

## **DEVELOPMENT CHANGES IN MOTOR SPACE IN 6 AND 7 YEARS OLD CHILDREN**

*(Research note)*

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### **Abstract**

*With aim to determine the development changes in motor space at 6 and 7 years old children, longitudinal research was realized on a sample of 123 male six years old children included in initial measurement, also measured one year later in final measuring as a seven years old children. Children's motor achievements were estimated using 33 motor test used for evaluation of nine motor abilities. Differences in used systems of motor variables between 6 and 7 years old children were estimated using multivariate analysis of variance MANOVA, while individual differences between variables are fortified using *t* – test. Results obtained in research points out on better numeric achievements at 7 years old children in all tests, yet statistical significant differences in 27 from total 33 applied tests. Better results are noted in the final measurement at the age of seven, and point out on positive and continuous development changes in motor segment in researched periods.*

**Keywords:** *boys, motor tests, initial measurement, final measuring, physical education, teaching process, MANOVA, t-test.*

### **INTRODUCTION**

One of the basic principles in contemporary teaching process is to respect children's personality and individual needs, interests and possibilities to every child, while one of the basic demands and tendencies of education is teaching curricula to be a product of objective needs and possibilities of children and the total educational process to be acquired on children's individual growth and development and to follow their tempo of changes (Conception for education, Bureau of Education, 2007). In this sense, the main precondition in order to respect and answer with proper activities to all this demands regard to children needs is knowledge for children's development characteristics and possibilities in every age period, mainly in the period of pre – school and early school age when this changes are particularly intensive (Haywood, & Getchell, (2004; Jürimäe, T., & Jürimäe, J., 2001; Malina, Bouchard & Bar – Om, 2004).

The need for knowledge of children's development characteristics is particularly issued when it refers for physical education teaching process, because the segment of motor development is closely related and influence to all other development domains (Malina, Bouchard & Bar – Om, 2004). According the Theory of Integral development presented by Ismail motor

potentials and acquirements of different movement experiences and motor knowledge's are closely related with physical, functional, intellectual and socio – emotional development in children (Ismail, 1976).

Aldo integrated in common system, from the aspect of PE, it's needs and aims, significant changes occurs in the segment of motor development. Therefore, knowledge for the characteristics of motor development, motor abilities, there manifestation and development able correct choice of age appropriate contents, real expectations for motor demands from children's well as easier understanding, explanation and practical application of findings and results in kinesiology. All these leads to quality PE curricula and efficient teaching process based on children's real needs, appropriate pedagogic approach oriented to children's' needs, interests and possibilities. On the other hand, well organized PE teaching process, appropriate to children's age, have a positive influence of growth, development and mainly of motor abilities (Malina & Boushard, 1991; Bouchard, Shepherd, Stephens, Sutton, McPherson, 1990).

Knowledge, not only for motor abilities and characteristics of motor development for certain age, but also the knowledge for differences that occurs in certain age

period in sense of motor achievements are very important for organization of PE teaching process, the process of training as well as for following and evaluation of individual achievement as a form for determination of the efficiency of certain physical activities and programs.

In this sense, the aim of this paper is to determine the development changes in manifest motor space at and 7 years old children.

## METHODS

With aim to determine the development changes in motor space at 6 and 7 years old children, we conducted a longitudinal research on a sample of examiners, first and second grade elementary school pupils in five schools in Skopje, Republic of Macedonia. Children were measured in two followed measurements, initial measurement that enrolled 123 six years old children and same children measured a year later in the final measurement as seven years old. The examinees were tested in 33 motor tests, hypothetically used for estimation of nine motor abilities or 4 motor tests used for estimation of co-ordination, explosive and repetitive strength, 3 movement tasks used for estimation of running speed, frequency of movement, static strength, balance and flexibility and five motor tasks for evaluation of preciseness. following motor tests were used: 1. *Coordination*: Coordination with stick (KOPAL), obstacle course backwards (KOPON), two balls slalom rolling (KOSL2), rolling with ball on floor (KOTRT); 2. *Speed of running*: 10m running from flying start (BT10LS), running 4 x 10 (BT4X10), cries – cross running 4 x 5m (BTZMT); 3. *Frequency of movement*: arm plate – tapping (BSTAR), one foot – tapping (BSTAN), both feet – tapping on wall (BSTNZ); 4. *Explosive strength*: standing broad jump (ESSDM), throwing medicine ball 1 kg from standing position (ESFMST), throwing medicine ball 1 kg from sitting position (ESFMG) и 20m dash running (ES20VS); 5. *Repetitive strength*: modified pushups (RSSKL), sit-ups (RSPTR), trunk lift (PSITR), hands pulling over the diagonal swedish bench (RSVKK); 6. *Static strength*: bent arms hang (SSVZG), horizontal hold lying on stomach (SSZLM), horizontal hold lying on back (SSZLG); 7. *Flexibility*: deep bend on bench (FLDPK), both legs extension lying on bag (FLRLG), legs extended forward bend on floor (FLPRP); 8. *Balance*: walking on upturned swedish bench (RAOSK), standing on bench in width (RASKS), standing on bench in length (RASKD) and 9. *Preciseness*: throwing circles on stick (PIOBS), throwing tennis ball in vertical goal with arm (PITET), throwing ball in horizontal goal with arm (PITHC), throwing ball in vertical goal with leg

(PIVCN), leading with short stick (PVGKS), leading with short stick (PVGKD). The author of the paper has the detailed description of tests and procedure of measurement and estimation.

Motor tests used in this research have a hypothetic character and are created according the motor structure in older examiners, using the structure model proposed by Metikoš, Prot, Hofman, Pintar, & Oreb (1989). This approach is used in other numerous researches with same or similar subject of research (Strel & Šturm, 1981; Dukovski, 1984; Rajtmajer & Proje, 1990; Rajtmajer, 1993, 1997; Pisot & Planinsec, 2005).

The structure and demands in movement tasks are similar with contents in PE curricula, children's age and possibilities, results of previous researches and recommendations of researchers that previously explored this issue with children in pre-school and early school age period were used as a criteria for selection of motor tests. Findings and recommendations of previous mentioned researchers are implemented in research procedure (Bala, 1981, 1999a; Perić, 1991; Dukovski, 1984; Rajtmajer & Proje, 1990; Pišot & Planinšec, 2005; Zorc, Pišot & Strojnik, 2005; Popeska, 2009, 2011).

The differences in used systems of motor tests between 6 and 7 years old children are assessed using multivariate analysis of the variance (MANOVA), while individual differences between individual variables are assessed using t-test.

## RESULTS

Analysis of results obtained using multivariate analysis of the variance (MANOVA) point out of existence of statistical significant differences in the applied systems of motor tests used at 6 and 7 years old children. According values of Wilkins lambda (.22) the total variability of the system is explained with 22%. Obtained results are significant at the level of  $p=0.00$ .

Aldo is a relatively low variability; it is significant for this sample of examiners. This value means that there is a lot of space for influence of other abilities and knowledge's when performing the movement tasks from the tests.

Significance of individual differences between achievements at all applied motor tests in initial and final measurement is assessed using t – test. Obtained results are presented in Table 2.

Analyzing the obtained results, it could be concluded that at the age of 7, children have better achievements in all applied motor tests. According results from the t-test, differences obtained in average achievements at motor tests are significant at 27 of total 33 applied

Table 1. Multivariate analysis of the variance (MANOVA) of motor tests applied at 6 and 7 years old children

Wilks' Lambda	Rao's R	df 1	df 2	p-level
0,22	22,54	33	212	0,00

Table 2. Comparative analysis of arithmetic measures at motor tests applied with and 7 years old children (t-test)

Tests	Age	X6y	X7y	SD6y	SD7y	Sx6y	Sx7y	t- test	P
KOPAL	6 y - 7 y	7,41	6,42	2,61	1,78	,24	,16	3,4	,001
KOPON	6 y - 7 y	27,17	21,31	7,05	6,27	,64	,56	6,89	,000
KOSL2	6 y - 7 y	40,33	32,37	9,78	8,36	,88	,75	6,86	,000
KOTRT	6 y - 7 y	7,5	5,95	1,12	1,20	,10	,11	11,02	,000
BT10LS	6 y - 7 y	7,68	6,44	2,66	1,84	,24	,17	4,24	,000
BT4X10	6 y - 7 y	15,56	14,58	1,80	1,87	,16	,17	4,20	,000
BT3MT	6 y - 7 y	16,03	8,60	1,63	4,42	,15	,40	17,49	,000
BSTAR	6 y - 7 y	11,30	14,16	3,20	5,02	,29	,45	10,34	,000
BSTAN	6 y - 7 y	8,50	9,53	1,10	1,25	,10	,11	-6,87	,000
BSTNZ	6 y - 7 y	5,95	8,08	2,45	2,85	,22	,26	-6,29	,000
ESSDM	6 y - 7 y	98,43	110,11	18,02	19,26	1,63	1,74	-4,91	,000
ESFMST	6 y - 7 y	2,65	3,40	,56	,93	,05	,08	-7,58	,000
ESFMG	6 y - 7 y	1,24	1,70	,29	,51	,026	,046	-8,72	,000
ES20VS	6 y - 7 y	5,62	4,79	,73	,63	,066	,057	9,51	,000
RSSKL	6 y - 7 y	13,00	13,63	5,83	6,48	,53	,59	-,81	,421
RSPTR	6 y - 7 y	10,08	14,75	7,83	9,37	,71	,85	-4,24	,000
RSITR	6 y - 7 y	10,99	15,17	4,85	8,07	,44	,73	-4,93	,000
RSVKK	6 y - 7 y	16,08	13,11	7,38	5,75	,67	,52	3,53	,000
SSVZG	6 y - 7 y	5,28	7,38	4,62	5,64	,42	,51	-3,19	,002
SSZLM	6 y - 7 y	21,20	22,64	15,12	16,94	1,36	1,53	-,71	,482
SSZLG	6 y - 7 y	10,54	16,75	9,41	12,28	,85	1,11	-4,46	,000
FLDPK	6 y - 7 y	35,27	41,40	7,75	6,39	,70	,58	-6,77	,000
FLRLG	6 y - 7 y	90,77	92,34	12,34	17,59	1,11	1,59	-,81	,418
FLPRP	6 y - 7 y	32,90	36,86	5,54	10,06	,50	,91	-3,82	,000
RAOSK	6 y - 7 y	18,15	13,82	6,30	4,61	,57	,42	6,14	,000
RASKS	6 y - 7 y	5,08	6,12	3,79	5,24	,34	,47	-1,80	,074
RASKD	6 y - 7 y	10,84	11,32	9,96	10,08	,90	,91	-,375	,708
PIOBS	6 y - 7 y	,84	,82	,58	,57	,05	,05	,23	,821
PITET	6 y - 7 y	5,50	6,50	2,38	2,84	,22	,26	-3,00	,003
PITHC	6 y - 7 y	3,07	3,76	2,08	2,18	,19	,20	-2,53	,012
PIVCN	6 y - 7 y	3,33	3,97	1,75	1,96	,16	,18	-2,71	,007
PVGKS	6 y - 7 y	43,83	51,29	7,63	6,97	,69	,63	-8,00	,000
PVGDS	6 y - 7 y	43,76	50,83	7,08	7,10	,64	,64	-7,82	,000

movement tasks. In the rest 6 tasks, particularly in the tests: Modified pushups (RSSKL), Horizontal hold lying on stomach (SSZLM), Both legs extension lying on bag (FLRLG), Standing on bench in width (RASKS), Standing on bench in length (RASKD) and Throwing circles on stick (PIOBS), 7 years old children have numerically better, but statistically insignificant results.

Better motor achievements at the age of seven, compared with results achieved a year earlier at the age of six are expected and conditioned by the development processes. Similar results are obtained in the research of Bala, Jaksić, & Katić (2009) where quantitative improvement of results is noted for all age groups from 4 to 7 years. Improvement with different variability is particularly noted for the variables for estimation of co – ordination and strength (static and repetitive). Differences in younger groups were bigger, compared with older examiners.

## DISCUSSION AND CONCLUSION

Better result in motor tests applied at the age of seven is influenced by many factors:

- Changes that occurs as a result of characteristics of natural growth and development;

- Changes in morphologic status and its influence on motor activities;

- The learning process that occurs during repetitions of the movement tasks (Planinšec, 1995; Pišot & Planinšec, 2005);

- Children's everyday physical activity in school and during the leisure time; emotional and psychological maturation of children (better motivation, wish for better achievement and better result specific for this age period).

In initial and final measurement, children's have nearly the same results (statistically insignificant differences) in applied motor tests for estimation of: repetitive strength of the arms, static strength and tests for balance, or tests in which larger anthropometric measures remains additional demands' for the children at the age of 7 years, enables them to manifest bigger strength and better results during the performance of modified pushups, Horizontal hold lying on stomach or in the tests for repetitive strength and preciseness.

In the tests Modified pushups (RSSKL), body should be elevated higher than the bench because of the longer hands, while at the tests used for estimation of balance: Standing on bench in width (RASKS) and Standing on bench in length (RASKD), the center of the body is placed higher and it makes it difficult to maintain the stabile balanced position. In the tests throwing circles on stick (PIOBS), the preciseness is decreased because of small muscle strength of the arms, followed with longer measures at longitudinal dimensionality, precisely, longer hands able longer trajectory of the movement of the circle. At the tests horizontal hold lying on stomach (SSZLM) anthropometric measures such as passive mass makes difficulties in the realization of the test. As a result of these changes, conditioned by the development

changes characteristic for children at the age of 6 and 7 years manifested Growth and development, as well as the individual tempo of development changes, 6 and 7 years old children achieved similar results in 6 from 33 applied motor tests.

Statistical insignificant differences between the two surveyed groups of children are also obtained for the test throwing circles on stick (PIOBS). The complicated technique of realization of this test is the main reason for similar results in researched periods. Similar results for this test are obtained in the transversal research conducted by Popeska (Попеска) (2009). The small differences in achieved results could be explained with the analysis of the technique of realization of the test. Namely, this test have a bit complicated technique of realization because the throwing of the circle which should be realized as a rotational movement and it is still not yet learned enough by the 6 and 7 years old children. When pitching the circle, the body is bending forward; the arm is positioned in front. This position is unusual for children at this age; while in the other hand the starting position have a huge influence on the acquisition of the technique and the final results of the test. Different starting positions activate different muscle groups that define the direction of the movement, while the pitching and the movement of the circle should be parabolic to front. In the same time, the circle should have a rotational movement. These and other specifics in the technical performance of these tests make the differences in the final result.

For performance on several movements at the same time, children need to poses and to develop co – ordination as a motor ability responsible for performance of motor tasks with complicated structure, or to movements with different body parts and localization of the object ejected in space. Individual development of nervous system conditioned the development of co – ordination as a motor ability, which in other hand is a core for development of other motor abilities. If movements are performed uncoordinated, with lack of structure of motor tasks, the motor abilities supposed to adjust with certain tests, could not be manifested efficiently and objective. In concrete test for evaluation of preciseness (throwing circles on stick, PIOBS) the basic technique is not well overcome, movements are performed with lack of co – ordination and the preciseness as ability could not be adjusted regularly. In separate research aimed to determined the metric characteristic of motor tests (Popeska (Попеска), 2011), it's concluded that this test applied with 6 and 7 years old children is hard to performed, it has bad discrimination and in general the test have bad metric characteristics used with 6 years old children, while for 7 years old children test characteristics are improved. This means, that the final result at this tests is mostly conditioned by the level of acquisition of technique of performance of the tests as well as co – ordination and other motor abilities (strength, speed etc.). Regarding to this are the findings of Bala, (1999b) (according which, some tests applied at

adults used to estimate certain motor ability, when used with younger examiners (children) adjust different motor ability (example: the test Standing broad jump applied at adults is used for estimation of explosive strength of legs, while applied at children it could be used for estimation of co – ordination, because the technique of jumps is not jet overcome and movements with legs and arm are not synchronized).

Results obtained in the applied tests for estimation of preciseness, leads to conclusion that children in pre – school and early school period are able to peach and lead object precisely to certain goal, without changing the direction of movement, for example: throwing a ball in vertical goal with arm (PITET), Throwing ball in vertical goal with leg (PIVCN), Leading with short stick (PVGKS), Leading with short stick (PVGKD). If the direction of the started movement should change, children at 6 and 7 years have difficulties in task performance. Insignificant differences between two age groups are obtained in the transversal research conducted by Popeska (Попеска) (2009), realized on two different groups of children.

Results obtained with analysis of manifest motor variables point out on statistical significant differences in motor achievements at the same group of children at the age of 6 and a year later at the age of 7, that points out on significant development changes in the segment of motor development. Analysis of test achievements analyzed separately points out on higher results at motor tests at 7 years old children, compared with achievements acquired a year earlier, at the age of six – initial measurement. This emphasizes the continuous and positive development changes expected for this age period. Similar results are obtained in the research of Bala, Jakšić, & Katić, (2009) where qualitative better improvement in results are noted in all age groups in the period from 4 to 7 years of age. In our research, detected changes are statistically significant in 27 from 33 applied motor tests, or in 82% of applied tasks, while in the rest 6 tests, obtained results are numerically better but statistically are not significant.

Statistically insignificant differences are noted in following motor tests: Modified pushups (RSSKL), Horizontal hold lying on stomach (SSZLM), Both legs extension lying on bag (FLRLG), Standing on bench in width (RASKS), Standing on bench in length (RASKD) and Throwing circles on stick (PIOBS). Development changes characteristic for 6 and 7 years old children are manifested as different tempo of development and individual tempo of manifestation of certain development processes that influence to nearly the same achievement in the researched segment.

In general, better motor achievements noted at the age of seven years point out on positive and continuous development changes which are expected and conditioned by the influence of many factors such as: characteristics of children's natural growth and development; Changes in morphologic status and its influence on motor activities; the level of acquisition

of certain contents of applied movement tasks; the learning process that occurs during repetitions of the movement tasks (Planinšec, 1995; Pišot & Planinšec, 2005); Children's everyday physical activity in school and during the leisure time; emotional and psychological maturation of children.

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