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Original Article

Motor competence and implications in primary school

MATHISEN, GUNNAR E.
School of Sport Sciences, UiT The Artic University of Norway, NORWAY

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Abstract:
The level of motor competence for six-year-old children are of special interest because at this age they have started at school, and they have to master new requirements. Ninety-four children were tested in fine- and gross-motor skills, by the Movement ABC test. Within the fifth percentile of the USA norms, 9.6 % of the children would have to be classified as to have motor problems, with 11.7% classified in the 'borderline' group. Sex difference were apparent in the section for manual dexterity, but in the sections balance and ball skills there were no significant differences, however, the girls were shown some better performance in balance skills. Finding from the present study shows boys falling into the motor impaired group to 12% and 6.8% for the girls. The cross-sectional data may provide a basis for recommendations for intervention programme for children with low motor competence in the primary school.
Key words: motor competence; six-year-old children; motor impairment; motor skill testing

Introduction

Motor competence play a significant role in fitness level, and are important for general health (Lubans et al., 2010; Cantell et al., 2008; Blair et al., 2001). When children are six-year-old, they have to master different motor skills, and have a basic motor competence that is necessary in school. Difficulty with daily living skills as dressing and gross motor activity as play in schoolyard will reduce the children participation (Summers et al., 2008). Motor learning is as a set of processes related to practice or experience that lead to relatively permanent change in the ability to perform motor skills. Furthermore, motor development are connected to the concept of motor learning, and is a continuous change in motor behaviour throughout the life cycle, brought about by the movement task, the biology of the individual, and the conditions of the environment (Gallahue & Ozmun, 2006).

Children who have problems with motor skills like running, climbing or ball-skills are often reffered to as clumsy, motor impaired or children with DCD (developmental coordination disorder), and have been shown to be less physically active than their peers, they often withdraw or are shut out from play with other children (Geuze et al., 2001; Smyth & Anderson, 2000). Activity stimulate motor development, while insufficient activity reduce motor development (Cantell et al., 2008; Fisher et al., 2005), and a cycle with resistance to practice will get consequences for normal motor development. Motor impairments is supposed to be caused by lack of experience, delayed biological maturation or a combination of the two (Sigmundsson, 2005). Research points to some of the circularity in causal network, children with motor problems have shown to be less physically active than that of their peers (Wrotniak et al., 2006), and is often associated with other problems like bad self-image, concentration problems and learning difficulties (Green et al., 2008; Skinner & Piek, 2001). It is important to discover the problems at an early stage, and possibly bring into action any enterprise (Lahno et al., 2015). In the absence of an intervention, the syndrome will likely continue to manifest itself, although there may be some alleviation over the years (Pless et al., 2002).

Research is indicating that 5-6 % of school-children are categorised as motor impaired (Zwicker et al., 2012). The results are similar to the previous estimates, the general range reported are 5-10 % (Kadesjö & Gillberg, 1999). Sigmundsson & Rostoft (2003) tested 91 pre-school children aged four to five years, and found only one out of these children would be classified as motor impaired, but seven children as `borderline`, that means that they are in risk sone to develop motor impairment. Some findings indicate that boys more often have motor problems than found among girls (Missiuna et al., 2008). The present study is focusing on primary school children. At school, we can reach the whole population, and if we can identify children with in risk zone at an early phase, we have possibility to provide support and prevent later problems.

Method

Participants and tests

A number of 94 six-year-old children participated in the study. They were selected from two schools in an urban area in Norway, and the children come from a wide range of socio-economic backgrounds. The Movement Assessment Battery for Children (M-ABC-test) was applied for movement skill assessment

Corresponding Author MATHISEN, GUNNAR E., E-mail: gunnar.mathisen@uit.no

(Henderson & Sugden, 1992). On the basis of the norms it is possible to establish whether a child has a normal motor performance, `borderline` performance, or regarded as children with motor problems. Children scoring at or below the 5th percentile of the Movement ABC are regarded as children with motor problems, and children scoring at or below 15th percentile is `borderline` performance group (Henderson & Sugden, 1992).

The Movement ABC-test (version 1992) consist of three sub-tests, with eight items, the content of which differs depending on the age range for which the test is used, and have shown good reliability and validity of the movement assessment in children (Croce et al., 2001). The sub-tests and items are as follows: *manual dexterity,* with the items posting coins, threading beads and 'bicycle' trail (drawing skill); *ball skills*, with the items catching beanbag and rolling ball into goal and *balance*, with the items one leg balance, jumping over cord and walking heels raised. On each item, a score from 0 to 5 can be given, a higher score indicating worse performance. Scores on manual dexterity and balance range from 0 to 15, while scores on ball skills range from 0 to 10. Summation over the sub-tests results in a total score, which ranges from 0 to 40. The administration and scoring was carried out according to the prescription given in the test manual. The children were tested at their school in a quiet room, where they were alone with the experimenter. Two trained experimenters carried out the testing.

Data Analysis

The test result was converted to scaled scores, according to norms presented in the manual. In the present study, the focus was on children`s scaled scores dealing exclusively with the totals for the test as a whole, and for the three sub-sections. Mann-Whitney U-test was carried out for statistical analyses.

RESULTS

Distributions as Percentages of Total Scores

Distributions in percentages of M-ABC-score of 6-year-old Norwegian children are presented in Table 1. Children scoring at or below the 5th percentile (score 13+) of the M-ABC test are regarded as children with motor problems, and scoring at or below 15th percentile (score 10-13) is `borderline` performance group (Henderson & Sugden, 1992). It will be seen that 9.6 % of the population were below the 5th percentile, and of these were 12 % boys and 6.8 % girls.

Table 1. Distributions in percentages of Movement ABC-score of six-year-old children (n = 94)

Movement ABC-score	Percentile	Boys (n = 50)	Girls (n = 44)	Both sexes (n = 94)
0 – 4,5	49 -100	34,0	52,3	42,6
5 – 9,5	16 - 48	36,0	36,4	36,2
10 – 13	6 - 15	18,0	4,5	11,7
13,5 +	< 5	12,0	6,8	9,6

Movement ABC Items Scores

The mean scores and standard deviations (SD) on M-ABC test items are presented in Table 2. The mean total score for the boys were 7.2 and for the girls 5.4 which indicate a significant difference between the sexes. The total score for *manual dexterity*, and for the item *threading beads* indicate significant difference.

Table 2. Mean values and standard deviations (SD) on Movement ABC items for six-year-old children (n = 94, 50 boys and 44 girls).

Movement ABC-score	Mean (boys)	SD (boys)	Mean (girls)	SD (girls)	P^a
Total	7.2	4.3	5.4	4.0	0,032
Manual dexterity	3.8	2.1	2.5	1.8	0,001
Posting coins	1.6	1.1	1.3	0.8	n.s
Threading beads	1.9	1.1	1.0	1.1	0,001
Bicycle trail	0.2	0.5	0.1	0.4	n.s
Balls skills	1.6	1.5	1.5	1,4	n.s
Catching bean bag	0.6	0.8	0.7	1,0	n.s
Rolling ball into goal	1.0	1.2	0.8	1,1	n.s
Balance	1.6	1.7	1.3	2,0	n.s
One leg balance	0.9	1.3	0.8	1,2	n.s
Jumping over cord	0.3	0.7	0.3	0,9	n.s
Walking heels raised	0.4	0.7	0.2	0,4	n.s

p^a Mann-Whitney U-test (two-tailed). n.s. (not significant).

Discussion

Motor competence

This study indicates that 9.6 % of the children have motor problems, and 11.7 % as borderline group according to standardisation with M-ABC-test. To draw comparison to previous research shows 5-10 % of children to be classified as motor impaired (Zwicker et al., 2012; Kadesjö & Gillberg, 1999). This result also indicate motor problems to be more common in the 6-year-age than in the 4-year-age (Sigmundsson & Rostoft, 2003). There might be a causal connection between low activity level and motor competence, and a possible explanation can be that children who fall within the borderline rating to be less inclined to take part in motor activities at which their more skilled peers excel, resulting in their becoming more incompetent by the age (Cantell et al., 2008; Smyth & Anderson, 2000). Fjørtoft (2000) reported significant differences in balance and co-ordination skills with 6- and 7-year-old children playing in natural environments, and concluded that this effect was due to the impact of playing in more challenging natural habitats. Fisher et al. (2005) found correlation between percent time spent in moderate to vigorous physical activity and movement skills score in preschool children.

Sex difference in this study is in accordance to other studies, and indicates boys to be more exposed (Missiuna et al., 2008; Mæland, 1992). Finding from the present study shows boys falling into the motor impaired groups to 12% and 6.8% for the girls, mostly because of difference in manual dexterity. In ball skills and balance skills, there were no significant differences between the sexes. Previous studies shows girls to do better than boys in balance-skills (Gallahue & Ozmun, 2006), and shows no differences between the sexes with respect to ball skills (Mæland, 1992). However, motor development are complex processes, and there is no agreement why boys are supposed to be more affected (Sigmundsson & Rostoft, 2003).

Motor impairment and implications at school

There is always a small group of children at school who would benefit from extra help with basic motor skills (Henderson, 1992), and this recearch confirm that point of view. These children have often problems with fine motor manipulations such as writing, buttoning and tying shoes and they require more time to respond in fine motor activities (Summers et al., 2008; Pless et al., 2002). The impairment may influence on daily motor tasks as fine motor activity like drawing and writing and gross motor activity as play in schoolyard, and it is unusual for motor problems to disappear over time (Pless et al., 2002). Motor skill observations, or in some cases tests by the time children start at school, can make a sense with early identification of children who might have motor problems. Among requirements in the school, successful education in writing, have to be on basis of perceptual development, cognitive ability and fine motor skills (Karlsdottir & Stefansson, 2003). Reports shows an overlap from 40-70% in skills like reading, writing and motor skills (Rintala et al., 1998), but the learning problems is too complex to deal with fully in this paper.

M-ABC-test or other motor tests can make sense to verify motor problems, but in most cases observations of the motor skill level done of a qualified teacher is sufficient. School-based movement programs have reported to contribute to motor learning of poorly coordinated children, and positive implications in terms of alleviating social problems (Barnett & Henderson, 1998), however, it is crucial that training programme can start before motor deficits become a bigger problem to the children (Cantell et al., 2008; Green et al., 2008).

Conclusions

This study indicates that some children possess problems with gross- and fine-motor tasks when they start at school. At school, it is important that a teacher skilled in motor development is present to provide training programs, and give the feedback that many of these children need to eliminate inefficient movement habit. There is a need for more recearch about motor competence and the comprehensive and causal connection to motor problems, and effects of intervention programs. For example what connection can we find between physical finess, motor competence and perceptual factors, or what effect does motor learning programme have as regards to methods, intensity, duration, frequency and feed-back.

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