (McCraty et al., 2009; McCraty, Barrios-Choplin, Rozman, Atkinson & Watkins, 1998; Rein, Atkinson, & McCraty, 1995). However, studies typically measured changes after single sessions, conducted mostly in controlled conditions in laboratory settings. Further research is needed to investigate the nature and process of such emotional changes on a longitudinal and session to session basis. This provided the motivation for the present study. Findings from the abovementioned studies, indicating typical findings of emotional state improvements, led to the postulation of the general research hypothesis that HeartMath practice of at least five sessions would be associated with higher psychophysiological coherence levels, decreases in negative feeling states and increases in positive feeling states.

Methodology

Design

This small scale study required a pre- and post-test, mixed methods, correlational, within subjects, outcome evaluative design (Cresswell & Plano-Clark, 2007; Terre Blanche, Durrheim & Painter, 2006).

Participants

The participants were a small, convenience sample of 6 volunteer adults, four women and two men, with a mean age of 38.3 years, standard deviation 14.6, and age range of 26 to 63 years. Three participants already owned and practised HeartMath tools, Inner Balance and emWave2, the other three were encouraged, lent and taught the practice of these tools. All participants were selected for their commitment to participate in the research and willingness to explore, describe, explicate and articulate their experience. While such qualitative research selection criteria have certain advantages in pilot type, evaluative research as the present study, they do present methodological limitations including social desirability, Hawthorn and experimenter effects. These limitations can be addressed through further randomized, controlled studies with larger samples.

Procedure

The study was introduced to participants with the abovementioned rationale of heart focus, heart breathing and heart feeling. All were informed that research on heart rhythm coherence feedback training had indicated various physiological and psychological benefits, such as blood pressure reduction and improved positive emotions. Specific instructions were as follows: “Please complete and record psychophysiological coherence levels for at least five sessions. Before each session give each feelings state a score and after each session give each a