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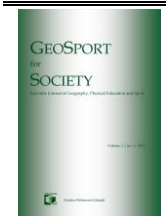

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Aspects of aerobic endurance in middle school students

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Abstract: The general, harmonious physical development of school youth is a major desideratum included among the aims of physical education promoted by all authors with concerns in this field, being the most important requirement of the ideal of physical education, a presence in any stage of design, planning, organization and development. this activity. In accordance with this task of great importance for school physical education, we mention that this paper aims primarily at the student, but also to improve the activities of teachers in the direction of achieving higher levels, a very important goal in general physical training of students and mainly the development / optimization of aerobic endurance. Goal: the role of this paper is to highlight the effects that "application paths" can generate as means oriented towards the development of aerobic endurance. Methods: In carrying out the research we mainly used the field test method, the observation method and the statistical-mathematical method. Results: The means used in the form of "application path" influence and demand at the same time the cardiovascular and respiratory systems and automatically lead to the increase of somato-functional indices of students.

Keywords: skills, application path, aerobic endurance, middle school, student

Introduction

In accordance with the current requirements, the theory and methodology of school physical education amplifies the role of a better knowledge of age peculiarities, real possibilities of students, orientation of the instructive-educational process towards the good organization of physical education activities, improvement of methods and technologies used, selection and the standardization of the most efficient means in order to amplify the efficiency of the activities (Sopa and Pomohaci, 2021). The permanent modernization of physical education and

sports activities in school, requires finding new procedures and means to act in practice (Erdely et al., 2020), as well as the continuous adaptation of existing ones, even in terms of "tools" for the development of aerobic endurance (Pálinkás et al., 2022; Armstrong and Welsman, 1997), legătura dintre capacitatea de efort, fitness-ul aerob (Rodas et al., 2021), puterea aerobă, frecvența cardiacă pe de o parte și starea generală de sănătate nemaifiind o noutate.

The Curricular area of Physical Education and Sports has specific contributions in all eight areas of key competencies and to a greater extent to the competencies: learning to learn, interpersonal, intercultural, social and civic competences, sensitivity to culture and subsequently to other key competencies such as: communication in the native language, communication in foreign languages, mathematics, science and technology, information and communication technology (ICT), entrepreneurial culture (Dragomir and Scarlat, 2004).

The permanent modernization of the physical education and sports activities in schools, requires the finding of new methods, procedures and means to act in practice, as well as the continuous improvement of the existing ones, including the exercises aimed at developing aerobic endurance (Gavarry et al., 2003). In accordance with this task of great importance for school physical education, we mention that this paper aims primarily at the student, but also to improve the activities of teachers in the direction of achieving higher levels, a very important goal in general physical training of students, namely development of motor quality - aerobic endurance, the absence of this category of concerns causing over time a degradation of the functional capacity of the human body (Islam et al., 2005).

In order to make the instructive-educational activity more efficient, the teacher has a wide range of ways and means starting with the didactic design according to his human and material resources, specifying the objectives (Kinczel et al., 2020), structure and content of the lesson, essentializing, updating and adapting the content to the level of the students ability of understanding (Kyröläinen et al., 2001).

In middle school students, the need for movement is in fact a need for physical, mental, motor development and this is manifested by their permanent desire to play, run, jump, throw, to "fly" either spontaneously or organized (in kindergarten or school), the mobility of the superior nervous processes making games, relays and application paths, particularly important means of influence. The most suitable age for the development of the optimal physical capacity for effort is the age of 11-16 years. Taking into account the developmental characteristics of children at this age, we consider that the application paths, through the effect of mobilizing mental resources and creating a favorable emotional background, are a viable solution for developing aerobic endurance in middle school students, in relation to the consecrated methods (continuous effort method, interval method etc).

Without going exhaustively through all the formulas of definition produced over time, we resume the opinion of T. Ardelean (quoted by Tudor, 2001) that resistance is primarily "a problem of oxidative muscle metabolism", completed (Demeter, 1981) with the fact that the dimensional factors and the functional

capacities of the cardiovascular and respiratory system occupy a secondary place in the current conception about the development of motor capacities (Benson and Connolly, 2011). Depending on the metabolic characteristics of the energy-supplying processes, resistance can be anaerobic or aerobic (Demeter, 1981). For reasons related to age-specific features and physiological effects produced by physical effort, the concern was to observe the involvement of the aerobic component of endurance (Bassett and Howley, 2000).

Methodology

The research took place in the 2nd semester of the current school year, during nine effective working weeks (to which were added two weeks for initial and final measurements and evaluations), involving a number of 52 students (boys) from the 6th and 7th grades (Table 1), from "Zelk Zoltan" Secondary School from Valea lui Mihai, Bihor County.

Table 1. Distribution of subjects by number, grade and gender

Grade		Number of subjects	Gender	Total
6th	A	14	Male	24
	B	10	Male	
7th	A	15	Male	28
	B	13	Male	

The data obtained from somato-functional measurements were processed using 4 statistical indicators: average, standard deviation, coefficient of variability and average error.

For a more eloquent characterization of the sample, the research began with the evaluation of somato-functional parameters (weight, height, Body Mass Index - BMI, resting heart rate, thoracic perimeter in forced expiration). In order to highlight the possible effects of the use of application paths on aerobic endurance, the standardized 1000 m test was used, carried out under the same conditions, the measurements being made using an electronic timer with 100 memories.

Results and discussions

The data obtained during the two tests (initial-1 and final-2), together with the values of the statistical indicators used, are illustrated in Table 2 and Table 3.

Table 2. Data obtained from somato-functional measurements (6th grade students)

Statistical indicators	WEIGHT (kg.)		HEIGHT (cm.)		B.M.I.		CHEST PERIMETER (cm.)		HEART RATE (beat/min)	
	T 1	*T 2*	*T 1*	*T 2*	*T 1*	*T 2*	*T 1*	*T 2*	*T 1*	*T 2*
AVERAGE	*61.48*	*61.46*	*163*	*164*	*22.9*	*22.02*	*65.24*	*65.96*	*69.24*	*65.48*
STDEV	*4.73*	*4.46*	*0.04*	*0.04*	*1.64*	*1.67*	*3.08*	*3.40*	*3.81*	*4.73*
COVAR	*7.79*	*7.20*	*2.98*	*2.90*	*7.17*	*7.27*	*4.73*	*5.16*	*5.50*	*5.70*
AVERROR	*0.18*	*0.17*	*0.01*	*0.01*	*0.06*	*0.06*	*0.12*	*0.13*	*0.15*	*0.13*

Table 3. Data obtained from somato-functional measurements (7th grade students)

Statistical indicators	WEIGHT (kg.)		HEIGHT (cm.)		B.M.I.		CHEST PERIMETER (cm.)		HEART RATE (beat/min)	
	T 1	*T 2*	*T 1*	*T 2*	*T 1*	*T 2*	*T 1*	*T 2*	*T 1*	*T 2*
AVERAGE	*62.9*	*62.56*	*166*	*167*	*20.74*	*19.91*	*65.4*	*66.6*	*69.6*	*69.3*
STDEV	*7.5*	*7.66*	*0.05*	*0.05*	*2.22*	*2.35*	*3.08*	*3.07*	*3.37*	*2.21*
COVAR	*12.9*	*13.08*	*3.31*	*3.27*	*10.72*	*11.25*	*4.70*	*4.61*	*4.84*	*3.19*
AVERROR	*0.30*	*0.30*	*0.01*	*0.01*	*0.08*	*0.09*	*0.12*	*0.12*	*0.13*	*0.08*

The intervention took place over nine effective working weeks (divided into three cycles of three weeks each), to which were added two weeks for initial and final measurements and evaluations. In each three-week cycle, a package of means was used, each consisting of two application paths, each week carrying out two physical education lessons lasting 50 minutes each. Details regarding the dosing of the efforts, the means used and the frequency of the interventions are given below (Table 4).

Table 4. Effort dosing in intervention cycles for aerobic endurance (power)

		I**st** cycle	II**nd** cycle	III**rd** cycle
Intensity		70-80% Vmax/ Passive rest	70-80% Vmax/ Active rest	70-80% Vmax/ Active rest
Volume/lesson	**Minutes**	15	15	15
	Term	3x2x2:30 min.	3x2x2:30 min.	3x2x2:30 min.
Load time		2:30 min.	2:30 min.	2:30 min.
Rest period		90 sec.	90 sec.	90 sec.
Means		Application path (1st batch)	Application path (2nd batch)	Application path (3rd batch)
Frequency		2/week	2/week	2/week

In the first and last week of the study, in addition to somato-functional measurements, the level of development of aerobic endurance was assessed. To evaluate the aerobic power (aerobic endurance parameter), we used the 1000 m field test, the collected results being highlighted below (Table 5). The measurement was performed using a digital timer with 100 memories, recording the order of arrival being performed manually.

Table 5. Data obtained at the 1000m test

Statistical indicator	6th grade 1000m (min, sec)		Progress		7th grade 1000m (min, sec)		Progress	
	T 1	**T 2**	+ (sec)	%	**T 1**	**T 2**	+ (sec)	%
AVERAGE	4:20	4:11	9	3.47	3:51	3:46	5	2.17
STDEV	0.53	0.52			0.17	0.17		
COVAR	13.99	14.14			5.04	4.99		

AVERROR	0.02	0.02		0.007	0.006	

We need to clarify that the choice of means (application paths) for the development of aerobic endurance was also influenced by their variety in terms of content, which may lead in parallel to the development of general motor skills, as a basis for easier acquisition of specialized skills. Also, the choice of a field test to assess aerobic endurance capacity was determined by the possibility to estimate the probability of success and to establish possible strategies for the physical education lesson in perspective (Bunc et al., 1992; Neumann et al., 1999).

Conclusions

Even if the progress does not seem to be very consistent, it occurred on a favorable emotional background, the students being totally involved in the specific effort of the lessons, avoiding the monotony produced by the method of continuous efforts. The analysis of data on somato-functional indices reveals an improvement, even if the general positive trend can also be attributed to the natural process of somatic and functional growth and maturation. In the context of increasing the impact of obesity, especially among young people, improving BMI is a good signal, especially if in the future, physical exertion will be accompanied by an increase in information on healthy nutrition. The increase of the thoracic perimeter in correlation with the decrease of the heart rate level, reveals positive physiological effects that can be correlated with the improvement of the aerobic endurance indices. Equally, we can observe a decrease in the value of the spread and an improvement in the homogeneity around the average in all the analyzed parameters.

Regarding the most important aspects, we find a progress in absolute value of the average time in the 1000 m field test of 9 seconds in the 6th grade and 5 seconds in the 7th grade, which corresponds to a relative value of 3.47% in the 6th grade and 2.17% in the 7th grade, thus highlighting an improvement of the aerobic endurance indices.

We can also assume that, as a result of the use of the chosen means (application path), through their diversity of content, the general motor background of the students has improved, favoring in perspective the more efficient acquisition of other elements of content specific to physical education.

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