

MOBILE GAMES AS THE FACTORS OF MOTORIC SKILL'S DEVELOPMENT IN CHILDREN AGED FROM 3 TO 4 YEARS

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Abstract: *This paper presents the results of research which main goal was to explore the impact of mobile games in physical education on the development of motoric skills of children aged 3 - 4 years. The children's motoric capabilities have been assessed according to the six tests applied in the areas of explosive and general strength, accuracy, vitality and velocity. Obtained results have been statistically analysed using t-test. Results obtained from a sample of 60 children divided into two groups (experimental and control) showed statistically significant differences between investigated groups. According to the results of the final measurement, it was concluded that different methodological approaches of mobile games, and the programmed motoric activities that was carried out with the children in the experimental group had a significant positive impact on the development of motoric skills of these preschool children.*

Keywords: *motoric skills, children aged 3-4 years, mobile games, tests for the motoric skills determination.*

Introduction

The main focus of our research was directed to the finding of an effective tool for development of motoric skills of preschool children and to develop their an interest and motivation for physical exercise, since the life need is to become fast, agile, strong and courageous. The development of motoric skills is of great importance in daily life and work of a every man. The current findings have shown that all motoric skills could be develop at greater or lesser manner and the final level of this development is affected by genetic basis, as well as influence of the social environment. Acquisition of motoric skills is one part of the adaptive human behavior. In order to develop

and improve custom templates with which a certain individual act and interact with their environment, countless requirements for motoric responses were placed in front of every living,

"Motoric learning can be defined as a specific type of learning differently defined material based on the problem-solving process that involves cognitive and verbal processes" (Dedaj, 2011:95).

Motoric learning experience can be viewed as a series of processes associated with exercise in which people acquire new motoric skills. Common to all definitions is that the process of learning and improvement of motoric skills is gradual.

"The process of motoric learning usually involve learning based on demonstration, ie. the mode learning. The foundation of every learning is cognitive process, because the movement is made up of mental action, sensory neural stimuli, internal actions of the central nervous system and the external physical movement "(Kosinac, 2002: 14).Ages from 4 to 10 years are very important for human motoric development. It is believed that this period has the general development character and the child solves motoric problems with whole being, or whole body that is motoricly very uneconomical. "This is because differentiation of various motoric structures has not took part yet" (Bala, Krnjeta, 2006: 602).

Motoric abilities are very important for the child's motoric skills and child's movement apparatus, so-called "locomotoric apparatus" as executive subsystem by which they are manifested. Every movement is caused by synchronization of space-time relations, actually by the kinematic structure of the movement, that is responsible for the informational component of movement. Frequently used terms in practice are coordination, precision, flexibility, balance, various power types, force and endurance. Since the age of children from 3 - 4 years is generally early stage of children development when the organs and organ systems are still developing and when they have not reached its full maturity, the most effective way to develop motoric skills is through game. The game is a reflection of the child's need for activity and activation of the whole body; expression of emotion; satisfaing of social needs; need for movement and engagement of all the senses; intellectual mastery of reality that surrounds it; the creation of identity and self-awareness; integration into society; realization of desire and creativity, independent and autonomous action (Rule book on a general basis of preschool program of Republic of Serbia, 2006: 75).

Game is way of child's life, it reflects how child thinks and acts. It is an activity that is essential for all areas of its development, it strengthens and develops the child's motoric skills, and promotes its emotional development. For the child, game is a joy that it is accompanied by pleasure and happiness,

and besides that, during a game child processes his own experiences from its family and the community in a personal manner.

Mobile games are the best form of exercise for children in a pre-school period, as they meet the child's need for acting and thus becomes a natural and important stimulus for growth, development and promotion of the health. Mobile games consist of various content and tasks. It is a free activity characterized by pleasure and joy of player to engage and confirm themselves in it. The mobile game provides unity of intellectual, motoric, emotional and social factors in the development of the child, as well as child's need to socialize with its peers, engaging curiosity, adopting rules of behaving, gaining first experience of life, friends, self-affirmation, and so on. (Ivanovic, 2008: 15).

Investigation of the influence of mobile games on the development of children motoric skills, and of results of their exercising and adopting of both skills and knowledge in these games are based on individual child capabilities and state of physical development of a child. These problems are still insufficiently explored in the scientific and methodological literature. For instance, there was study called "The impact of programmed physical exercise on motoric development in preschool children" by Mesaros-Zhivkov, Mark (2008). This program was conducted for six months, every day and it lasted 30 minutes. The results of this investigation showed a statistically significant difference in all motoric abilities between children in experimental and children in control group.

In other study, Rodic (2010) examined the influence of selected program on motoric abilities of preschool children. The sixty children aged from 3 to 4 years have been included in this study, where four indicators have been evaluated: in manifested area for the evaluation of coordination, explosive strength, flexibility, precision). Author found significant difference between experimental and control groups in the initial and final state of motoric skills in children of preschool age. It was concluded that the targeted program activities significantly improved development of motoric skills within the experimental group, while in the control group it was strictly the consequence of growth and development.

Stanisic, Kostic, Uzunović, Markovic (2008) conducted research on 80 girls at preschool age (6-7 years) and confirmed the relation between the quality of performing dance acts and capabilities for motoric coordination. During the 6 months of this program, girls attended organized dance activities (Waltz, Polka and Moravac). The analysis of the obtained results have made the link between the quality of dance acts and motoric coordinative ability.

Research Methodology

The main objective of this research was to assemble scientific data upon which will be attainable to identify, justify and experimentally verify the possible impact of mobile games on the motoric skills development of children aged from 3 to 4 years. In other words, this research should be able to find out whether the mobile games, methodically implemented through modern playroom, present a determinant of the development of children' motoric skills. This goal has been realized through several factors: a) collecting data by measuring some motoric abilities (speed, integrity, strength of arms, legs and overall strength), b) implementation of mobile playgrounds in the experimental group, c) implementation of physical activities with children in preschool at the applicable Program guidelines. The experimental sample included children from kindergartens "Hero Mouse", and "Children's Gaj" in Belgrade. This sample included 60 children of ages from 3 to 4 years. All the children in the sample attended preschool program of education. Basic characteristics of the sample that underwent the study and variables to which they were classified were motoric skills of children. This approach allowed the verification of basic research hypotheses in which it was assumed that the physical education program, which puts mobile games as a primary activities, has positive effect on motoric development of children aged from 3-4 years, as well as that there is statistically significant difference in the results of some measurements of motoric abilities in the final measurement, in favor of the experimental group.

Kinesiology research techniques used in this paper study were techniques of anthropo-motoric status evaluation.

Table 1. Directly measured motoric variable with measuring units

Nr	Parameters	Units
1.	Bend on the bench – effectiveness, flexibility and elasticity	cm
2.	I and my muscles – strength of stomach muscles	reps/s
3.	Pin Running at 10 m – endurance, body's ability to prolong moving	s
4.	Long Jump – explosive strength of leg muscles	cm
5.	Lateral transfer of body weight from one foot to another – ability of skilled and agile body weight shifting	s
6.	Throwing the Ball – throwing ability, explosive strength of arm muscles	cm

For each used variables we calculated: mean (AS); standard deviation (SD); standard error (SE); and statistical significance of differences was determined by t-test (T); the level of significance (p), as an indicator of the significance level of the results according to t-test.

All analyzes were done using a statistical package for data analysis (SPSS - Statistical Package of Social Sciences - for Windows).

Results and Discussion

The control groups realized usual activities of physical education, actually contents provided by the Plan and Program of Preschool Physical Education. Mobile games in modern play games were used through directed activities with the children in experimental group. This treatment consisted of non-traditional mobile games. The results were presented in Table 1. We analyzed each variable individually. Statistical significance was calculated for each test. For each variable of motoric ability, after initial measurement and comparing to the examed groups, the significance of difference (t-test) was calculated. The results showed that despite the numerical differences, there are no statistically significant differences at the level of $p = 0.05$ between control and experimental groups.

Table 1. Results of the initial measurement

Test number	T	p
1	2,24	0,67
2	3,21	0,45
3	054	1,12
4	0,98	2,09
5	1,12	0,08
6	0,34	1,01

Legend: 1 - Bend over the bench; 2 - I and my muscles; 3 - Pin running; 4 - Long Jump; 5 - The lateral transfer of body weight; 6 - Throwing the ball.

Interpretation and analysis of the indicators of children motoric skills at the final measurement

Vitality and motility were measured by (forward) Bend on the Bench. Values were expressed in centimeters. As was shown in Table 2, the final measuring of children in the experimental group displayed better outcomes than children in control group. Based on the results of t-test ($t = 0.22$ and $p = 0.82$) the hypothesis which assumed that in the area of flexibility there would be present statistically significant difference in favor of the children of the experimental group, it was not confirmed and thus may be discarded.

Table 2. The difference between the control and experimental groups at the final measurement on the test “Forward Bend on the Bench”.

Test	Group	AS	SD	SG	t	p
Front bend on the bench	Control group	39,97	12,25	2,28	0,22	0,82
	Experimental group	45,40	5,28	0,96		

Legend: AS - Mean, SD - standard deviation, SG - standard error of the mean, t –“t -test”, p -level of significance.

Analysis: flexibility, as motoric skill requires daily exercise. If daily exercise is not present, the value of this ability rapidly declines. In the implementation of this test it has been shown that children did not sufficiently mastered with this skill (two children in the control group did not successfully perform this test, since each flexion of trunk was followed by bending of the knee). The test should be carried out through the form of game and children must be motivated.

The power of the lower limbs was measured by the jump out of the site (“Long Jumps”) and was expressed in centimeters, while the power of the stomach was measured with the test “I and my muscles” and was expressed with reps in seconds. The hypothesis for the first test which assumed that children of the experimental group would show better results than the control group children in these tests can be partially accepted and partially rejected. The results for the stomach strength observed by the task “I and my muscles” showed that there was a difference between the results of the experimental and control groups ($t = 2.24$ and $p = 0.03$) and thus difference was statistically significant. The results of the strength of the lower extremities explored with the “Long Jumps” showed no difference between the results of the experimental and control groups ($t = 1.62$ and $p = 0.09$), so that the hypothesis can be partially discarded.

Table 3. The difference between the control and experimental groups at the final measurement in tests “I and my muscles” and “Jump out the site”

Test name	AS	SD	SG	t	p
My muscle and me					
Control group	1,73	1,26	0,23	2,24	0,03
Experimental group	1,8	1,0	0,18		
Long Jumps					
Control group	46,74	28,55	5,13	1,62	0,09
Experimental group	57,19	19,03	3,42		

Legend: AS - Mean, SD - standard deviation, SG - standard error of the mean, t – “t-test”, p –level of significance.

Analysis: The inborn coefficient of strength in children of this age is very small. Developing these capabilities can significantly be improved by practicing. Implementation of the test “I and my muscles” does not require much coordination abilities as much as the realization of the test “Jump out of the site” where nine results were 0 because the children were not able to do the movement correctly. Given difference in the results should be sought in a part of motoricic coordination, where Long jumps require several synchronized movements of upper and lower extremities, so children who haven’t exercise cannot perform that.

Endurance or the body's ability to extend its movement was measured by test “Pin running at 10 meters”. Values were expressed in seconds. It is shown in Table 4 shows that the final measurements of the children in the experimental group showed better outcomes than ones in the control group. Based on the results of t-test ($t = 2.00$ and $p = 0.04$) hypothesis, which assumed that children are able to extend the movement running at 10m, the difference that was statistically significant in favor of the experimental group children was found.

Table 4. Difference between controls and experimental group in final measurement of test Pin Running at 10 meters

Test	Group	AS	SD	SG	t	P
Pin running at 10 m	Control group	12,67	2,25	0,41	2,00	0,04
	Experimental	11,62	1,71	0,37		

Legend: A - Mean, SD - standard deviation, SG - standard error of the mean, t - test, p -Level significance.

Analysis: The speed is not universal, which means that the results depend on the individual abilities of the child and the selected test. We opted for explosive speed that requires quick reaction to start, then for the speed of single movement and speed of a higher frequency of steps per unit of time. The results confirmed earlier studies and suggested that the speed of development of children in our study was influenced by the selected program of mobile game that was organized and implemented to the children twice a week.

Ability of a skilled and agile moving of body weight in children was evaluated with the test “Lateral transfer of body weight from one foot to another”. It was shown in the Table 5 that the final measuring of children showed better outcomes in the experimental group than in the control group. Based on the results of t-test ($t = 0.19$ and $p = 0.84$) hypothesis, which assumed that on the ground of balance and coordination there would exist

some statistically significant difference in favor of the experimental group children, was not confirmed and may be discarded as well.

Table 5. The difference between the control and experimental groups at the final measurement in the test “Lateral transfer of body weight from one foot to another”.

Test	Group	AS	SD	SG	T	p
Lateral body weight transferring	Control group	5,83	3,2	0,58	0,19	0,84
	Experimental	6,00	3,5	0,64		

Legend: A - Mean, SD - standard deviation, SG - standard error of the mean, t - test, p -Level significance.

Coordination means performing complex motoric operation. Most authors considered coordination as motoric intelligence. Children aged 3-4 years have not mastered intermediate skills such as orientation in space and time, balancing, and have no control over individual movements, and thus coordination develops in the coming years.

Throwing ability, or explosive strength of the upper extremity in children was measured by the test “Throwing the ball”. Values were expressed in centimeters. Data in Table 6 showed that the final measurement of children in the experimental group showed better outcomes than the children in the control group. Based on the results of t-test ($t = 2.94$ and $p = 0.00$) hypothesis, which assumed that there was statistically significant difference of explosive force of the upper extremities in favor of the experimental group children was confirmed and can be accepted.

Table 6. The difference between the control and experimental groups at the final measurement in the test throwing the ball.

Test	Group	AS	SD	SG	t	p
Throwing the ball	Control group	0,97	0,76	0,14	2,94	0,00
	Experimental group	1,5	0,63	0,11		

Legend: A - Mean, SD - standard deviation, SG - standard error of the mean, t - test, p -Level significance.

Analysis: improving of throwing skills goes simultaneously with the development of the central nervous system. Earlier studies that included preschool children (or older children) showed great progress of the children

when they exercise this motoric ability, so that a statistically significant difference between these motoric skills groups can be sought in this section.

The results of this research, as well as previous studies, confirmed that each organized, programmed and dosed form of physical activity contributes to the positive development of motoric skills in preschool children. If the children are younger there more they ought to exercise more. Stimulating the motoric abilities significantly affects the raising the level of cognitive functioning, it allows gaining experience and knowledge upon which they continue to build their higher cognitive functions and social experiences.

Concluding Remarks

Motoric skills in children aged 3-4 years are not yet differentiated so often raised question of its applicability and validity for some tests used for assessing individual (hypothetical) dimensions of motoric status stands. Another problem is in the measurement protocol of motoric skills. The measurement of motoric skills include maximum engagement of respondents. At this age, it is practically impossible to achieve this because children are not aware of the need to achieve maximum energy engagement, which is the basis for the precise determination of the state in certain motoric skills.

In this study, based on the analysis of obtained results, it can be concluded that groups of children at the initial measurement, ie at the beginning of the experiment were equal and that there was no statistically significant difference in the results achieved in tests of motoric skills testing. During the experiment, the experimental group has implemented with a special program of physical education (non-traditional playground of mobile games) in which the exercise activities were based on the development of basic motoric skills for a period of three months. The results of research on the final measurement showed statistically significant differences in variables which tested the strength of the abdominal muscles, precision and speed.

The results came as expected, and in line with most previous research. It is important to emphasize that the testing has been done on subjects who are at the stage of early motoric development and where the motoric space is treated as unique matter. Difficulties in determining the correct motoric status of the child in the observed group were the fact that when performing motoric tests they do not show an isolated individual motoric skills as well as in adults, so it is very difficult to determine the assessment of which motoric skills they serve to.

Motoric skills are manifested in the way that one compensates another, and child in different situations and tasks manifests its complex motoric ability (Nićin, 2000). No matter the fact that motoric skills during the preschool age have not yet been fully defined, this period is very important in the development, particularly basic (general) motoric skills. Application programs with specific mobile games has enabled that when mastering motoric movement tasks (by which the child's motoric skills is assessed) it actually exhibited general affection of various abilities and skills of the child. Practically, it seems that the children with their overall motoric skills achieved the realization of motoric movement tasks. Therefore, many experiences speak that physical exercise in a period of three to seven years should be based on games in making a better foundation, i.e. practically preparing a better basis for future development of specific motoric skills.

Motoric development encourages the emotional, social and intellectual development of children, and the lack of games and the opportunity to participate in different physical activities can slow physical and mental development of children. Following this thought every organized program, which will expand and allow systematic work on the development of motoric skills may be recommended.

The importance of work for teachers and future research is reflected not only on the need to modernize the current programs and introduce new one, but also the need for a differentiated approach respecting the child's individual abilities and skills. Changes in relation to the monitoring and programming development of motoric skills and motoric competence of preschool children are needed. In this regard, it is necessary to fully examine the motoric level of functioning of individual, collect data that will enable educators to structure and choose the type and form of physical activity, appropriate methods, location, devices and requisites, to determine the correct level of programs and its content in accordance with the training principles, age and individual abilities of children. It is necessary to warn accountable to specific problems and dangers and thus prevent the failure of the educational process before the situation would become critical or irreversible. If the teacher monitors and evaluates the progress of each child, he/she would have an insight into the achievements of each individual and will directly influence its development and health.

This paper is an introduction to further research with an attention focused on monitoring in order obtaining some information about the state of physical and motoric development and health of children, essential in solving various tasks of the educational process of physical education.

Longitudinal studies on a sample of preschool children are rarely enforced. Research should be intensified and encouraged for solving this issue and analyzing the effect of new, modern programs and their impact on

the motoric status of children. The conclusion of this study is that the implementation of the physical education program through the game generally, specifically designed through non-traditional mobile games that should present the base ground from which ideas would derive and some programs would be created that would make a positive impact and trend of development of loco-motoric abilities of preschool children.

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