EVOLUTION OF PHYSICAL, MOTOR AND FUNCTIONAL DEVELOPMENT IN 6-7 YEAR-OLD CHILDREN

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Abstract[*]

Aim. The purpose of this research is to emphasize the dynamics of the physical, motor and functional development in 6-7-year-old children, enrolled in the preparatory grade at school.

Methods. The paper is an experimental study carried out on 40 children, aged 6-7, divided into 2 groups: a control group and an experimental one. The study took place from October 2013 to May 2014, the assessment events being performed initially and at the end.

Results. In the field of sport and physical education science, as a field ensuring a complex development, the knowledge of the evolution of children enrolled in the preparatory grade is a starting point to approach the teaching-learning process. The paper constitutes a study which has as its objective the development of physical, motor and functional development in children, aged 6-7. For this purpose, we performed an experimental research which was based on the assumption that "if children in the preparatory grade use games of movement including running, jumping, throwing and catching skills during their physical education lessons, a better physical, motor and functional development can be achieved". In order to demonstrate this aspect we used a series of tests and events consisting of: anthropometric measurements (height, body weight), functional parameters (Ruffier Test - assessing the adaptability of effort), motility events (20m speed running, 200m/300m long-distance running for girls/for boys, standing long jump, torso dorsal raises).

Conclusions. The results of the research highlight the improvement of children in the three directions and validate the hypothesis.

Keywords: physical, motor, functional, development, children

Introduction

"The golden age of childhood" is the age in which behaviour varies, as a result of the integration into the compulsory education system (preparatory grade), of the cognitive as well as motor requirements which a child deals with and for which he/she is assessed. This stage of the development aims (Dragnea, Bota A, 1999, p. 136) "to develop the flexor muscles, the dorsal muscles which are involved in maintaining the spine, to develop chest and intercostal muscles for correct breathing, in addition to analytical exercises to use them with cumulative influence on the body, to avoid the force, traction, weight exercises, to supervise the learning method for jumps, particularly landing, which involves the ligament and articular system, a system which is still not well developed".

In parallel with the motor development, the teacher aims at physical and functional development. "The physical development of a child in the first years of his/her life takes place, as known, at the highest paces, especially for certain parameters", (Metveev, Novikov, 1980, p. 432), but this development is influenced by the way in which physical exercises are practised, by their quantity and quality, by the living conditions, family and social possibilities. Demeter, (1974 p. 7) considers that "the children's development and growth do not happen at a uniform pace, but, along the way, there are periods of slow growth, with variable periods in relation to age, children's living conditions and individual, genetic peculiarities. During the slower morpho-functional development, there are periods of rapid growth, recording some leaps", which should be respected and which should be taken into account in the teaching-learning process specific to physical education, as subject. The efforts pupils make during the physical education lessons are influenced by their growth rate, an aspect pointed out also by Albu and Rascarache (in 1984, p. 11) which notices that "the rhythms of life directly influence the breathing rates, causing changes which oscillate, according to life, mood, profile of activity, environment, adaptability etc.)". The acquiring of motor skills, execution

techniques during the physical education lessons is made by "multiple repetitions and become automated components of the respective activities, "having a voluntary character, but they may be subject to the control of consciousness at any time" (Mitra, Mogos, 1980, p. 67), which it influences, in fact. The basic motor skills, consolidated at an early age, have a wide range of applicability both in the daily and sports activity" (Scarlat, Scarlat, 2003, p. 20) and they also contribute to improving the child's physical and functional development and by default to improving the health state and capacity of knowledge and interaction.

Methods

In this research, we used as methods the following: the study of the bibliographic material, observation, experiment, statistical-mathematical testing method, graphical method, and as assessment indicators: arithmetic mean, standard deviation, maximum value, minimum value.

For this, we designed an experimental research which was based on the **hypothesis** according to which "if in an experimental group from a preparatory grade we use games of movement and applicative paths which include running, jumping, throwing and catching skills, in each physical education lesson, will get good physical, motor and functional development". In order to demonstrate this, we used a series of tests and events consisting of: anthropometric measurements (height, body weight), functional parameters (the Ruffier Test - assessing the adaptability to effort), motility events (20 m speed running, 200m/300m long-distance running -for girls/for boys, standing long jump, torso dorsal raises). The study was performed at the Lower Secondary School no.10 in Bacau City, where we conduct the in-service teaching practice with our university students. The experiment on the preparatory grade was carried out over a period of 4 months (15 February - 15 June 2014). We took the initial measurements during January 2014, and the final measurements in June 2014. The study's 40 subjects were divided equally into 2 groups, a control group and an experiment one. In each group, there were 10 girls and 10 boys. In order to highlight the evolution in 6-7-year-old children in the experiment group we organised the activity requiring that each lesson should contain at least 2 games and a dynamic applicative path (these included walking, running, jumping, throwing and catching skills) and in the control group, we played one dynamic game every lesson and only exercises for learning the execution techniques during the rest of the lesson.

Discussions

In the summary table 1, there are presented arithmetic mean values mean, standard deviation, maximum and minimum values recorded by the experimental and control groups according to their height, weight, body width and the Ruffier Test in the initial and final assessment.

A. Analysis and interpretation of the results of the anthropometric development in the experimental group and in the control group

Summary table 1 – results of the anthropometric growth in the experimental group and in the control group

Calculated indicators	Height (m)			Weight (Kg)			Body width (cm)		
	Ti	Tf	Dif .	Ti	Tf	Dif.	Ti	Tf	Dif .
X exp.	1.23	1.35	0.12	23.69	26.53	2.84	113.75	125.39	11.64
X. cont.	1.21	1.28	0.07	26.14	29.42	3.28	122.30	128.44	6.14
S.exp.	0.06	0.06	0.02	5.04	5.18	1.47	6.06	6.78	0.01
S.con.	0.05	0.05	0.02	3.91	4.52	1.19	4.61	5.26	0.15
V. max.exp.	1.36	1.49	0.13	34	39	5	129	140	11
V. max.con.	1.31	1.40	0.09	33	38	5	132	140	8
V. min.exp.	1.11	1.24	0.13	16	19	3	100	109	9
V. min.con.	1.13	1.19	0.06	20	21	1	113	120	7

Legend: X. exp.= the arithmetic mean for the experimental group; X.con= the arithmetic mean for the control group; S. exp.= standard deviation for the experimental group; S. con. = standard deviation for the control group; V. max. = maximum value for the experimental group; V. max. con.= maximum value for the control group; V. min. exp.= the minimum value for the experimental group; V. min. con.= minimum value for the control group.

For **height** (tab. no. 1), the arithmetic mean has a value of 1.23 m in the initial assessment and of 1.35 m in the final assessment, and therefore an increase of 12 cm for the experimental group and of 1.21m in the initial assessment and of 1.28 m in the final assessment, and therefore, an increase of 7 cm in the control group. The maximum value recorded 1.36m in the initial assessment and 1.49 m in the final assessment and therefore, an increase of 13 cm for the experimental group and 1.31 m in the initial assessment, 1.40 m in the final assessment and therefore an increase of 9 cm in the control group. The minimum value recorded 1.11 m in the initial assessment and 1.24 m in the final assessment in the experimental group and therefore, an increase of 13 cm and 1.13 m in the initial assessment and 1.19 m in the final assessment for the control group, and therefore an increase of 6 cm. The standard deviation has values between 0.02 and 0.06 which emphasizes a good homogeneity.

For **weight** (tab. no. 1), the arithmetic mean has a value of 23.69 kg in the initial assessment and of 26.53 kg in the final assessment, and therefore, an increase of 2.84 kg for the experimental group and of 26.14 kg in the initial assessment and of 29.42 kg in the final assessment, and therefore, an increase of 3.28 kg in the control group. The maximum value recorded 34 kg in the initial assessment and 39 kg in the final assessment and therefore, an increase of 5 kg for the experimental group and 33 kg in the initial assessment, 38 kg in the final assessment and therefore, an increase of 5 kg for the control group. The minimum value recorded 16 kg in the initial assessment and 19 kg in the final assessment in the experimental group and therefore, an increase of 3 kg and 20 kg in the initial assessment and 21 kg in the final assessment for the control group, and therefore, an increase of 1 kg. The standard deviation has values between 1.19 kg and 5.18 kg which emphasizes a good homogeneity.

For **body width** (tab. no. 1), the arithmetic mean recorded 113.75 kg in the initial assessment and 125.39 cm in the final assessment, and therefore, an increase of 11.64 cm for the experimental group and of 122.30 cm in the initial assessment and of 128.44 in the final assessment, and therefore, an increase of 4.14 cm in the control group. The maximum value recorded 129 cm the initial assessment and 140 cm in the final assessment and therefore an increase of 11 cm for the experimental group and 132 cm in the initial assessment, 140 cm in the final assessment and therefore, an increase of 8 cm in the control group. The minimum value recorded 100 cm in the initial assessment and 109 cm in the final assessment in the experimental group and therefore, an increase of 9 cm and 113 cm in the initial assessment and 120 cm in the final assessment for the control group, and therefore an increase of 7 cm. The standard deviation has values between 1.19 and 5.04 which emphasizes a good homogeneity.

As it can be seen, there is an improvement, from the initial assessment to the final assessment of the mean value by 13 cm for the experimental group and by 9 cm in the control group, an increase in weight by 2.84 kg for the experimental group and by 3.28 kg in the control group as well as an increase of 11.64 cm for the experimental group and of 4.14 cm for the control group, which are within the normal evolution of children at this age.
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B. Analysis and interpretation of the results for the effort adaptability in the experimental group and in the control group
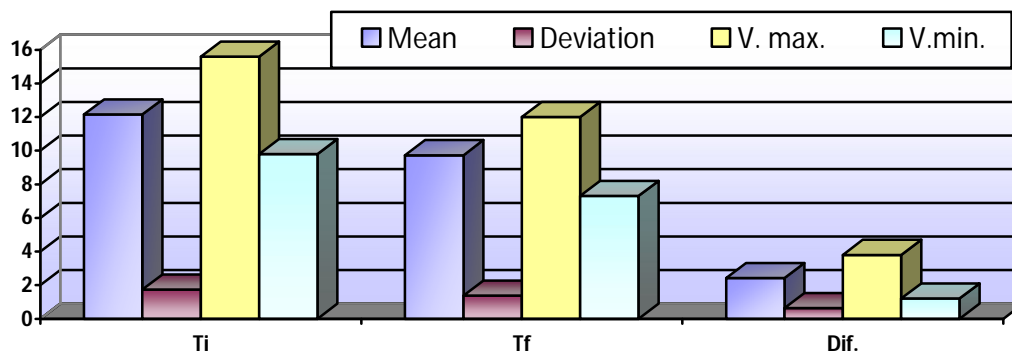
Summary table 2 -the results for the effort adaptability in the experimental group and in the control group

Calculated indicators	Ruffier Test		
	Ti	Tf	Dif .
X exp.	12.16	9.73	2.43
X. cont.	12.96	11.27	1.69
S.exp.	1.74	1.27	0.64
S.con.	9.63	1.39	0.69
V. max.exp.	15.7	12.1	3.6
V. max.con.	13.1	11.6	1.5
V. min.exp.	9.8	7.3	2.5
V. min.con.	9.9	7.7	2.2

Legend: X. exp.= the arithmetic mean for the experimental group; X.con= the arithmetic mean for the control group; S. exp.= standard deviation for the experimental group; S. con. = standard deviation for the control group; V. max. = maximum value for the experimental group; V. max. con.= maximum value for the control group; V. min. exp.= the minimum value for the experimental group; V. min. con.= minimum value for the control group.

The Ruffier Test (table no. 2 and graph no. 1), a test for assessing the children's effort adaptability, shows that the arithmetic mean records the value of 12.16 in the initial assessment and 9.73 in the final assessment. The decrease of the mean of the Ruffier index by 2.43 emphasizes the improvement of the children's effort adaptability for the experimental group and their classification in the final assessment as "moderate" (7.1 - 12). For the control group, the arithmetic mean records a value of the Ruffier Test of 12.96 in the initial assessment and of 11.27 in the final assessment, thus the value of the Ruffier Test is decreasing, but the drop is below 1.69,

consequently positioning the group as "low" on the assessment scale. For the experimental group, the *maximum value* recorded a result of 15.7 in the initial assessment and 12.1 in the final assessment, and for the control group, 13.1 in the initial assessment and 11.6 in the final assessment. The *minimum value* recorded a value of 9.8 in the initial assessment and 7.3 in the final assessment for the experimental group and 9.9 in the initial assessment and 7.7 in the final assessment for the control group. The standard Deviation has values between 0.23 and 9.63, which emphasizes a good homogeneity.

Graph no. 1- Graphical representation of the results for the effort adaptability (Ruffier Test)

The improvement from the initial assessment to the final assessment of the mean or the Ruffier Test by 2.43 for the experimental group and by 1.69 for the control group, as well as the transition of the experimental group to the "moderate" assessment level emphasizes the efficiency of the two operation modes and the superiority of the experimental group, at this age.

III. 3. Analysis and interpretation of the results for motor development
In summary table 3, there are presented the average values, the standard deviation, the maximum and minimum values recorded by the experimental and control groups for 20m speed running, 200m/300m long-distance running -for girls/for boys, standing long jump, torso dorsal raises in the initial and final assessment.

Summary Table 2 - results for the anthropometric growth and effort adaptability

Calculated indicators	A. v 20 m (s)			A. r. 200 mF/300 m B. (s)			Sr.l (m)			Abd. (s)		
	Ti	Tf	Dif.	Ti	Tf	Dif.	Ti	Tf	Dif.	Ti	Tf	Dif.
X exp.	7.31	6.15	1.16	143	125	18	0.86	1.04	0.18	19.25	21.82	2.57
X. cont.	7.05	6.45	0.60	135	120	15	0.90	0.95	0.05	18.18	19.65	1.47
S.exp.	0.62	0.54	0.08	0.12	0.10	0.02	0.16	0.14	0.06	2.01	1.67	0.96
S.con.	0.55	0.45	0.10	0.36	0.32	0.04	0.17	0.16	0.05	3.02	2.14	1.70
V. max.exp.	8.12	7.59	0.53	157	138	18	1.12	1.29	0.17	23	25	2
V. max.con.	8.59	8.44	0.15	150	135	15	1.11	1.18	0.07	24	25	1
V. min.exp.	6.28	5.16	1.12	100	98	2	0.56	0.74	0.18	13	15	2
V. min.con.	6.62	6.52	0.10	101	100	1	0.69	0.74	0.05	12	14	2

Legend: X. exp.= the arithmetic mean for the experimental group; X.con= the arithmetic mean for the control group; S. exp.= standard deviation for the experimental group; S. con. = standard deviation for the control group; V. max. = maximum value for the experimental group; V. max. con.= maximum value for the control group; V. min. exp.= the minimum value for the experimental group; V. min. con.= minimum value for the control group. S.r.20 m (s) = 20 m speed running; L-d r. 200/300m = Long-distance running (200 mG/300 m B); L.j.= standing long-jump (m); Abd. = torso dorsal raises (seconds).

For the **20m speed running**, (tab. No 3), the mean records a value of 7.31 seconds in the initial assessment and 6.15 seconds in the final assessment, and therefore, a decrease by 1.16 seconds for the experimental group, and for the control group, the arithmetic mean records a value of 7.05 seconds in the initial assessment and 6.45 seconds in the final assessment, and therefore, a decrease by 0.60 seconds. The experimental group recorded a maximum value of 8.12 seconds in the initial assessment and 7.59 in the final assessment, and therefore, a decrease by 0.53 seconds, and the control group, 8.59 seconds in the initial assessment and 8.44 in the final assessment, and therefore, a decrease by 0.15 seconds. The minimum value recorded 6.28 seconds in the initial assessment and 5.16 in the final assessment for the experimental group, and therefore, an improvement of 1.12s and for the control group, 6.62 seconds in initial assessment and 6.52 in the final assessment, and therefore a decrease by 0.10 seconds. The standard deviation has values between 0.05 and 0.62, which emphasizes a good homogeneity.

For the **long-distance running**, (tab. No 3), the mean records a value of 143 seconds in the initial assessment and 125 seconds in the final assessment, and therefore, an improvement in the running time by 18 seconds for the experimental group, and for the control group, the arithmetic mean records a value of 135 seconds in the initial assessment and 120 seconds in the final assessment, and therefore, a time improvement by 15 seconds. The experimental group recorded a maximum value of 157 seconds in the initial assessment and 138 in the final assessment, and therefore a decrease by 15 seconds, and the control group, 150 seconds in the initial assessment and 135 in the final assessment, and therefore a decrease by 15 seconds. The minimum value recorded 100 seconds in the initial assessment and 98 in the final assessment for the experimental group and for the control group, 101 seconds in the initial assessment and 100 in the final assessment. The standard deviation has values between 0.05 and 0.37, which emphasizes a good homogeneity.

For **the standing long-jump** (tab. No 3), the mean records a value of 0.86 m in the initial assessment and 1.04 m in the final assessment, and therefore an increase by 0.18 m for the experimental group, and for the control group, the arithmetic mean records a value of 0.90 m in the initial assessment and 0.95 m in the final assessment, and therefore an increase by 0.05 m. The experimental group recorded a maximum value of 1.12 m in the initial assessment and 1.29 in the final assessment, and therefore, an increase by 0.17 m, and the control group had 1.11 m in the initial assessment and 1.18 m in the final assessment, and therefore, an increase by 0.07 seconds. The minimum value recorded 0.56 m in the initial assessment and 0.74 in the final assessment, with an increase of 0.05 m for the experimental group and for the control group, 0.69 m in the initial assessment and 0.75 m in the final assessment. The standard deviation has values between 0.05 and 0.17, which emphasizes a good homogeneity.

For **the torso dorsal raises** (tab. No. 2) the arithmetic mean records the value of 19.25 torso raises in the initial assessment and 21.82 in the final assessment, an increase by 2.57 raises for the experimental group, and for the control group, the arithmetic mean records the value of 18.18 raises in the initial assessment and 19.65 in the final assessment, an increase of 1.47 raises. The maximum value recorded 23 in the initial assessment and 25 in the final assessment, an increase by 2 raises for the experimental group and for the control group recorded 24 in the initial assessment and 25 in the final assessment, an increase of 1 raise. The minimum value recorded 13 in the initial assessment and 15 in the final assessment, and therefore an increase of 2 raises for the experimental group and for the control group recorded 12 in the initial assessment and 14 in the final assessment, and therefore an increase of 2 raises. Standard Deviation has values between 0.70 and 3.02, which emphasizes a good homogeneity.

Conclusions

The analysis of the results performed within the study initiated at the preparatory grade revealed the evolution of physical development, effort adaptability and motility development.

The following have been found:

- regarding physical development, this was improved from the initial assessment to the final assessment because the height mean increased by 13 cm in the experimental group and by 6 cm in the control group, the weight mean increased by 2.79 kg in the experimental group and by 3.78 kg in the control group, and the body width mean increased by 11.64 cm in the experimental group and by 4.14 cm in the control group. These increases are within the normal development of children at this age;

- regarding the effort adaptability, capacity assessed by the Ruffier test, we noticed an improvement, from the initial assessment to the final assessment by 2.43 for the experimental group and by 1.69 in the control group, as well as the transition of the experimental group to "moderate", on the assessment scale and of the control group to "low",

on the same scale. This evolution of the effort adaptability emphasizes the efficiency of the two modes of operation and the superiority of the experimental group, at this age;

- regarding the motor capacity, we highlighted the fact that the mean improved during the experiment, for the 20 m speed running by 1.16 s in the experimental group and by 0.60 seconds in the control group, for the 200/300 m long-distance running by 18 seconds in the experimental group and by 15 seconds in the control group, for the standing long-jump by 18 cm in the experimental group and by 5 cm in the control group, and for the torso dorsal raises, an improvement was recorded with 2.57 raises in the experimental group and with 1.47 raises in the control group. These improvements underline that the physical education lessons are useful, but also the efficiency of the two operations;

- the hypothesis according to which "if children in the preparatory grade use games of movement including running, jumping, throwing and catching skills during their physical education lessons, a better physical, motor and functional development can be achieved" has been validated;

- we also underlined that the use of games of movement and applicative paths in every lesson in the experimental group led to a better level to improve the effort adaptability and the motor skills compared to the use of technical exercises in the control group.

Aknowledgements

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