FACTOR MODEL OF MOTOR PERFORMANCE IN PRIMARY EDUCATION

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- primary school, children,
- motor abilities
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Abstract:

Evidence for a structural model for motor performance has been well documented for adults during last decades. Testing of physical fitness should be an integral part of elementary physical education. However, there is an ambiguity in approaches to application of individual test issues within the primary school age. The aim of the study is to define dimension particularities of motor performance in primary school age. Within the research objective, there were applied tests to diagnose motor performance of 10 -year-old children. 378 children participated in the research, 180 girls. Tested children were randomly selected from primary schools in the East Region of Presov, Slovak Republic. Results show that motor performance is primarily described by strength, coordination, and physical indicators regardless of sex. These findings show on a necessity to apply a multidimensional approach to motor performance diagnostics in primary school children. The present study is an attempt to verify a structural model of motor abilities for children. Such a factor model should be a base point for constructing valid, reliable, and feasible diagnostic measure in primary education context.

INTRODUCTION

National educational program in Slovakia defines within the ISCED 1 the "Health and Movement" field of education covered by the subject of physical education with the contribution of other subjects. In addition, it provides space in the areas of education as a part of cross-sectional topics interconnecting, and extending knowledge by means of optional subjects. Diagnostic tools applied within the context of primary education are on the low level with the preference of condition oriented motor tests only. This is related to a professional preparation of elementary teachers.

Motor abilities are usually thought to be a relatively stable characteristic or trait. As stated in [12], they can also be conceptualized as representing limitations on performance, or as defining a person's potential for success.

There is an ambiguity in approaches to application of individual test issues within this age group. It is necessary to stem from the premise that a child is not a smaller model of an adult. Due to these reasons methodological approaches used with this age group are diametrically opposite and their results are difficult to compare [4, 3]. In the studies of motor development in early childhood many various motor tests were applied. However, their feasibility seems problematic, particularly with respect to the specificity of motor development at that age [11, 3].

A variety of tasks can be used to document levels of motor performance. But emphasis is placed on standardized tasks that can be used in the field or school setting, in contrast to those limited to the laboratory [7]. That is considered to be very important point for selection of motor tests in preschool and primary school children.

There is much intraindividual and interindividual variability in the level of motor abilities among young children. Changes in mean levels of performance with age should be viewed with this variability in mind [8].

METHODS

Within the research objective, there was the motor performance of 10-years-old primary school children diagnosed using 16 motor tests and 3 anthropometric measures. 378 children participated in the study, 180 girls and 198 boys. Tested children were randomly selected from primary schools in the Region of Prešov in the Slovak Republic during years 2005 – 2008. A selection of the tests was based on *Eurofit* [1] test battery and on motor tests for coordination abilities [5, 9]. Selection of motor tests resulted from the thesis that condition and coordination motor abilities represent a complex and their research corresponds with this principle. Body weight was measured using with a precision of 0.5 kg. Stature was measured using Martin's anthropometer with a precision of 0.1 cm. Skinfolds were measured using the Harpenden caliper and following skinfolds were measured with a precision of 0.1 mm. Then the sum of all 5 skinfolds was calculated. Tables 1 and 2 include lists of test items applied within the research project.

Research data was processed using the SPSS 16.0 programme at the Faculty of Sports, University in Presov. Interpretation of factors is based on evaluating of factor loadings. Criterion was stated at the level of *> 0.4.* Factors contain the same information as a correlation matrix, but in a different form. There are rotated into the position, in which is presented the simplest relation among variables and factors. *Varimax rotation* was applied.

Table 1. List of the EUROFIT items and anthropometric measures

Motor tests	**Motor abilities**
Target jumping (cm)	Kinaesthetic differentiation
Turns on the bench	Dynamic balance
Run towards balls	Orientation ability
Stop a rolling ball	Reaction ability
Random drumming	Rhythmical ability
Jump without a swing	Ability of joining the acyclic movements
Jump backwards	Ability of adaptation and transfer of movements

Table 2. List of coordination abilities tests

Eurofit tests	**Motor abilities**
Flamingo balance (n)	Static balance
Plate tapping (sec)	Frequency speed of an arm
Sit and reach (n)	Joint flexibility of a trunk
Standing broad jump (cm)	Explosive power of lower limbs
Hand grip (kg)	Static strength of a dominant hand
Sit-ups (n)	Dynamic and endurance strength of abdominal, coxal and thigh muscle
Bent arm hang (sec)	Static and endurance strength of upper limbs
Shuttle run 10x5 m (sec)	Running speed - agility
Endurance shuttle run (n)	Cardio-respiratory endurance
Anthropometric measures	Weight (kg)
	Height (cm)
	Sum of 5 skinfolds (mm) / biceps, triceps, subscapular, anterior suprailiac, medial calf

RESULTS AND DISCUSSION

Results of applied factor analysis are presented in tables 3 and 4. *Factors 2 (F2)* in both examined groups are defined as physical factors with a share of approximately 13 % on the whole variance. These factors indicate an importance of physical development during this period of motor development. *Factor 1 (F1)* in a group of boys can be called as complex factor with the „weight" of approximately 20 % in a motor space. Similarly, *Factor 1 (F1)* in a group of girls with almost 20 % share on the whole variance is defined as strength and coordination factor. Relatively high values of specific variance in both examined groups suggest that there are other factors which determine the level of motor performance in children but which we could not encompass.

Small communality values (0,39 – 0,53) of some indicators such as *Target jumping, Bent arm hang, Sit and reach, Shuttle run 50 m* and *Bench turns* strongly suggest their lower relevance within the factor model and they indicate their lower predicative relevance within the age period. *Factors 3 – 6* in both examined groups represent more and less complex factors that include condition as well as coordination indicators. This shows on necessity of including condition and coordination indicators into diagnostics within the age period. The internal structure of the studied variables proved some distinctions in boys and girls. However, there is a difficulty in interpreting so-called condition and coordination factors as there is still unclearly defined relationship between individual abilities and due to limited discriminatory value of some ability tests for this age period.

Our results correspond to some extent with research results of [2]. Their results proved that within the motor performance structure of primary school children the main role play a factor saturated by fast motions, balance and motions which need energetic components. In girls, coordination abilities and flexibility were shown as the key domain of motor space.

Motor performance is influenced beside physical characteristics by motivational factors, opportunity for practice, habitual physical activity, and other in the cultural environment. There is a need to consider all these factors while assessing motor performance differences. These variables may be especially relevant in the context of examining sex differences in performance [7].

It should be emphasized that during this specific period of motor development movement outcomes for the children are evidence of their undergoing biologically-driven growth and intersection of the underlying movement capacity of coordination with the learned performance of motor skills [10]. The choice of motor tests can be debated since no definitive consensus on the best measurement exists in this field.

CONCLUSION

The process of childhood growth and motor development is predictable in terms of universal principles and sequential progressions. However, children show considerable individual variation due to a variety of environmental and hereditary factors. It must be considered the individual appropriateness of the movement activities we employ in the physical education programs.

It is obvious, that successful participation of children in physical activities is determined by their adequate motor development and motor experience. Factor model of motor performance in our research indicate, that coordination abilities should be involved into diagnostics within this period of motor development.

Diagnostic tools applied in the context of primary education should become an integral part of the educational process. Elementary teachers should be prepared for an evaluation of the individual changes in motor development of children.

This knowledge creates the base for the determination of more efficient diagnostic methods and retrospectively for development of individual motor abilities. It is critical,

though, to understand developmental characteristics of children as well as their limitations or potentials. Only in this way we can structure movement experiences for young children that truly reflect their needs and interests and are within their level of ability.

Table 3. Factor analysis of motor and physical indicators in 10 years old girls (n = 180)

Indicators	F1	F2	F3	F4	F5	F6	h^2
Flamingo balance	**0,41**	0,18	0,28	0,07	**-0,53**	0,27	*0,64*
Plate tapping	0,09	-0,08	0,01	-0,04	0,02	**-0,78**	*0,63*
Sit and reach	-0,16	-0,23	-0,03	-0,04	**-0,60**	0,29	*0,53*
Standing broad jump	**-0,73**	-0,10	0,27	-0,01	0,16	0,11	*0,66*
Hand grip	-0,23	0,34	**0,46**	**0,51**	0,08	-0,11	*0,66*
Sit-ups	**-0,77**	-0,06	0,07	-0,15	-0,12	-0,06	*0,64*
Bent arm hang	-0,29	**-0,57**	0,30	0,08	-0,13	0,11	*0,53*
Shuttle run 10x5 m	0,34	0,22	**-0,53**	0,27	0,18	0,07	*0,56*
Endurance shuttle run	-0,05	-0,12	**0,73**	-0,22	0,00	0,14	*0,61*
Body weight	0,13	**0,90**	-0,05	0,02	0,02	0,11	*0,84*
Body height	0,13	**0,83**	0,08	-0,03	0,02	0,01	*0,72*
Sum of 5 skinfolds	-0,20	**0,74**	-0,21	0,04	-0,07	0,07	*0,64*
Target jumping	**0,59**	0,14	0,14	0,10	0,21	0,06	*0,44*
Bench turns	0,08	-0,20	**0,55**	0,24	0,39	-0,15	*0,58*
Run towards balls	-0,01	-0,16	-0,30	**0,68**	-0,08	0,15	*0,61*
Stop a rolling ball	0,10	0,01	-0,02	**0,78**	0,01	-0,03	*0,63*
Random drumming	0,06	-0,04	0,09	-0,07	**0,72**	**0,40**	*0,69*
Jump without a swing	**-0,66**	0,09	0,08	**0,35**	0,25	0,12	*0,65*
Jump backwards	**-0,66**	0,04	0,06	0,08	-0,13	**0,44**	*0,66*

Table 4. Factor analysis of motor and physical indicators in 10 years old boys (n = 198)

Indicators	F1	F2	F3	F4	F5	F6	h^2
Flamingo balance	-0,02	0,39	0,09	**0,60**	-0,08	-0,08	*0,53*
Plate tapping	0,23	0,06	0,03	0,15	**0,71**	-0,21	*0,63*
Sit and reach	0,12	0,02	0,09	0,17	**-0,57**	-0,11	*0,39*
Standing broad jump	**0,63**	0,02	-0,32	-0,08	**-0,42**	0,09	*0,69*
Hand grip	0,17	0,33	0,05	-0,09	0,06	**0,76**	*0,73*
Sit-ups	0,02	-0,13	-0,25	0,05	-0,10	**0,72**	*0,62*
Bent arm hang	**0,61**	**-0,31**	-0,11	-0,14	0,18	0,06	*0,53*
Shuttle run 10x5 m	**-0,51**	0,16	0,09	**0,54**	0,04	-0,01	*0,58*
Endurance shuttle run	**0,48**	-0,13	-0,16	**-0,45**	0,07	-0,07	*0,68*
Body weight	-0,10	**0,94**	0,01	0,01	0,00	0,03	*0,89*
Body height	0,07	**0,84**	-0,07	-0,05	-0,10	0,12	*0,74*
Sum of 5 skinfolds	-0,31	**0,65**	0,09	0,16	**0,33**	-0,04	*0,67*
Target jumping	0,07	-0,03	**0,49**	0,20	0,06	**-0,44**	*0,48*
Bench turns	0,09	0,17	0,12	**-0,76**	0,06	0,10	*0,64*
Run towards balls	-0,16	-0,07	0,12	**0,59**	0,31	0,18	*0,52*
Stop a rolling ball	**-0,69**	-0,14	-0,36	-0,07	0,01	-0,05	*0,63*
Random drumming	-0,14	-0,02	0,11	**-0,51**	0,10	0,37	*0,47*
Jump without a swing	0,07	0,09	**-0,78**	0,00	0,12	0,06	*0,64*
Jump backwards	0,04	-0,10	**-0,83**	0,05	-0,06	0,05	*0,71*

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