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**THE LEVEL OF GROSS MOTOR SKILLS AND PERCEPTION  
DEVELOPMENT IN PRE-SCHOOL CHILD**

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*Abstract*

Literature suggest that there is a relationship between the level of visual and hearing perception and the level of motor skills in pre-school children. The research question of this study is, whether there is a relationship between the level of motor skills of preschool children and the level of visual and phonological perception. The aim of this research is to describe and analyse the relationships between the level of motor skills of a child in preschool age and the level of sensory perception with a focus on visual and auditory perception. The research group consisted of 101 children attending kindergarten, the average age was  $5.97 \pm 0.49$  years (50 boys, 51 girls). The data was obtained from the IGA\_PdF\_2019\_015 project. For assessment of motor skills test TGMD-2 was used and MaTeRS test was used for assessing perception of the child. On the basis of the results it is possible to state the connection between visual perception and the level of preschool child's motor skills. Pre-school education plays an important role in preparation for future education and social and professional life. By supporting the development of the motor skills of children in kindergartens and the targeted focus on eliminating some deficiencies in motor skills, teachers can significantly contribute to the positive relationship of the child to education.

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**Keywords:** Visual and hearing perception, motor skills.



## 1. Introduction

The relationship of motor proficiency and child's perception is currently in scope of researchers in different perspectives (Barnett & Makin, 2018; Barnett, Lubans, Timperio, Salmon, & Ridgers, 2019; Nobre, Valentini, & Nobre, 2018). The evidence suggests that this topic should be wider examined also in the Czech Republic. Perception is related to actual skill ability and also how motor perception is associated with health behaviors and outcomes (Barnett et al., 2016). Authors focused on children aged 8 years and less, so is this study aimed, on pre-school children. There is compulsory pre-school education in the Czech Republic, which applies to children who reach the age of six in the following school year. This type of education leads to compulsory primary school education. Benefits of adequate motor proficiency and child's perception can be seen in many ways. Morris-Binelli and Müller (2017) note, that visual or spatial perception can be important in connection with motor proficiency for striking sports. Motor proficiency contributes to the personal growth and the balanced development of physical, cognitive, emotional and social characteristics, and it is an indispensable means of disease prevention (Bailey, 2006; WHO, 2003; WHO, 2007). As many authors highlight, physical activity is also important in future life of children, later adults (Garber et al., 2011; Budde, Voelcker-Rehage, Pietrażyk-Kendziorra, Ribeiro, & Tidow 2008; Jaakkola, Yli-Piipari, Huotari, Watt, & Liukkonen, 2016; Barnett, Van Beurden, Morgan, Brooks, & Beard, 2008). In history, there were some author offering the ideal amount of physical activity even for pre-school children (Timmons, Naylor, & Pfeiffer, 2007; Janssen, 2007; National Association for Physical Education, 2002). In very young children are body proportions positively related to motor skill performance (Loovis & Butterfield, 2003; Bala, Jaksic, & Katic, 2009). Collela and Morano (2011) say that motor activity is essential for promoting health in children. In recent years the scope of studies is rather aimed on the quality of these fundamental motor skills. Rudd et al., (2015) note that fundamental motor skills are not only locomotor and object control skills, but also include stability. But stability is in many researches neglected. Motor skills do not only have effect on physical activity and benefits connected with health issues. Authors connect motor proficiency with different cognitive skills and perceptions (Wassenberg et al., 2005; Carlson, Rowe, & Curby, 2013; Lopes, Santos, Pereira, & Lopes, 2013; DuBose, McMillan, Wood, & Sisson, 2018; Donnelly et al., 2016; Fernandes et al., 2016; van der Fels et al., 2015). Mainly van der Fels and collective of authors (2015) showed of a relationship between cognition and certain motor skills, where bilateral body coordination showed strong relationship with fluid intelligence, whereas fine motor skills presented a moderate to strong relationship with visual processing, two cognitive skills highly required in complex motor tasks. Authors dealt with different perceptions, not only hearing or visual. Crane, Naylor, Cook, and Temple (2015) in their research they found small but significant relationship between perceptions of competence and fundamental motor skill proficiency; suggesting the emergence of more realistic assessment of performance. Therefore the main aim of this study is, if there is a relationship between the level of motor skills of preschool children and the level of visual and phonological perception.

## 2. Problem Statement

Fundamental motor skills of children are currently in scope of attention of many researches from different points and perspectives (Barnett & Makin, 2018; Barnett, Lubans, Timperio, Salmon, & Ridgers,

2019; Nobre, Valentini, & Nobre, 2018; Carlson, Rowe, & Curby, 2013; Lopes, Santos, Pereira, & Lopes, 2013; DuBose, McMillan, Wood, & Sisson, 2018; Donnelly et al., 2016; Fernandes, et al., 2016). Deeper understanding of this perspective and important issue can lead to increased quality of education, which is important for future life of children, later adults, their school achievements and welfare of the society. Confirmation of the relationship between motor proficiency and the level of visual and phonological perception of pre-school children can lead to better position of Physical Education in kindergartens, where is physical activity rather neglected. Also, the preparation of future teachers can be affected by the results deeper understanding of this phenomena.

### **3. Research Questions**

The main research question of this study is, if there is a relationship between the level of motor skills of preschool children and

- 3.1. Will there be found significant differences in the level of gross motor skills in terms of gender?**
- 3.2. Are girls significantly better in locomotor skills?**
- 3.3. Do boys have significantly higher level of object control skills**
- 3.4. Are there significant differences in hearing perception between genders?**
- 3.5. Will there be found significant differences in the level of spatial perception between boys and girls?**

### **4. Purpose of the Study**

Recent academic papers (Barnett & Makin, 2018; Barnett, Lubans, Timperio, Salmon, & Ridgers, 2019; Nobre, Valentini, & Nobre, 2018; MacDonald et al., 2016) indicate the interest in the relationship in cognitive component represented by visual and hearing perception and motor proficiency in children. Beyond the Czech borders, scientist are even further. They prepare intervention programs to improve motor proficiency of children (Bellows, Davies, Anderson, & Kennedy, 2012; Jones, Riethmuller, Hesketh, Trezise, Batterham, & Okely, 2011; Africa & van Deventer, 2017; Chan, Ha, & Ng, 2016). Confirmation of the relationship between spatial and hearing perception and motor skills in children can also in the Czech Republic lead to higher attention to this topic. And thanks to this higher interest can intervention programs be developed and not only lower level of motor skills can be improved.

### **5. Research Methods**

A research group consisted of 100 children (50 boys, 50 girls) at the age of  $5.26 \pm 0.45$  years from kindergartens as part of compulsory pre-school attendance. For the participation in the research group was chosen intentional selection, where only pre-school children with the category above-average to superior of motor proficiency were included. The research was approved by the Ethics Committee of the Pedagogical Faculty of Palacký University in Olomouc and implemented as part of the IGA\_PdF\_2019\_015 project.

The child was placed in the research after signing written agreement of his / her parents / legal representatives and after the approval of the management of kindergartens. The participation in the project was voluntary and free of charge. The anonymity of the data was declared and guaranteed to all participants. Testing was done in kindergartens, which children normally attend, in accordance with manuals for work with selected methods and techniques of research work. Children may have asked questions during the testing, could at any time temporarily interrupt or leave the research based on their decision or decision made by their parents/ legal representatives. Children's responses were observed and, in case of a negative reaction, testing was interrupted or ended. The level of motor skills was determined by the TGMD-2 test (Ulrich, 2000), which monitors the level of locomotor and object control skills. The result is a standard score that is converted from rough score based on the child's age and gender. The standard score is converted to Gross Motor Quotient (GMQ), which is an indicator of the final level of gross motor skills. 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). For the evaluation of visual and hearing perception was used subtest of MaTeRS (Vlčková & Poláková, 2013). MaTeRS serves for the evaluation of so-called school readiness of a pre-school child in the area of fine motor skills. Part of the test can be administered in groups (max. 8 children), the second part, which follows immediately, requires individual examination. The result in each subtest is a rough score, which is calculated based on the child's age as a weighted score. However, for a clinical examination by a school psychologist, the level of percentiles and weighted scores is being used and the same is being done in this research. The relationship between the weighted scores of visual and hearing perception and the child's gross motor skills was correlated. Gender differences in gross motor and cognitive competences were evaluated by t-test. The level of significant importance was declared on  $p < 0.05$ . Data were processed by software STATISTICA, version 13.4.0 (Tibco Software, Inc., 2019)

## 6. Findings

As it was mentioned (see chapter 5), only children with higher level of gross motor skills than average were chosen for the research. Detailed categorization according to gross motor skills can be seen in Table 1. From the results is clear, that girls achieved better results in gross motor skills. Also statistical processing confirmed statistically significant differences  $p=0,001$  by using t-test. Mean value for boys was  $129,70 \pm 6,07$  and for girls  $133,82 \pm 6,97$  points of GMQ (Table 01).

**Table 01.** Number of children according to their GMQ level (n=100)

	Very superior	Superior	Above average
All	49	50	1
Boys	19	30	1
Girls	30	21	0

Two research questions dealt with locomotor skills and object control skills in terms of gender. We can say, that there was no statistically significant difference in locomotor skills in term of gender ( $p = 0,50$ ), mean values for boys are  $45,44 \pm 1,65$  and for girls  $45,22 \pm 1,64$  points. Also in the second subtest was not found significant difference between boys and girls in object control skills ( $p = 0,31$ ) according to rough

scores. Mean values for boys were  $44,12 \pm 2,78$  and for girls  $43,53 \pm 3,01$  points. Based on the overall result where is significant difference between boys and girls, it is clear, that there is very important fact, that in object control skills girls have different standard scores than boys, which for sure made the significant difference, although rough scores were almost similar. We confirmed this fact also with statistical processing of standard scores and we get significant difference  $p = 0,00$ , where mean value for boys was 13,82 standard score and girls achieved 15,76 points of standard score.

The main research question was, if there is a relationship between hearing perception and motor proficiency and also between spatial perception and the level of motor skills in pre-school children. The results indicate, that there is weak, but significant relationship between hearing perception and the level of gross motor skills  $r_s = -0,38$  ( $p < 0.05$ ). Significant negative correlation was also found between motor proficiency and the level of spatial perception in pre-school children. This correlation was significantly negative moderate  $r_s = -0,42$  ( $p < 0.05$ ).

Another two research questions were dealing with differences between genders. The fourth and fifth research question (3.4, 3.5) investigate differences between boys and girls. The fourth (3.4) research question examined gender differences from the point of view of hearing perception. Used statistical method revealed significant difference  $p = 0,001$ . Boys achieved significantly better results than girls, mean values for boys were  $26,50 \pm 3,14$  and for girls  $23,67 \pm 5,15$  rough score points. The last research question was aimed on spatial perception skills, the results did not showed statistically significant difference, although boys performed better again. Mean values from the rough scores for boys were  $8,64 \pm 1,91$  and for girls  $7,86 \pm 2,80$  from the overall of 11 points possible.

## 7. Conclusion

Pre-school education plays an important role in preparation for future education and social and professional life. By supporting the development of the motor skills of children in kindergartens and the targeted focus on eliminating some deficiencies in motor skills, teachers can significantly contribute to the positive relationship of the child to education. Thanks to the results, we can see, that girls performed better in motor proficiency, but we also explained, that girls scored almost similar results according to rough scores, but methodology of the TGMD-2 test showed, mainly because of different object control skills assessment, that girls are significantly better. Opposite to our results are Chow and Lobo (2013), who did not state significant differences in a group of pre-school children. The significant negative correlation between the level of gross motor skills and hearing and spatial perception is confirmed by the fact that boys scored better in both cognitive components. In hearing perception, they even scored significantly better results than girls did. Hearing perception is an important tool for communication and highly influence development of speech and thinking. Hearing perception is also a foundation for reading and writing and is considered to be linked to current level of speech abilities of the child. Also MacDonald Lipscomb, McClelland et al. (2016) confirmed that children's visual-motor integration and object manipulation skills in the fall have modest to moderate relations with executive function and social behaviors later in the preschool year. These findings have implications for early learning initiatives and school readiness. But this topic should be more investigated further (larger research group, more representative research group, etc.) and also from different perspectives and possibly with another research tools. Because Chow and Lobo

(2013) suggest that pre-school physical size in play area affects children's locomotor skills but not object control skills. This means that not only teachers themselves can influence the level of motor skills in pre-school children and therefore improve other parts connected to motor proficiency.

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