99 - IDENTIFICATION OF CHILDREN WITH MOTOR COORDINATION DIFFICULTIES: APPLICATION OF THE CHECKLIST

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INTRODUCTION

Developmental Coordination Disorder (DCD) is a chronic condition, often permanent, found in children characterized by difficulties in motor coordination and control. The children diagnosed with DCD are unable to develop fully movement capabilities that are necessary to perform a series of daily activities in the school and at home. These children, for example, show delays in fundamental motor patterns as walking, jumping, clumsy movements in the object manipulation, and low performance in sport competition. As a consequence, children with DCD tend to be away of all activities that require a certain level of motor coordination. Some studies have pointed out serious consequences in the social and affective behavior of the child with DCD (e.g., Schoemaker & Kalverboer, 1994). These authors have shown that DCD children are more introverted, beyond of judging themselves less competent not only physical but also socially as compared with children without DCD.

The clinical picture of children with DCD can still be more serious due to frequent co-morbidity due to other developmental disorders as the Attention-Deficit/ Hyperactivity Disorder. According to Jongmans and cols (2003), there is a prevalence of DCD in approximately 6% of the children from 5 to 11 years of age. The authors also indicated that in the literature there are reports for a variability in this picture that goes from de 2,7% to 15,7%. They considered also that the underlying mechanisms to this lack of motor control are not well explained and that some studies have shown that children with DCD show some deficit in the neuromuscular function (Johnston, Burns, Brauer, & Richardson, 2002; Pereira, Landgren, Gillberg, & Forssberg, 2001).

According to the American Psychiatric Association (1994) there are four criteria for DCD diagnose. It is diagnosed when a child's motor ability is significantly lower than would be expected given the child's age and intellectual ability. The second indicates that the disorder from the first criteria must interfere with academic performance or in the person daily activities. The third indicates that such disorders cannot be related to medical condition. And, finally, the fourth indicates that if a mental retardation is present, then the motor difficulties should be associated with the retardation.

Among the various motor tests used for quantitatively diagnose a person with DCD, probably the most popular is the Movement ABC (Movement Assessment Battery for Children, M-ABC) (Henderson & Sugden, 1992). The test consists of eight items in the three following categories: manual dexterity, ball skills and balance. If the total score in the Movement ABC is below the 15th percentile or the 5th percentile, then these children could be included in the DCD group (Schoemaker et al., 2001).

The test Movement ABC was designed to be applied in children with ages between 6 the 12 years. The battery is divided in four age groups: from 4 to 6 years, 7-8, 9-10, and 11-12. Differently from other tests that use the same task for children of different age groups, the Movement ABC has as principle to evaluate the same abilities in all age groups but using different motor tasks.

An important aspect of the Movement ABC is the checklist that can be applied by parents, teachers and other professionals in order to perform a first assessment of the child motor difficulties. This checklist contains 48 items associated to motor activities performed by children in the school environment, as for example, to write, to cut, to run, among others. According to Barnett and Henderson (1998), the checklist must be filled by the teacher in a period of time that allow him/her to have a careful observation of the child behavior in both the classroom and the playground.

The value of using the checklist for identification of children with motor problems was shown by Wright and cols. (1994) in a study with children conducted in Singapore. The research done by Wright and cols showed results of the checklist filled by teachers very close to those obtained with the test Movement ABC. These results point out the effectiveness in the use of the M-ABC checklist in the diagnostic of children with motor coordination problems. The use of this list by teachers seems to be an important strategy in the sense of minimizing the time spent in the application of the Movement ABC as it takes approximately 20 minutes to apply the test individually. Therefore, in the school context, where the number of students is very large, the use of the checklist to perform a first screening in the identification of children that needed to be tested seem to be of great importance.

This investigation consists of the assessment of the ability of teachers of elementary school in Brazil to identify children with motor coordination problems via a checklist (Henderson & Sugden, 1992). Such assessment can be justified on basis of the teachers professional preparation is specific of each country and studies on this nature were not made in Brazil yet. The use of the checklist by teachers seems to be of singular importance in the sense of minimizing the time needed in the application of the M-ABC, as the application of this test to each child takes approximately 20 minutes. Thus, in the school context where the number of students is very high, the use of the checklist in order to perform a first screening in the identification of children that need to be tested in terms of motor coordination seems to be of great value. The problem we raised in this study consisted of the skill of elementary school teachers in Brazil to perform this initial identification of children motor capacities through the checklist.

METHOD

Participants: All children from first and second grades of an elementary public school were invited to participate in this study. Parents were required to sign a Consent form for theirs children participation after obtaining information of the objectives and procedures adopted in this study. Participants were children of 7 (n=119) and 8 (n=79) years of age, 96 boys and 102 girls (N=198), The classroom teachers of these children (n=13) also participated in this study and signed the Consent form as required by the Ethic Committee. According to the school records, none of the children had physical, neurological or mental known disorder.

Materials: A set of materials from Harcourt Assessment Company was used. for Movement ABC and a translation for Portuguese of the checklist were used for data collection. Data were registered in a PC and analyzed via Statistica 6.0 for Windows.

Procedures: We explained to the teachers how to use the check-list and left the check-list forms with them for completion in the time required. It took approximately one month to have all forms returned and no information was given to the teachers about the level of performance of the children in the test M-ABC.

The checklist can be used both as a screening tool as well as a means for planning intervention. The checklist contains four sections that are related directly to skill performance, in progressively more complex situations: (1) child stationary-environment stable; (2) child moving-environment stable; (3) child stationary-environment changing; and (4) child mobbing-environment changing. Section 5 is directed to the global behavior of the child. Each section has 12 items to be assessed.

Taking into consideration the total set of items of the sections 1-4, of the checklist to M-ABC, the child can have scores varying from 0 to 144. However, for section 5, the score vary from 0 to 24. Similarly to the test M-ABC, the higher the total score from

section 1-4, and 5 of the checklist, the worst is the child motor competency and behavior respectively. The same cut-off points used in the M-ABC as criterion for identification of those in the DCD and at risk group are used for the total score of sections 1-4.

The test M-ABC was administered individually by researchers and university students from UNESP, trained in the assessment and treatment of children. It was done in the school setting, in a room specially prepared and without obstacles in order to facilitate the child's performance of the tests. The M-ABC consists of eight tasks, three of manual dexterity, two of ball skills, and three of static and dynamic balance (Henderson & Sugden, 1992). The tests are designed for four age groups: 4 to 6, 7-8, 9-10, 11-12 years of age. The present study focused the assessment of children of 7-8 years of age and the time required for assessment of each child varied between 20 and 30 minutes.

.The total score a child can obtain in the test M-ABC vary from 0 to 40. As in the checklist, the higher the score the worst is his (her) performance in the battery. If the child's score is at or below the 5º percentile, then he/she will be considered as having severe motor difficulty, thus DCD. If the child's score is in the interval between the 5º and the 15º percentile, then he/she will be considered as having moderate motor difficulty, thus at risk. Those children with scores above the 15º percentile are considered as normal, therefore without motor difficulties.

RESULTS

Relationship between the checklist (sections 1- 4) and the M-ABC test

Pearson Correlation was used for assessment of the degree of agreement between each of the section from the checklist filled by the teachers and the results from the test M-ABC obtained by the children. Table 1 shows that not only the correlation coefficients between the score from each section and the M-ABC total score as well as the correlation coefficient of the sum of scores from section 1 to 4 and the M-ABC total score indicated a very low correlation. According to these results, all correlation coefficients between the checklist and the M-ABC scores did not reach level of statistical significance.

Checklist	Test M-ABC
Section 1	.17 ns
Section 2	.14 ns
Section 3	.15 ns
Section 4	.17 ns
Section 1-4	.17 ns

ns (not significant, $p > .01$)

TABLE1. Level of agreement between each section of the checklist and section 1-4 and the M-ABC results.

Table 2 shows the absolute and relative frequency (%) of children identified as DCD, at risk of developing DCD and children without motor difficulties (normal) for the checklist and the M-ABC. According to the literature, the results of the present study showed prevalence of DCD around 7%. A relevant aspect shown in Table 2 is the corrected identification by classroom teachers of children at risk of DCD (58,82%) and normal (60,47%). However, teachers were able to identify only 14,28% children as having DCD.

	Checklist	Test M-ABC	Correct Ident
Percentile	N (%)	N (%)	N (%)
5° percentile (DCD)	15 (7,58)	14 (7,07)	2 (14,28)
5°-15° percentile(at Risk)	70 (35,35)	17 (8,59)	10 (58,82)
16°+ (Normal)	113 (57,07)	167 (84,34)	101 (60,47)
TOTAL	198	198	113

TABLE 2. Absolute frequency (% in parenthesis) identified by checklist and test M-ABC and corrected identification by teachers of children as DCD, at risk and normal.

In order to examine differences among the four sections of the checklist filled by classroom teachers as a function of the children gender and age, the total score obtained in the checklist were submitted to a ANOVA 2 (Gender) x 2 (Age) x 4 (Section) with repeated measures in the last factor. Gender involved the sex (male and female), age involved children with 7 and 8 years old. The main factor section included the four sections (1, 2, 3, and 4) of the checklist of the M-ABC.

The ANOVA results indicated a significant main effect for gender, $F(1,194) = 4.52$, $p < 0.05$; age, $F(1,194) = 62.76$, $p < 0.001$ and section, $F(1,582) = 36.94$, $p < 0.001$. The following interactions also reached level of significance, Gender x Section, $F(3,582) = 3.03$, $p < 0.05$, and Age x Section, $F(3,582) = 5.03$, $p < 0.01$. For gender x section interaction, Figure 1 shows that the girls had higher scores than boys in the four sections of the M-ABC checklist. In addition, Figure 1a shows that the higher the number of the section, larger is the difference between boys and girls. The section number corresponds to the situations where the child is stable or in movement and the environment is stable of or changing. The higher the section, more difficult is the task.

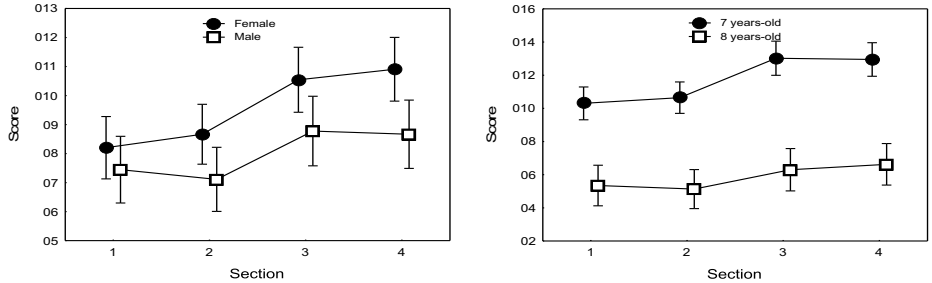

FIGURE 1. Mean and standard deviation of the total score in the test M-ABC as a function of checklist section and gender of the child (male and female).

DISCUSSION

The time needed for M-ABC test application is a factor to be considered when we plan, for example, to assess the total population of an elementary school. It takes between 20 and 30 minutes to assess one child depending on the easy with which the child performs each task of the battery. In this case, the utilization of the checklist that is included in the M-ABC test may be an important tool for screening purposes to select the children that must be assessed by the M-ABC test. The objective of this study was to examine elementary school teachers' ability to identify children with motor coordination difficulties through the M-ABC checklist.

The present study results showed that the correlation coefficients between the score from the checklist as assessed by

elementary school teachers and the scores from the M-ABC test were very low. Specifically, these results indicate that teachers had difficulty in identifying children not only with motor difficulty but also without motor difficulty. Prior studies that examined the correlation between the M-ABC checklist results and the M-ABC test also showed relatively low correlation coefficients (Junaid, Harris *et al.*, 2000; Schoemaker, Smits-Engelsman *et al.*, 2003). In specific, Junaid and colleagues argued that the lack of a high correlation between these results (checklist and test M-ABC), cannot be considered sufficient for the use of the checklist as a tool for screening. A relevant aspect examined by Piek and Edwards (1997) was to look at physical education teachers applying the checklist. Piek and Edwards reported that physical education teachers identified children with DCD or at risk, better than the classroom teachers have done. It is possible that the low results in the correlation coefficient occurs due to the difficulty classroom teachers have in filling the checklist form as a result of not being adapted to the environment where motor activities take place, the patio or the gymnasium

In addition to the correlation analysis, the percentage of corrected identification of children with motor difficulties (i.e, DCD and at risk) and without motor difficulties (normal) by the classroom teachers was calculated. In particular, teachers failed in identifying children with severe motor difficulties as only 2 children out 14 were correctly identified as DCD. Also, 10 out 17 were identified as at risk of developing DCD. The classroom teachers identified correctly 101 out 167 children as not having motor difficulty. Moreover, the degree of total agreement between the identification by the teacher using the checklist and the M-ABC test children results with and without motor difficulties was 57.07%. These results indicate a very low percentage of correct identification by the teachers via checklist, having the M-ABC test as a criterion measure. The results in the present study are similar to those obtained by Junaid and colleagues (2000), in which the identification of a children with motor difficulties by the checklist was so low that many children with motor problems or at risk, based on M-ABC performance were not identified. In contrast, in a more recent study conduceted by Shoemaker and colleagues (2003), classroom teachers were capable of identifying a relatively high percentage of children with motor difficulties. It is possible that differences in perception by the teachers related to children's motor performance in general and in daily activities have influenced the results. In addition, it could be that teacher's academic background related to body concept and motor skills may vary from country to country.

Finally, the ANOVA results revealed that the mean score was significantly higher for the seven-years old than for the eight-year old children. This result indicates that teachers can perceive better the motor behavior of older children as compared to the youngest ones. Teachers were also able to perceive better the qualities of motor behavior of boys than of the girls. The difference between boys and girls increased as the level of complexity of the checklist sections also increased. The increased level of movement difficulty suggested by the authors of the M-ABC were confirmed, in which the mean scores between sections 1 and 2, and 3 and 4 were very close.

CONCLUSION

The results indicated that classroom teachers in Brazil show some difficulties of identifying children with motor problems both severe (DCD) and moderate (at risk). Therefore, the identification through the M-ABC checklist needs to be accompanied by the application of the M-ABC test. It is suggested for future investigation to examine whether physical education teachers would identify, based on M-ABC test, children with DCD and at risk through the M-ABC checklist.

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IDENTIFICATION OF CHILDREN WITH MOTOR COORDINATION DIFFICULTIES: APPLICATION OF THE CHECKLIST

Abstract

Introduction**:** Developmental Coordination Disorder (DCD) is characterized as a huge difficulty in movement coordination, usually permanent, not related to physical, neurological and/or mental problems. The diagnose is obtained from the *Movement ABC* (Movement Assessment Battery for Children, M-ABC, Henderson & Sugden, 1992), a standardized battery that consisted of eight items in three categories: manual dexterity, ball skills, and balance. A check-list is used by teachers in order to provide assessment of the nature and incidence of movement difficulties by children. Taking in consideration the results of the test of motor competence from the M-ABC, the objective of this study was to verify, in our educational context, the ability of teachers from elementary school to identify children with motor difficulties through the check-list. Method**:** Participants were 198 students

between 7 and 8 years of a public elementary school and the 13 classroom teachers. Children were assessed through the check-list by theirs classroom teachers and through the motor competence test M-ABC by the researchers and university students, duly trained. Results. A low correlation between the results obtained by the teachers in the check-list and the results obtained in the M-ABC, $r = .17$, $p > 0.01$. Teachers were able to correctly identify 41,9% of the children with high (DCD) and low (at risk) motor difficulties. Conclusion**:** The results pointed out that classroom teachers have difficulty identifying children with severe (DCD) or moderate (at risk) motor difficulties. Therefore, this identification must be complemented by the motor component of the M-ABC. A question raised from these results is weather physical education teachers when available and working in the shool setting would be able to identify correctly children with DCD and/or at risk using the check-list.

Key-words: assessment, motor coordination, children

IDENTIFICATION DES ENFANTS AVEC DIFFICULTES EN COORDINATION MOTRICE: UTILISATION DE LA LISTE DE CONTROLE

Rèsumé

Introduction**:** La Désordre Développemental de Coordination (DCD) est caractérisée par une grande difficulté de coordination de mouvements, sans rapport aux problèmes physiques, neurologiques et /ou mentales. Diagnostiquée par le *Movement ABC* (Movement Assessment Battery for Children, M-ABC, Henderson & Sugden, 1992), cette batterie est uniformisée et consiste en huit items en trois catégories: dextérité manuel, habileté avec ballon et équilibre. Une liste de contrôle remplie par les professeurs pour informer la nature et l'incidence de difficultés motrices des enfants est comprise dans la batterie. En ayant comme référence les résultats du test de compétence motrice M-ABC, l'objectif de l'étude a été de vérifier, dans notre contexte, l'habileté des professeurs de l'éducation fondamentale en identifier les enfants avec difficultés motrices par le moyen d'une liste de contrôle. Méthode**:** Ont participé de cette étude 198 enfants entre 7 et 8 ans d'une école publique d'éducation fondamentale et 13 professeurs de classe. Les enfants ont été évalués au moyen d'une liste de contrôle par les professeurs de classe et par le test de compétence motrice M-ABC, par chercheurs et étudiants d'université du Cours d'Éducation Physique, dûment instruits. Résultats**:** Il y a eu une basse corrélation entre les résultats obtenus par les professeurs avec la liste de contrôle et les résultats du test M-ABC, $r = .17$, $p > 0.01$. Les professeurs ont été capables d'identifier correctement 41,9% des enfants avec DCD et de risque. Conclusion**:** Les résultats indiquent que les professeurs de classe ont présentés des difficultés en identifier les enfants avec DCD ou en risque. Ainsi, telle identification doit être nécessairement accompagnée de l'application du test motrice M-ABC. Une question élevée est si le professeur d'éducation physique, quand disponible et performant dans l'enseignement fondamental, pourrait identifier correctement les enfants avec DCD ou en risque, au moyen de la liste de contrôle.

Mots clés: Évaluation, coordination motrice, enfants.

IDENTIFICACIÓN DE NIÑOS CON DIFICULTADES DE COORDINACIÓN MOTORA: USO DE LA LISTA DE CONTROL

Resumen

Introducción: El D*esorden de Desarrollo de la Coordinación* (DCD) es caracterizado por una grande dificultad en la coordinación de movimientos, no relacionada a problemas físicos, neurológicos y/o mentales. Diagnosticada por el *Movement ABC* (Movement Assessment Battery for Children, M-ABC, Henderson & Sugden, 1992), esta batería es estandarizada y se constituye de ocho testes en tres categorías: destreza manual, habilidades con pelota y equilibrio. Una lista de control rellenada por los profesores para informar la naturaleza y la incidencia de las dificultades motoras de los niños está inclusa en la batería. Teniendo como referencia los resultados del M-ABC, el objetivo del actual estudio fue verificar, en nuestro contexto, la habilidad de las profesoras de educación básica en la identificación de niños con dificultades motoras. Método**:** Participaron de este estudio 198 niños entre 7 y 8 años de una escuela pública de enseñanza básica y 13 profesoras de estos niños. Los niños fueron evaluados por medio de la lista de control por sus profesoras y por medio de la prueba de capacidad motora M-ABC hecho por los investigadores y alumnos del Curso de Educación Física, debidamente entrenados. Resultados: Hubo correlación baja entre los resultados obtenidos por las profesoras con la lista de control y los resultados de la prueba M-ABC, $r = .17$, $p > 0.01$. Las profesoras fueron capaces de identificar correctamente 41,9% de niños con DCD y en riesgo. Conclusión**:** Los resultados indican que las profesoras presentan dificultad en identificar niños con dificultades motoras graves (DCD) o moderadas (en riesgo). Por lo tanto, tal identificación debe ser necesariamente acompañada de la aplicación de la prueba motora M-ABC. Una cuestión destacada desde los resultados es si el profesor de educación física, cuando disponible y actuante en la enseñanza básica, identificaría correctamente niños con DCD o en riesgo por medio de la lista de control.

Palabras Claves: evaluación, coordinación motora, niños.

IDENTIFICAÇÃO DE CRIANÇAS COM DIFICULDADES NA COORDENAÇÃO MOTORA: USO DA LISTA DE CHECAGEM

Resumo

Introdução: A *Desordem Coordenativa Desenvolvimental* (DCD) é caracterizada por uma grande dificuldade na coordenação de movimentos, geralmente permanente, não relacionada a problemas físicos, neurológicos e/ou mentais. Diagnosticada pelo *Movement ABC* (Movement Assessment Battery for Children, M-ABC, Henderson & Sugden, 1992), esta bateria é padronizada e consiste de oito itens em três categorias: destreza manual, habilidades com bola e equilíbrio. Uma lista de checagem preenchida pelos professores para informar a natureza e incidência das dificuldades motoras das crianças esta incluída na bateria. Tendo como referência os resultados do teste de competência motora M-ABC, o objetivo do presente estudo foi verificar, em nosso contexto, a habilidade das professoras da educação fundamental na identificação de crianças com dificuldades motoras através da lista de checagem. Método**:** Participaram deste estudo 198 crianças entre 7 e 8 anos de uma escola pública de ensino fundamental e 13 professoras de classe destas crianças. As crianças foram avaliadas através da lista de checagem pelas professoras de sala de aula e através do teste de competência motora M-ABC por pesquisadores e alunos do Curso de Educação Física, devidamente treinados. Resultados. Houve baixa correlação entre os resultados obtidos pelas professoras com a lista de checagem e os resultados do teste M-ABC, $r = .17$, $p > 0.01$. As professoras foram capazes de identificar corretamente 41,9% de crianças com DCD e de risco. Conclusão**.** Os resultados indicam que as professoras de classe apresentam dificuldade em identificar crianças com dificuldades motoras tanto graves (DCD) como moderadas (em risco). Portanto, tal identificação deve ser necessariamente acompanhada da aplicação do teste motor M-ABC. Uma questão levantada a partir dos resultados é se o professor de educação física, quando disponível e atuante no ensino fundamental, identificaria corretamente crianças com DCD ou em risco através da lista de checagem.

Palavras Chaves: avaliação, coordenação motora, crianças.