

Concurrent validity of the Movement Assessment Battery for Children Checklist-2: A Greek Population-Based Study

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Introduction

Children with Developmental Coordination Disorder (DCD) often face difficulties with the activities of daily living that require motor coordination (Barnett, 2014; Kaiser, Albaret & Cantell, 2015; Lingam, Hunt, Golding, Jongmans, & Emond, 2009). According to the 5th edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) DCD is

established on the basis of four criterion: (i) the acquisition and execution of coordinated motor skills is substantially below that expected given the individual's chronological age and opportunity for skill learning and use; difficulties are manifested as clumsiness as well as slowness and inaccuracy of performance of motor skills; (ii) the motor skills deficit significantly and persistently interferes with activities of daily living appropriate to chronological age and impacts academic/school productivity, prevocational and vocational activities, leisure, and play; (iii) onset of symptoms is in the early developmental period; (iv)

Abstract

The aim of this study was to examine a) the concurrent validity of the Movement Assessment Battery for Children Checklist-2 (MABCC-2) within Greek population, and b) the educators effect on the concurrent validity of the MABCC-2. Seventy-three educators (23 pre-school teachers, 30 primary school teachers and 20 primary physical education teachers) participated in the study assessing 584 students (age range 5–12 years, 292 boys & 292 girls), covering the total of age range addressed by the MABCC-2. Students were assessed both by the MABCC-2 and the Movement Assessment Battery for Children-2 motor test (MABC-2-T). Concurrent validity was investigated by measuring the level of agreement (Kappa coefficient) between the checklist and the motor test, as well as by calculating the sensitivity, specificity and accuracy rates. Results revealed a moderate value of agreement ($k=.28$), moderate sensitivity (50.6%) and acceptable specificity (80.7%). The type of educator displayed a significant effect on MABCC-2 concurrent validity rates. Best results were obtained for preschool and primary school teachers. The findings suggest that the exclusive use of the MABCC-2 may not be sufficient to identify children with motor difficulties in Greek school context. However, the rates of concurrent validity obtained in the present study are not unusual for checklists. In general, it was stressed by several researchers that motor assessment checklists for educators usually present low concurrent validity especially in population-based samples.

Keywords: concurrent validity, movement difficulties, MABC-2 Checklist, educators, DCD

the motor skills deficits are not better explained by intellectual disability or visual impairment and are not attributable to a neurological condition affecting movement.

Several researchers have stressed the need for early identification of DCD, not only to provide support for the child as early as possible, but also to prevent the development of secondary consequences on other aspects of daily living such as social interaction, behavior and self-esteem (Gaines & Missiuna, 2006; Kourtessis, Tsougou, Maheridou, Tsigilis, Psalti, & Kioumourtzoglou 2008a; Larkin & Cermak, 2002; Schoemaker, Flapper, Verheij, Wilson, Reinders-Messelink & de Kloet, 2006).

A multidisciplinary approach to the assessment of children with motor difficulties has been stressed by many researchers (Faught, Cairney, Hay, Veldhuizen, Missiuna & Spironello, 2008; Henderson & Sugden, 1992; Linde, van Netten, Otten, Postema, Geuze & Schoemaker, 2015; Schoemaker, Smits-Engelsman & Jongmans, 2003). This means that assessment should engage a variety of information beginning with a detailed assessment of motor impairment and extending to the impact on activities of daily living and school performance (Van Waelvelde & Peersman, 2007). However, the administration of a motor test, especially in the case where the assessment involves many children, is time consuming, expensive and requires trained personnel (Netelenbos, 2005). Moreover, it is advocated that since motor tests are administered in a more controlled environment, they tend not to evaluate skills of real life activities which are essential for a more complete diagnosis (Lingam et al., 2009).

Using motor assessment checklists is an alternative approach, although less objective than the standardized motor tests, to gather information on children's daily life motor activities from the perspective of educators, parents and other professionals. Regardless of the fact that the application of a standardized motor test is required in order to identify children with movement difficulties (criterion I of DSM V) (Missiuna, Pollock, Egan, DeLaat, Gaines & Soucie, 2008; Sugden, 2006), checklists are mainly used as a diagnostic first step to the identification of children with movement difficulties, in order to give additional information in the diagnostic process (Blank, Smits-Engelsman, Polatajko & Wilson, 2012; Cardoso & Magalhaes, 2012; Holsbeeke, Ketelaar, Linde et al., 2015; Schoemaker & Gorter, 2009; Schoemaker, Flapper, Reinders-Messelink & De Kloet, 2008). Within this framework, checklists operate as complementary to movement assessment tests in order to provide

information regarding the degree of influence of movement difficulties on self-handling, school performance, professional, social and leisure activities, as foreseen by the second diagnostic criterion of DSM V.

Several checklists have been developed to assess children's functional motor skills. Some address the teachers' opinions (Henderson, Sugden & Burnett, 2007; Rosenblum, 2006; Schoemaker et al., 2008) some address the parents' views (Rihtman, Wilson & Parush, 2011; Wilson, Kaplan, Crawford, Campbell & Dewey, 2000) while others are self-report questionnaires that address the children's self-perceptions of their motor performance (Hay, Hawes & Faught, 2004). A widely used approach for providing a relatively fast impression of a child's level of motor competence is using teacher-report questionnaires such as the MABCC-2, which is part of the Movement Assessment Battery for Children-2 (MABC-2), one of the most widely used motor assessment batteries.

The MABC-2 (Henderson et al., 2007) is the new version of the original MABC, which was published by Henderson & Sugden (1992). This new version contains a new standardized test of motor impairment, a new criterion referenced checklist and a new intervention manual based on participation and learning. Both the MABC-2_T and MABCC-2 norms were derived from a validation sample representative of the UK children population. Some changes have been made as far as the structure of the MABC-2 performance test is concerned. First of all, it has been extended to encompass the motor assessment of the age range from the initial four to twelve, to three to sixteen years old. Taking into account the increased recognition of DCD as a clinical diagnosis and the importance of early assessment, the MABC-2 authors decided to include 3 year-old-children in the motor performance assessment. Moreover, worldwide research to adolescents revealed that many of them often faced difficulties in their motor performance which were not better explained by intellectual disability and were not attributable to a neurological condition affecting movement was another consideration for the development of the 11 through 16-year age band. Secondly, a new age band (7-10 year old) has been developed, due to the fact that pilot studies by the test authors proved that the two separate age bands (7-8 year old and 9-10 year old age) for the MABC could be combined (Brown & Laylor, 2009). Changes have also been made in the revised version of MABCC-2. One of the most severe criticism regarding the initial version of the MABC checklist concerned its length. Having 48 items, the checklist took long for classroom teachers to complete. Taking into consideration this weakness, the authors decided

some changes focused on the content and structure of the checklist in order to become more effective in the identification of children with movement difficulties. As a result, the revised version of MABCC-2 consists of fewer items (thirty instead of forty-eight) and fewer sections (three instead of four). The authors of the MABCC-2 checklist assume that it is a valid tool supporting the view that the validity data which have been reported for the MABC checklist can be generalized to the MABCC-2.

However, research on concurrent validity of the original version of the MABC has produced conflicting results. Some studies revealed moderate agreement ($k=0.44-0.51$) between the original MABC motor test and the MABC-Checklist (Junaid, Harris, Fulmer & Carswell, 2000; Piek & Edwards, 1997; Schoemaker et al., 2003) while others demonstrated lower rates of agreement ($k=0.14$) (Ellinoudis, Kyparisis, Gitsas & Kourtesis, 2009; Green, Bishop, Wilson, Crawford, Shoop, Kaplan & Baird, 2005). The discrepancies found regarding concurrent validity, could be attributed to different methodologies used across these studies as well as to cultural factors. Studies conducted in Australia (Piek & Edwards, 1997) and Canada (Junaid et al., 2000) revealed a higher level of agreement between the MABC test and the MABC checklist in contrast to the studies conducted in European countries (Ellinoudis et al., 2009; Green et al., 2005). Moreover, in some studies the participants were a clinical group (Green et al., 2005), in others a mixed group (Schoemaker et al., 2003) while in others a typical development group (Ellinoudis et al., 2009; Junaid et al., 2000; Piek & Edwards, 1997). Differences also exist across studies regarding the type of assessors. For example, in the study of Ellinoudis et al., (2009) the assessors were physical education teachers, in the study conducted by Piek & Edwards (1997) the assessors were both class teachers and physical education teachers, while in other studies the assessors were class teachers only (Green et al., 2005; Junaid et al., 2000; Schoemaker et al., 2003). Finally, cultural factors such as the school context may have been responsible for the conflicting results. Junaid and et al. (2000) in the discussion of their findings support that the teachers who participated in their study could not answer MABCC questions about dressing and bike riding, as these activities cannot be observed in the Canadian school context. Thus, as there are discrepancies regarding the concurrent validity rates of the MABCC, then, the validity data which have been reported for the MABC checklist should not be generalized to the MABCC-2. Moreover, the validity of the MABCC-2 cannot be derived from the MABCC

since the MABC-2 is a new, discrete test that needs to have its own specific measurement properties evaluated and reported (Brown & Lalor, 2009).

The number of studies on the psychometric properties of the new version of the MABCC-2 are limited. The only study which investigated the psychometrics of MABCC-2, was the one conducted by Schoemaker and colleagues (2012). This study reported low sensitivity (41%) and acceptable specificity rates (88%) of the particular new version. According to the authors, one possible explanation of these results might be the relatively small size of the sample and the language barrier (translated into Dutch) and thus, they have suggested further examination of this topic.

Many researchers have stressed the view, that investigations on reliability and validity are vital prior to the use of instruments for individuals with different cultural backgrounds (Cicchetti & Rourke, 2004; Cronbach, 1989; Vallerand, 1989) whereas, Pienaar (2004) argues that the cultural factors can impact the use of assessment tools standardized on populations from different backgrounds. Since the MABCC-2 was developed and validated in the UK, it is imperative to investigate if it is suitable for use in a different cultural context such as the Greek one. Considering the necessity of having a valid tool that can identify children with motor problems, it was decided to test the concurrent validity of the MABC-2 Checklist in the Greek context.

Developmental Coordination Disorder is a common issue in Greek school environment since it has been estimated that 7-10% of primary school students face severe motor difficulties, while 10-15% face moderate motor difficulties (Kourtessis et al., 2008a). Educators play a vital role in identifying children with motor learning difficulties, since they are able to observe them engaging in different play and scholastic activities, and therefore, have an advantage not common to other professionals (Faught, et al., 2008; Larkin & Rose, 2005). However, it has been found that there are differences among educators assessment of movement difficulties. For example, the identification percentage of children with movement difficulties in the case of class teachers range from 14,3% to 80% (Capistrano, Ferrari, Souza, Beltrame, & Cardoso, 2015; De Milander, Coetzee, & Venter, 2016 ; Junaid, et al., 2000 ; Piek & Edwards, 1997; Rosenblum, 2006; Schoemaker et al., 2003; Schoemaker et al., 2008 ; Schoemaker et al., 2012) in the case of preschool teachers the rates range from 37,5% to 55%(Kourtessis et al., 2008b; Konstantinidou, 2010) while in the case

of physical educators the corresponding percentage ranges from 17,5% to 49% (Capistrano et al., 2015; Ellinoudis et al., 2009; Piek & Edwards ,1997). It seems that the concurrent validity rates of the checklists are consequently affected by the educators assessment.

Therefore, in this study, it was considered necessary for the MABCC-2 to be completed by preschool, primary and physical education teachers, to investigate which of the three types of educators expresses better sensibility in the evaluation of a child's motor behavior. The three types of educators that took part in the survey are the main group of educators that deal with the child throughout its school life. It is, therefore, important to further investigate if MABCC-2 is appropriate to be used by these groups of educators as it is vital to provide them with the appropriate assessment tools in order to assess the motor competence of their students. Summarizing, in this paper it will be investigated: (1) the validity of the Checklist as a screening instrument used by teachers for the identification of children with DCD (concurrent validity), and (2) the educators effect on the concurrent validity of the Checklist.

Method

Participants

To establish the concurrent validity, stratified sampling was used to select the participants. Throughout this process, 31 public schools (23 elementary schools & 8 nursery schools) from different regions in Greece were selected. 73 educators of the selected schools (23 pre-school teachers, 30 primary school teachers and 20 physical education teachers) assessed 584 5–12years old students (292 boys & 292 girls), who were randomly selected for this purpose (4 boys and 4 girls from each class). The detailed chart for gender, educational level, the mean (SD) total motor scores for the MABC-2 Checklist and mean (SD) total standard scores for the MABC-2 T for age and sex separately are shown in Table 1. Children who were referred for clinical assessment by their school teachers as well as children who had been diagnosed for intellectual disability, special learning difficulties, attention deficit hyperactivity disorder, neurological and sensory disorders, developmental disorders as well as children with chronic diseases were excluded from the study. Participation was voluntary. In addition, all parents and/or guardians of the participating students filled out the parental information consent. Moreover, ethical permission for this study was granted by the Institute of Educational Policy, which operates under the auspice of the Hellenic Ministry of Education.

Table 1: participants at the concurrent validity study

Educator group	Educators N	Male Students	Female Students	Students' Total	Total motor score for the MABCC-2 mean (SD)		Total motor score for the MABC-2_T mean (SD)	
					Male	Female	Male	Female
Primary school teachers	30	121	120	241	4,87(7,61)	5,51(7,74)	9,27(2,65)	9,36(2,47)
Preschool teachers	23	91	92	183	15,507(1,60)	13,749(1,44)	8,02(2,93)	8,56(2,40)
Physical education Teachers	20	80	80	160	7,28(11,05)	8,13(10,92)	9,58(2,93)	9,16(2,71)
Teachers Total	73	292	292	584	10,54(13,46)	10,21(12,10)	8,96(2,88)	9,07(2,53)

Materials

Movement Assessment Battery for Children – 2 – Checklist

The MABC-2 Checklist (Henderson et al., 2007) is part of a complete package (MABC-2) specifically developed to identify children likely to have a movement difficulty and to assist professionals responsible for helping these children. The Checklist is designed for use mainly with children of primary school age. As children start and finish primary school at different ages in different countries, the authors of the Checklist interpreted this as spanning the age range from 5 to 12 years (Henderson et al., 2007).

The Checklist has a motor and a non-motor part. The motor part consists of 30 items, grouped in two sections (section A = static and/ or predictable environment and section B = moving and/or unpredictable environment). Both sections are based on a list of specific motor behaviors that can be observed in daily life and provide data of how a child manages everyday tasks at home and at school. All items are classified in different categories: self care skills, classroom skills and physical education/recreational skills. The rating is a 4-point scale (0=very well; 3=not close). The total motor score derives from the sum of the 30 items which is then categorized using a traffic light system showing whether the child falls into the normal range of the expected age (below 85th percentile, green zone), shows minor movement problems (between the 85th and 94th percentile, amber zone) or has serious movement difficulties (equal or above the 95th percentile, red zone). At the non-motor part section, the

child's personal qualities during movement (planning and organization, impulsivity, passivity and confidence) were assessed. However, the non –motor part was outside the scope of the present study.

The authors of the MABC-2 Checklist didn't present any new information regarding its reliability, claiming that its reliability is based on the original version. Regarding validity, the authors support that the ability of the Checklist to correctly identify children with difficulties is the most important function. Thus, they offer information only for discriminative validity where one can see that the checklist categorizes children into the three categories (normal, at risk and DCD) according to the traffic light system (Henderson et al., 2007). It should be noted that the Greek translation of the Checklist with accompanying U.K. norms as reported in the published manual was used in this study.

Movement Assessment Battery for Children - 2 - test (MABC-2-T)

The MABC-2-T which was used for motor assessment was developed to assess motor performance of children aged 3 to 16 years old. (Henderson et al., 2007). According to its manual, the test is currently available to charter and research psychologists, occupational therapists, psychotherapists and pediatricians. It comprises of eight tasks grouped to evaluate the skills of manual dexterity (three items), ball skills (two items) and dynamic and static balance (three items). Norms are provided for 3–6-year-old, 7–10-year-old, and 11–16-year-old age bands. The total motor score (TMS) is the sum of the eight item standard scores (range 8–152), which can be interpreted in terms of cut-off points. A score above 15th percentile indicates performance in a normal range, between the 6th - 15th percentile indicates a child as being at risk and needs to be carefully monitored and a score below the 5th percentile is an indication of definite motor impairment. U.K. norms of the Test as reported in the published manual were used for the purposes of the present study.

The psychometric properties of the MABC-2-T are rather limited. The MABC-2-T seems to be a reliable instrument (Ellinoudis, Evaggelinou, Kourtessis, Konstantinidou, Venetsanou, & Kambas, 2011; Henderson et al., 2007; Hua, Gu, Meng & Wu, 2013; Wuang, Su & Chwen-Yng Su, 2012). Regarding its validity and according to the manual, the MABC-2-T covers enough of the validity conditions. Moreover, the manual supports the view that the motor test is “culture free” (Henderson et al., 2007). Its cross-cultural validity has also been supported

by many studies, showing that the MABC-2-T is considered a reliable and useful tool in identifying children with motor deficiencies (Cools, De Martelaer, Samaey & Andries, 2008).

Process

Translation process

The World Health Organization (WHOQOL Group, 1995) recommends the cross-cultural translation of existing instruments, since this process is cheaper, faster and can facilitate collaboration, exchange of information and comparison between international populations of children. Based on this view, the MABCC-2 was translated according to the following procedure.

Datasheets and guidelines for the MABC-2-T as well as those for MABCC-2, purchased from the Pearson Assessment Cooperation, were translated into Greek. A double-back reverse independent translation procedure was adopted according to guidelines developed by Beaton, Bombardier, Guillemin, and Feraz (2000) for cross-cultural adaptation of instruments. This process included three steps: (i) an initial English to Greek translation (ii) a Greek to English translation; and finally, (iii) a second English to Greek translation. These three translations were done by three independent and experienced translators. Since there was a consensus among the translators regarding the original and back translated versions it was decided that no changes on the context of the items were needed and therefore we could proceed to the phase of pretesting (Beaton et al., 2000).

In order to farther investigate whether an adaptation was in need, a pilot study was conducted in order to determine the level of understanding of the questions as well as if questionnaires could be completed by the teachers. Participants for this pilot study were 150 educators (50 primary school teachers, 50 kindergarten teachers and 50 physical education teachers). Educators had a teaching experience of more than 5 years. Teachers completed two questionnaires (one for a boy and one for a girl) for two of their students selected by them. Prior to the completion of the questionnaires, teachers were asked to observe the students for fifteen days. For each item of the Checklist, teachers were asked to answer the following questions: a. How sure are you that you understand the question and b. How clear is your view of the student? Answers were given on a Likert scale (0=very well, 1= just ok, 2=almost, 3= not at all). Results showed that 99% of the teachers understood the questions while the percentage of teachers that answered that they can complete the whole questionnaire was >95%. The only exception was the question “Maintains balance in water”, for which 30% of

teachers answered, “not at all”. Based on the results of the pilot study, it was decided that there was no need for any modifications. The main study was conducted.

Main procedure

Each one of the 73 educators (23 preschool teachers, 30 primary education teachers and 20 primary physical education teachers) was asked to complete the MABCC-2, for eight randomly selected children (4 boys; 4 girls) from his/her school class. This process gave a total of 584 children. All teachers were given a one-week observation period prior to completing the MABCC-2 for each selected student from their class. Teachers received written instructions on how to complete the Checklist. No information was given to the teachers regarding the motor performance of children in MABC-2-T.

During the same period, each one of the children was individually assessed by trained and experienced researchers using the MABC-2-T. Assessment took place according to the directions of the MABC-2 Manual in a quiet and specifically prepared room within the school. Four experts of adapted physical education, members of the laboratory of Adapted Physical Education of the Department of Physical Education and Sport Science of the University of Serres (FEK 1592/30-10-2003, vol.B., law), were trained to administrate the age bands 1, 2 and 3 of MABC-2 test. The trainee researchers learned the test guidance and then carried out a series of practice assessments on a small number of children who did not take part in the study. Any problems of administration during the training period were clarified by the research administrator prior to the beginning of the test. An interrater reliability of 83% was secured. The study took place for research purposes only.

Data analysis

Concurrent validity

The concurrent validity of the MABCC-2 was examined 1) across the total age range which is covered by the MABC-2 checklist και 2) across each type of educator. In the case of educators only the 15th percentile was used as a cut-off point according to European Academy of Childhood Disability (Blank et al., 2012) recommendations. To determine the concurrent validity, Cohen’s kappa was calculated as a measure of the extent to which there is an agreement between the categorization (typical range, at risk, DCD) of children according to the MABCC-2 and the categorization of children according to the MABC-2-T. Values of .21 or above are considered acceptable (Landis & Koch, 1977) (<.0 no agreement, 0-.20

slight, 0.21-0.40 fair, 0.41- 0.60 moderate, 0.61-0.80 substantial and 0.81-1 almost perfect agreement). In addition, the degree of concurrent validity was estimated by calculating the sensitivity, specificity and accuracy, of the MABCC-2. Sensitivity refers to the percentage of children with movement difficulties according to the MABC-2-T that is correctly detected by MABCC-2 (80% is preferable). Specificity refers to the percentage of children without difficulties who are correctly identified by the MABCC-2 (90% is preferable) (American Psychological Association, 1985). Finally, the accuracy refers to the percentage of children with and without movement difficulties who are correctly categorized by the MABCC-2. No norms are available regarding which percentage is preferable for accuracy (Schoemaker et al., 2003).

Results

Concurrent validity

Concurrent validity across all age bands

A kappa value of .28 was obtained between the MABCC-2 and the MABC-2-T, which is considered to be fair (Landis & Koch, 1977). To address the sensitivity, specificity and accuracy of the MABCC-2, the number of children passing or failing the MABCC-2 and passing or failing the MABC-2-T was calculated using the norms provided in the manual (table 2). This was done for the 5th and 15th percentiles as cut-off points to separate children with normal motor performance from those with moderate or severe movement difficulties. When the 15th percentile was used as a cut-off point, both children at risk for motor problems (scores between the 5th and 15th percentile) and those with severe motor difficulties (scores below the 5th percentile) were separated from children without motor problems (scores above the 15th percentile). Sensitivity, specificity and accuracy values across all age groups, using the 5th and 15th percentile as cut off points for both the MABC-2-T and MABCC-2 respectively, are presented in table 3.

Table 2: Cross-tabulation between Movement Assessment Battery for Children-2 (MABC-2) Test and MABCC-2 in classifying a child as typical range, at risk or DCD

		MABCC-2			Total
		Typical range	At risk	DCD	
MABC-2 test	Typical range	347	16	67	430
	At risk	50	18	13	81
	DCD	26	10	37	73
Total		423	44	117	584

Table 3: Sensitivity, specificity and accuracy of the MABCC-2 across all age levels using the 15th and 5th percentile cut-off points for both the MABC-2-T and MABCC-2

cut-of points	Sensitivity ^a	Specificity ^b	Accuracy ^c
≤15th - >5th	50.6 %	80.7 %	72.7%
≤5th	50.7%	80.7 %	68.8%

^aPercentage of children who fail on the MABC-2-T who were correctly identified by the MABCC-2

^bPercentage of children who pass the MABC-2-T who were correctly identified by the MABCC-2

^cPercentage of children with and without movement difficulties who were correctly categorized by the MABCC-2

Regarding sensitivity values, only slight differences become apparent when the 5th or 15th percentile was used as a cut-off criterion for the MABC-2-T. Neither sensitivity, nor specificity approached the desired rates proposed by APA (1985). As far as for the accuracy of the MABCC-2, the number of correct classification of children in the three categories (typical range, at risk and DCD) is 402 (the diagonal of table 2. Thus, the accuracy of the Checklist using the three categories of classification is 68.8% (402/584). For the estimation of the accuracy for only two categories (normal and below 15th percentile) the number of correct classification of children is 425, resulting in a percentage of 72.7% (425/584).

Educators effect on concurrent validity

The effect of educator type (preschool teachers, primary school teachers and physical education teachers) on concurrent validity was examined (table 4). This was done for 15th percentile as a cut-off point to separate children with normal motor performance from those with movement difficulties.

Table 4: Sensitivity, specificity, accuracy and Kappa coefficient of the MABCC-2 across each educational level using the 15th percentile cut-off point.

Educator group	Sensitivity	Specificity	Accuracy	Kappa
Pre-school educators	53.2%	95.8%	81.4% (149/183)	0.44
Primary educators	52.7%	77.4%	71.7% (173/241)	0.24
PE educators	43.2%	70.7%	64.3% (103/160)	0.15

It is obvious that the evaluation of physical education teachers yielded lower values on all parameters, followed by primary school teachers. All values were below the recommended cut-off points except for Preschool educators' specificity, which had an acceptable value. Kappa coefficient of agreement was low for PE educators and fair to medium for Primary and Pre-school educators respectively (Landis & Koch, 1977).

Discussion

The aim of this study was to examine 1) the concurrent validity of the MABCC-2 within the Greek school context and 2) the educators effect on the concurrent validity. To assess the accuracy of the MABCC-2 as a screening instrument for motor difficulties, the MABC-2_T was used as a criterion measure. Regarding the first aim of this study, the results revealed that significant but low measure of agreement (Cohen's kappa) was obtained between the MABCC-2 and the MABC-2 Test categorization of children (normal range, at risk, DCD). The obtained rate of Cohen's kappa between the Checklist and the motor test is similar to the one found in the Dutch sample for 5 to 8-year-old children (Schoemaker et al., 2012) and it is also in accordance with the rates reported in previous population-based studies between the original MABC Test and Checklist, which varied between .14 and .51 (Ellinoudis et al., 2009; Green et al., 2005; Jounaid et al., 2000; Shoemaker et al., 2003). However, the overall classification agreement percentage (accuracy) between the Checklist and the motor test was 72.7%, which is similar to the agreement found for the UK standardization sample (78%; Barnett, 2010, cited in Schoemaker et al., 2012) as well as to the one found for the Dutch standardization sample (Schoemaker et al., 2012). The aforementioned results may imply that these instruments assess both overlapping but also slightly distinct motor skills.

Regarding sensitivity and specificity values of the MABCC-2 obtained in the present study none of them reached the predicted standards proposed by the American Psychiatric

Association (1985) (>80% and > 90%) when using either the 5th or 15th percentiles as cut-off points. The specificity of the MABCC-2 was higher than its sensitivity. This finding implies that the MABCC-2 is more effective in identifying children without motor difficulties. In general, motor assessment checklists for educators usually present higher values of specificity (Ellinoudis et al., 2009; Schoemaker et al., 2012) in contrast to the sensitivity rates which are usually lower. The data regarding the sensitivity of the Checklist indicate that only 50% of the children who failed on the M-ABC Test were correctly identified by the Checklist. Low sensitivity values have been reported in many related studies either when the original version of the MABCC was used (Ellinoudis et al., 2009; Junaid et al., 2000; Piek & Edwards, 1997) or other comparable checklists such as the ChAS-P, (50%), the CHAS-T (67%) and the DCDQ'07 (47%), (Martini, St-Pierre, & Wilson, 2011; Rosenblum, 2006). However, in clinical samples, higher percentages for sensitivity have been found (Schoemaker et al., 2008).

Several explanations could be given to explain the above-mentioned low rates of concurrent validity. The first one can be attributed to the fact that the two instruments do not measure the exact same motor skills. The MABC-2-T measures eight specific basic motor skills regarding manual dexterity, aiming and catching and balance, while the MABCC-2 assesses self-care skills, classroom skills and physical education/recreational skills. According to Kaiser and colleagues (2015) the proportion of questions of the MABCC-2 related to manual dexterity is 17%, the proportion of items measuring aiming and catching is 20% while the proportion of items measuring balance is 43%. Furthermore, the low agreement among different motor tests and checklists identifying motor learning difficulties, has already been discussed by many authors (Barnett, 2014; Cardoso & Magalhaes, 2012; Kaiser et al., 2015; Netelenbos, 2005; Schoemaker et al., 2008; Schoemaker et al., 2012). According to these perspectives, it is logical to expect low sensitivity rates of the motor competence checklists, since motor tests measure motor abilities within a standardized situation, whereas questionnaires reflect motor performance in daily living situations. The second possible explanation could be attributed to cultural factors. According to Pienaar (2004) cultural factors can impact the results of assessment tools standardized on populations from different backgrounds. One such cultural factor concerns the Greek school context. There is a possibility that some of the items on the MABCC-2 were inappropriate for the Greek population due to the lack of infrastructure and equipment relevant to recreational activities. For example, Greek schools do not have bicycles or pools for recreational activities. Another

possible reason is that these findings may stem from the setting of the research. In this study, educators were asked to fill out the checklist on their own. The checklist includes questions that cannot be identified by all types of educators. For example, within the Greek educational system teachers cannot easily observe whether a child “Hits/strikes a moving ball using a bat or racquet”. Similarly, physical education teachers cannot easily observe whether children are able to form letters using a pencil or to use scissors to cut paper. Therefore, if they had completed the checklist with the cooperation of their colleagues, the results may have been different. This is a limitation of this study which should be further examined. Consequently, there is a possibility that the results regarding the concurrent validity of the MABCC-2 may have been influenced by the educator type who completed the Checklist. For this reason it was decided to examine how well primary school teachers, preschool teachers and physical education teachers in Greece respond to the MABCC-2.

Differences were identified in the concurrent validity rates of the MABCC-2 among the different types of educators. The sensitivity, specificity and accuracy of the MABCC-2 were much higher in preschool and primary school educators, than the respective rates of the primary physical education teachers. Especially in the case of MABCC-2 specificity, regardless of the fact that was high in all three types of educators, best results were obtained in the case of preschool teachers where the indicator reached the predicted standards ($>.90$, APA, 1985). Given the fact that the MABCC-2 was developed in order to identify children with movement difficulties, much importance should be given in its sensitivity. The MABCC-2 yielded higher sensitivity value in the case of preschool teachers followed by primary school teachers, while the lowest sensitivity value was obtained in the case of physical education teachers. This result is in accordance with an older study where, Greek pre-school teachers exhibited a better ability to identify children with movement difficulties compared to their physical education colleagues (Kourtessis, Tsigilis Maheridou, Ellinoudis, Kiparissis & Kioumourtzoglou, 2008b). Moreover, in another study differences were identified in the assessment of children's motor performance made by classroom teachers and physical education teachers, where classroom teachers obtained better results than the physical education teachers (Capistrano et al., 2015). However, these results are not in line with the findings of other studies suggesting that physical education teachers manage to correctly identify more children with DCD than classroom teachers (Kiparissis, 2008; Papalexopoulou, 2003; Parkkinen & Rintala, 2004; Piek & Edwards, 1997).

The differences found in the present study in the outcome of evaluators can be attributed to several factors. One possible explanation may stem from the nature of educators' jobs. It seems that, even though, due to the nature of their job, physical education teachers should have a better picture of children's motor performance, pre-school and primary school teachers can probably better observe children's motor capacity in daily living situations. This result may be due to the fact that in the Greek educational system, preschool and primary school educators spend more time with the children (30 hours and 20 hours per week respectively) while primary school physical education teachers spend only three hours per week. Therefore, preschool and primary school teachers may observe and assess the motor development better than their physical education colleagues.

The most important reason however, is linked to the level of knowledge of teachers on DCD. For the MABCC-2 to be properly completed, teachers should have the relevant knowledge on the assessment of motor behavior. In any other case, their estimations may lead to misunderstandings. Nevertheless, research shows that educators do not have the necessary knowledge regarding DCD, a fact which usually results in wrong assessment of motor behavior. In a recent research, the knowledge of elementary school Cyprus educators regarding developmental coordination disorder in childhood (Anastasiadis, Kourtessis, Zisi, & Kioumourtzoglou, 2016), was found moderate. The teachers claimed that their overall knowledge on DCD is very limited and that they would benefit from ongoing education and training. The importance of the training of teachers for the early detection of DCD has also been mentioned in a relevant study assessing the effectiveness of a short intervention program designed to enhance the educators' ability to identify children with DCD. The results revealed that the intervention program significantly enhanced the educators' ability to identify children with DCD using the MABC-2 checklist (Kourtessis, et al., 2008b).

In summary, the findings of the present study revealed low rates of concurrent validity, in both the total and the separate groups of educators. Some of the questions included in the checklist may have been difficult to be observed by each group of educators or within the Greek school environment. Nevertheless, it is believed that these questions may have been answered, if their completion was done in teams or even with the cooperation of the students' parents. Therefore, the authors of the present study believe that the findings of the present study were not affected by cultural factors but, may have been influenced by the level of knowledge of the participating educators.

Conclusion

In this study, the concurrent validity of the MABCC-2 was examined within a Greek population-based sample. The low rates of concurrent validity of the Greek translation of the MABCC-2 suggest that the exclusive use of the MABCC-2 is not sufficient to identify children with motor difficulties in Greek school context. Taking into consideration the fact that the level of understanding and perception of human movement of each group of evaluators, may have influenced the results, it is suggested that the completion of such a checklist should be a team and multidisciplinary work among the various educators and related professionals who are involved in the child's education and every day physical activity and not an individual single-sided process.

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