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## Motor skills as a predictor of adaptive behaviour of pupils – pilot study

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### Abstract

The level of motor skills is an important indicator of a child's optimal growth and development. Shortcomings in this area can cause a gradual decrease in the child's activity in the school group, which negatively effects the child's adaptive behaviour. The aim of this pilot study was to analyse the relationship between the level of motor skills and the ability to adapt in a given social group – school class. The research group obtained 110 pupils of primary school aged 9–11. The data about adaptive behaviour skills were collected by Piers-Harris Children's Self-Concept Scale 2. The level of motor skills was monitored by TGMD-2 test. The research was authorised by the ethical committee of the pedagogical faculty at Olomouc. The aimed development of motor skills could lead to adaptation of pro-social behaviour also in older age categories. The data were collected within the Project IGA\_PdF\_2017\_002.

Keywords: Motorics, primary school, readjustment, children.

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## 1. Introduction

The level of a child's school readiness or school maturity decides if the child is ready to start compulsory school attendance. School maturity is described as the level of development that allows adaptation to the school's environment and school regime. If we add to all this also dispositions made by the learning and social environment, it is called school readiness (Prucha, Walterova & Mares, 2003).

The important role of assessment of school readiness and maturity for compulsory school attendance are indicators of a child's physical maturity. One of them is the level of motor skills – ability of movement coordination, functioning of visual-motor skills and also overall physical fitness of the future pupil. Current research indicates that there is a complex relationship in the degree of motor skills, cognitive skills and motor development mastered (Decker, Englund, Carboni & Brooks, 2011; Jenni, Chaouch, Cafilischa & Rousson, 2013; Michel & Roebbers, 2008; Rothlisberger, Neuenschwander, Michel & Roebbers, 2010).

The ability for successful participation in common physical activities affects the adaptation process in new social groups – school class. Gross motor skills allow playing with other children, lead to development of social competencies and understanding of social rules. Insufficiency in this area leads to a gradual lowering of the pupil's social attractiveness in the social group. The literature research is usually aimed at the area of social competencies in relation to the adaptive behaviour or inactivity of the child, which is the negative result of overweight or obesity (American Occupational Therapy Association, 2014; Barnett, O'Loughlin, Gauvin, Paradis & Hanley, 2006; Oliver, Schofield & Kolt, 2007; Smith et al., 2013). The mentioned areas are researched mainly because of mental disorders or prevalence of the child's future academic achievement (Grissmer, Grimm, Aiyer, Murrah & Steele, 2010; Venetsanou, Kambas, Aggeloussis, Serbezis & Taxildaris, 2007; Yang, Cheong & Hong, 2006).

Research works show the relationship between cognitive abilities and the level of motor skills. The deficits in the area of fine motor skills implicate an occurrence of learning disabilities and misbehaviour, which may affect a child's academic achievement and adaptation in the school class. A few research works also indicate that the level of the child's motor skills correlates with the ability of adaptation and social competencies (Arbesman, Bazyk & Nochajski, 2013; Cho, Ji, Chung, Kim & Joung, 2014; Diamont, 2007; MacDonald, Lord. & Ulrich, 2013; O'Donnell, Deitz, Kartin, Nalty & Dawson, 2012).

## 2. Aim of this research

The aim of this pilot study was to find the relationship between the level of pupils' motor skills and their adaptive behaviour in the social group – at the school class, and the following hypotheses were inferred: 1) A higher level of gross motor skills predicts a higher level of adaptive behaviour in children, 2) girls show a higher level of adaptive behaviour than boys, and 3) boys at this age have a higher level of gross motor skills than girls.

## 3. Methods

### 3.1. Research group

The research group was created by 110 pupils from the lower level of primary school (64 girls, 46 boys). The average age of the probands was  $9.67 \pm 0.91$  years (girls  $9.77 \pm 0.96$ , boys  $9.54 \pm 0.84$ ). The height and weight were normal according to WHO child-growth standards ([http://www.who.int/childgrowth/standards/Technical\\_report.pdf](http://www.who.int/childgrowth/standards/Technical_report.pdf)). No child was handicapped. The project was realised from March to May 2017 in primary schools in the Czech Republic. The research was approved by the Ethical Committee authorities. Legal representatives (children's parents) were informed about the aims, methods and process before the start of the research. The anonymity of obtained data was

declared. All questions about research were answered by researchers. After that the legal representatives confirmed the agreement about participation of their children in the research. Obtained data were processed anonymously. Possible questions from children were answered in accordance with their age. The participation in the research was voluntary, without reward and no benefits for participants. The pupils could interrupt or leave their participation during the research at any time. Data were obtained within the Project IGA\_PdF\_2017\_002.

### **3.2. Research methods and techniques**

Data of adaptive behaviour skills were collected by the standardised questionnaire Piers-Harris Children's Self-Concept Scale 2 (Piers & Herzberg, 2009). Sub-scale behavioural adjustment (BEH) monitors pupil's problematic behaviour (in terms of its denial or permission). In the mentioned category – behavioural adjustments are probands divided based on their T-score into categories. The category above average range ( $\geq 56T$ ) is created by children who are able to follow rules at home but also at school, which means that they fulfill parents' and teachers' expectations. In the average range (40–55T) category are children who are usually brought up well, but also show some misbehaviour from time to time. Low range ( $\leq 39T$ ) category scored children who are not used to follow social rules in a certain social group. Low scores in the behavioural adjustment scale could be connected with some psychological syndromes. The level of gross motor skills was monitored by Test of Gross Motor Development-2 (Ulrich, 2000). The test consists of two sub-tests: locomotor skills and manipulative skills. Obtained standard scores are converted on the percentile and motor quotient (Gross motor quotient – GMQ). Based on GMQ, the level of motor skills is assessed in the following categories: very superior ( $>130$  points), superior (121–130 points), above average (111–120 points), average (90–110 points), below average (80–89 points), poor (70–79 points) and very poor ( $<70$  points).

### **3.3. Statistical data processing**

Basic statistic values about research group (number of girls and boys, average, height, weight and age of probands) are expressed by the average number and standard derivation number. Score of Behavioural Adjustment and GMQ were assessed based on the current methodology (Piers & Herzberg, 2009; Ulrich, 2000). Independent variable was declared as the level of motor skills and the dependent variable was the level of behavioural adjustment. The relationship between the level of gross motor and behavioural adjustment was detected by Spearman's correlation coefficient ( $\rho$ ). Differences in the GMQ level between girls and boys were detected by the Mann–Whitney U-test. The level of significant importance was declared as  $p < 0.05$ . Data were processed by the software STATISTICA, version 13.0 (StatSoft).

## **4. Results**

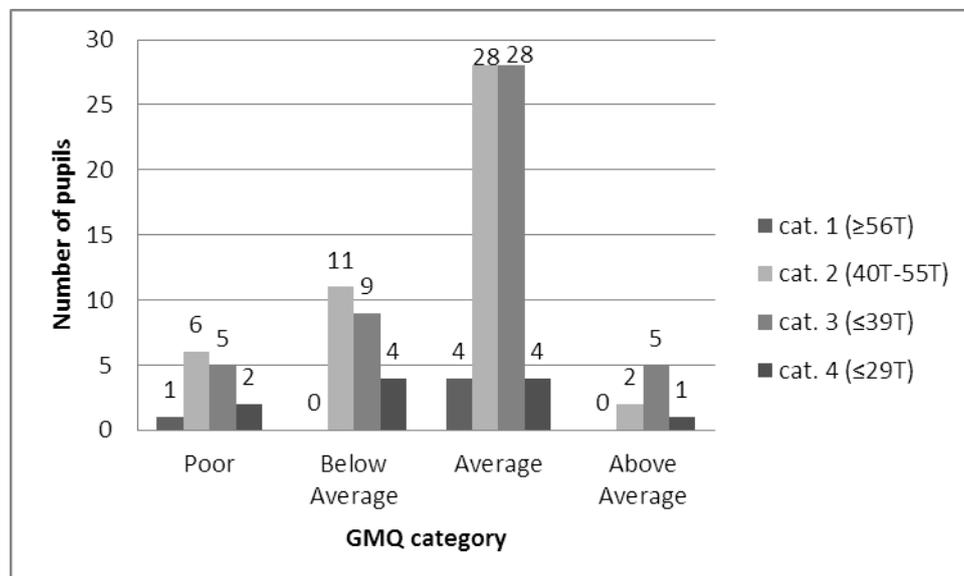
According to GMQ, most probands were in the categories average GMQ (58.18 %) and below average GMQ (21.82 %). Only 6.36 % of the monitored pupils were in the above average category. Poor GMQ was scored by 12.73 % of pupils. In the categories Superior, Very Superior and Very Poor according to GMQ, there was no proband found (Table 1). From the assessment of behavioural adjustment (BEH) it was clear that most pupils are in category 2 – Average range (42.73%) and category 3 low range (42.73%). According to Piers and Herzberg (2009), in the category low range are probands, who could, for example, have attention disorders connected with hyperactivity and behaviour disorders that could be classified as psychological syndromes. From the monitored group, only 4.55% of pupils were categorised into the above average range. On the other hand, in the very low range category was 10% of pupils (Table 1). The results provide evidence about the importance of continuous monitoring and discovering children with motor disorders. In the Czech Republic, these children are a part of ordinary school classes and do not have any diagnosed psychological symptoms

officially. Pedagogues in ordinary primary schools have no special education for the support of pupils with motor disorders and neither do they have special equipment for the development of motor skills.

**Table 1. Frequency occurrence of persons in the following categories GMQ in the context of adaptive behaviour categories**

GMQ/BEH	Category 1 (≥56T) above average range	Category 2 (40T–55T) above range	Category 3 (39T–30T) low range	Category 4 (≤29T) very low range	Overall
Very superior	0	0	0	0	0
Superior	0	0	0	0	0
Above average	0	2	5	1	8
Average	4	28	28	4	64
Below average	0	11	9	4	24
Poor	1	6	5	2	14
Very poor	0	0	0	0	0
Overall	5	47	47	11	110

Legend: GMQ – categories of Gross Motor Quotient; Very Superior – GMQ > 130 points; Superior – GMQ 121–130 points; Above Average – GMQ 111–120 points; Average – 90–110 points; Below Average – 80–89 points; Poor – 70–79 points; Very Poor – <70; BEH – categories of Behavioural Adjustment; cat.1(≥56T) – category of Behavioural Adjustment in the level Above Average range; cat. 2 (40T–55T) - category of Behavioural Adjustment in the level Average range; cat. 3 (39T–30T) – category of Behavioural Adjustment in the level Low range; cat. 4 (≤29T) – in pupils are options of behavioural disorders and disorders of attention.



**Figure 1. Frequency occurrence of pupils according to T-score of Behavioural Adjustment in GMQ categories (n = 110)**

The average score in the GMQ variable was  $94.16 \pm 10.70$  points; for boys it was  $90.41 \pm 10.56$  points and for girls  $96.86 \pm 10.05$  points. The average score in the Behavioural Adjustment variable was  $7.10 \pm 2.66$  points; for boys it was  $6.78 \pm 2.74$  points and for girls  $7.33 \pm 2.58$  points. There was no

confirmed relationship between the level of gross motor skills and the level of children’s Behavioural Adjustment ( $p = 0.012, p = 0.09$ ) (Figures 2–4).

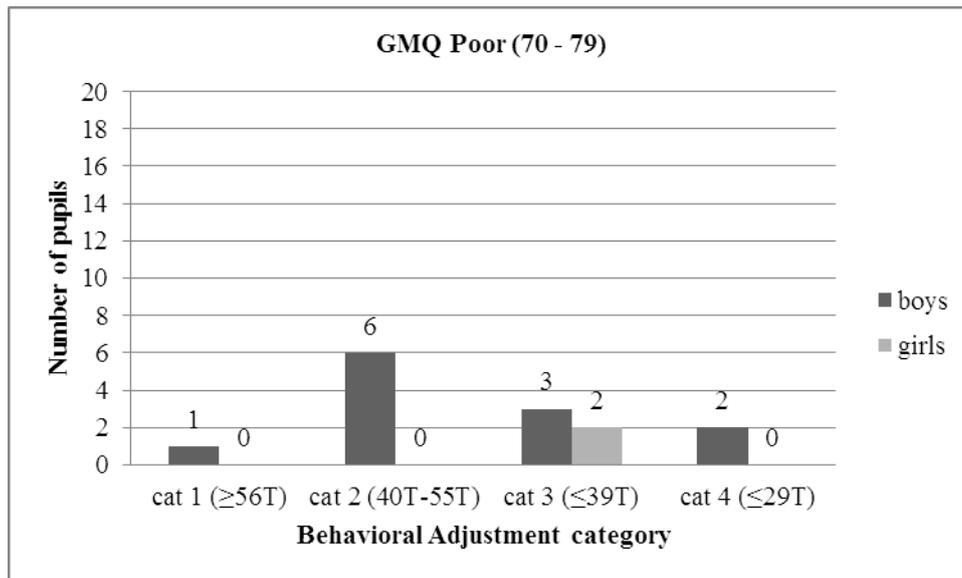


Figure 2. Frequency occurrence of pupils according to T-score of Behavioural Adjustment in Poor GMQ category ( $n = 14$ )

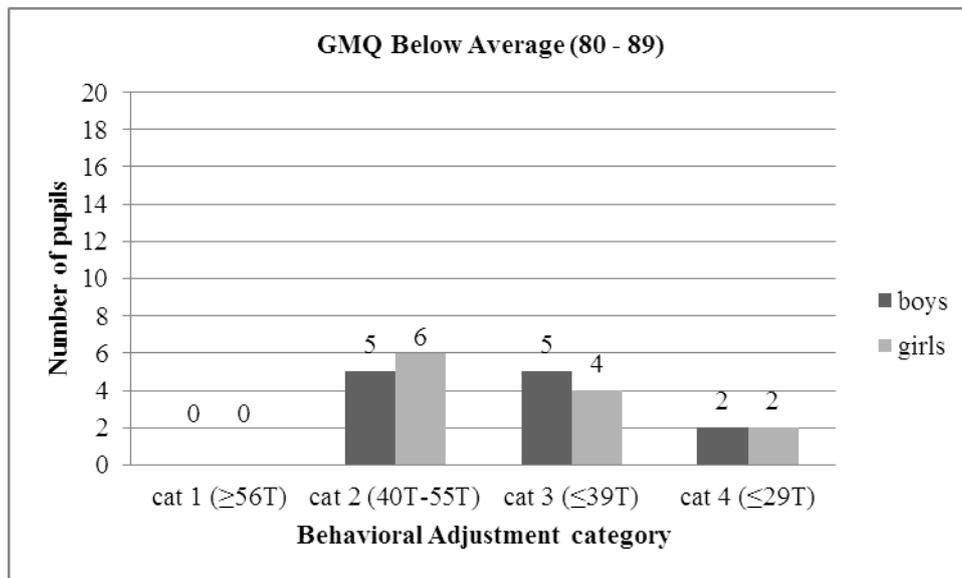


Figure 3. Frequency occurrence of pupils according to T-score of Behavioural Adjustment in Below average GMQ category ( $n = 24$ )

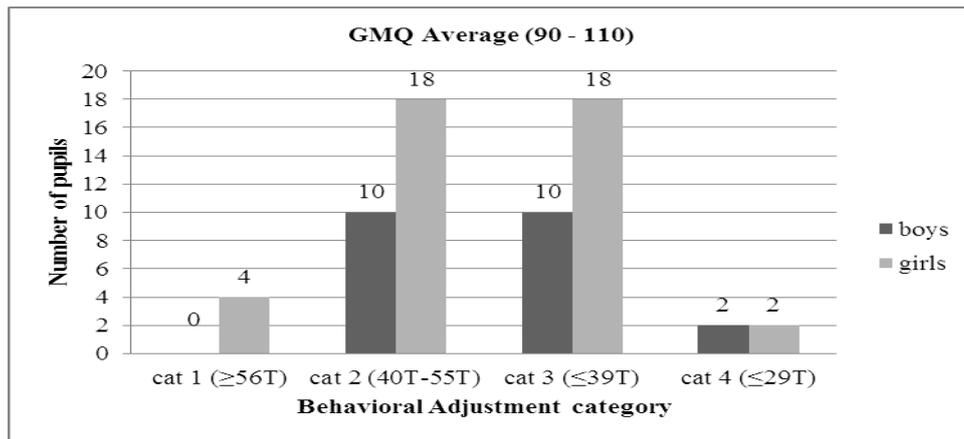


Figure 4. Frequency occurrence of pupils according to T-score of Behavioural Adjustment in Average GMQ category ( $n = 64$ )

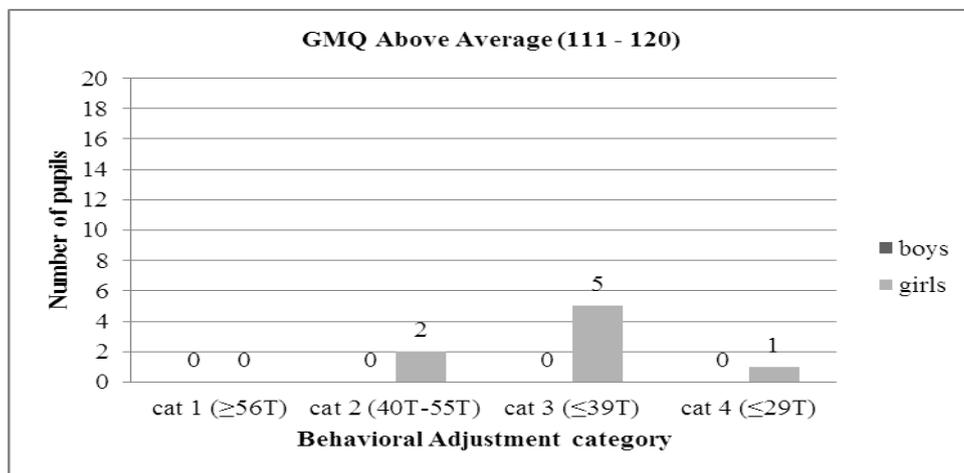


Figure 5. Frequency occurrence of pupils according to T-score of Behavioural Adjustment in Above average GMQ category ( $n = 8$ )

The result could probably be caused by the low number of pupils in the research group. This fact signalled the need for a larger research group. Another possible limitation is the non-representative sample. A research group was created by the children whose parents/legal representative confirmed written participation in the research. In general, the willingness for cooperation in the research over the decades is lower and lower in the Czech Republic. One of the possibilities is low sensitivity of the chosen tool in the context of the research aim.

In some partial research on children or adolescents with handicaps (Chen & Cohn, 2003; Leigh et al., 2015; Skinner & Piek, 2001), the relationship between motor skills and social competencies is confirmed. For example, Emck, Bosscher, Beek and Doreleijers (2009), who studied the relationship between motor skills and behavioural development disorders state that these children are limited during children’s games. This could lead to fixation of an inactive lifestyle. Insufficiency of contacts with peers predicts further disruption of the psychosocial development of a child. Authors agree on the need for further research of the problematics. Mann–Whitney tests indicate that the level of GMQ between girls (Mdn = 94) and boys (Mdn = 88) is significantly different ( $U = 1016.50$ ;  $p = 0.005$ ). The premised higher level of Behavioural Adjustment in girls was not confirmed ( $U = 1318.50$ ;  $p = 0.35$ ). Rigoli, Piek and Kane (2012) postulate the relationship between the level of coordination and emotional functioning in adolescents. They state that the level of coordination could have an indirect

effect on man's self-confidence. Piek, Barrett, Smith, Rigoli and Gasson (2010) in their research on children aged 4 years indicate the level of motor skills as a predictor of anxiety/depressive symptoms at school age. Similar conclusions were drawn on older children by Mancini, Rigoli, Heritage, Roberts and Piek (2016) and Ekornas, Lundervold, Tjus and Heimann (2010).

## 5. Conclusions

The stated hypotheses were not confirmed. In concordance with the authors mentioned above, we postulate that the problematics need to be examined further on the larger research group. The results of this pilot study could be influenced by the higher rate of girls than boys. The important knowledge of this research is the differences in the level of motor skills between genders, because pupils from the lower primary level are usually educated in physical education in a so-called co-educative way – both genders together. From the point of ontogenesis, during the age of pre-puberty there are differences in the physical and psychical development between boys and girls. The social isolation of children could be caused by ignoring these developmental specificities. Therefore, it is necessary to evaluate the possibilities of changes in primary school educational programmes, which would bear in mind these specificities. The university education of future primary teachers should also be modified based on this knowledge. The results of the pilot study confirm and support the need for further research in this area. Well-timed identification of motor disorders in children and aimed interventions could prevent more serious problems such as anxiety and depressions. Identification and intervention could partially or fully eliminate problems in the pupil's adaptation to the school environment.

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