Aspects Regarding the Optimization of the Physical Training of Student Swimmers in Semifond Trials

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Abstract: The aim of the paper is to improve the physical training level of the students. In order to achieve the proposed goal, we developed a training program, which focused on the classification of the specific operational structures according to the criterion of the effect on the optimization indicators for the physical training and, implicitly, on the students' results in the semifond trials, the methodical process used being that of the circuit. The research methods we used were the following: the direct and indirect observation method, the experimental method, the statistical-mathematical method and the graphic method. The subjects were evaluated in the initial, intermediate and final phase of the experiment by means of semifond trials: 400 m free and 200 m butterfly. The research activity was carried out during a one-year training period, from 08.10.2016 to 08.10.2017, on a sample of 24 students (aged 19-21) from the University „Politehnica” of Bucharest, who were divided into 2 groups: the experimental group and the control group. During the preparation of the experimental group, the independent variable of the research, namely the physical training program specific to the student swimmers for semifond trials, was introduced, while the control group did the normal training program. The results obtained during the research with the experimental group have materialized in the increase of the physical training parameters, with direct transfer on the results of the trials carried out in the water tests (400 m free and 200 m butterfly). This demonstrates the efficiency of the experimental group's preparation compared to that of the control group, an evolution which is due to applying the independent variable of our research.

Keywords: *physical training; semifond trials; students; swimmers; training program.*

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1. Introduction

In recent years, performance in swimming has had a spectacular evolution in Romania, both in what regards the results obtained in international competitions and, also in what regards the large number of children practicing this sport.

As we are all aware of, valuable sports results cannot be achieved without optimizing training in accordance with the requirements set for each training level. (Baldwin, Brooks, & Fahey, 2005).

Sports performance is a revelation of the athlete's possibilities and of training means.

Any motor activity involves in its performance the basic motor skills but combined differently.

Our concern in sports training is physical effort, which by its action involves the muscular and energy system as well as the system for the information transmission and processing. Physical effort also determines a certain body stress level, whose effect is to develop the physical and mental capacities. There are two types of stresses:

- external stress, characterized by the external parameters (intensity, volume, duration);
- internal stress characterized by the action of the external parameters on the functional system thus producing physiological, biochemical and mental changes (Aunola & Rusko, 2000: 38).

The physical and mental stress, which is above the previously recorded level, leads to improved sports performance.

The possibilities of the muscular system to release through glycolysis or phosphorylation, the energy needed to have the highest possible mechanical work and to maintain it as much as possible represent the effort capacity. (Girard, 2000).

Sports training aims to increase the effort capacity so as to be able to reach high-volume tolerance per training lesson and to maintain high intensity. (Bell, 1996).

This analysis process reveals the characteristics wealth of the competition trial from a physiological viewpoint, and also the importance of the combined motor skills in order to prepare a particular competition trial. The set of the trial specific characteristics, subject to rationalization, is systematized according to the criterion of efficiency; we can see it constitutes a unitary acting system, after we have previously analyzed and found the characteristics of the competition trial.

In swimming, we make the effort analysis at the 400m freestyle trial from the viewpoint of the energogenesis type underlying it. We analyze the aerobic and anaerobic relation as well as the effort zone in which it falls. Furthermore, we also deal with the combined motor skills and their weighting. (Bell, 1996).

Strength training in swimming improves swimming performance and performance-related parameters such as increased stroke length, reduced stroke rate and increased swimming force. Swimming velocity is the product of stroke length and stroke rate. However, out of the three studies which investigate the effects of on land strength training on swimming, only one found benefits between combined strength and a swim training group versus a swim-training only group. (Girolid, Calmels, Maurin, Milhau, & Chatard, 2006; Girolid, Maurin, Dugue, Chatard, & Millet, 2007; Tanaka, Costill, Thomas, Fink, & Widrick, 1993; Toussaint & Vervoorn, 1990; Trappe & Pearson, 1994)

Competitive swimmers need to have specific anthropometrical features compared with the other athletes, but they are nevertheless dependent on physiological adaptations in order to enhance their performance. Hence, swimmers engage in large volumes of training in the pool and on land. Strength training of various forms is widely used, and the energetic systems are dealt with by aerobic and anaerobic swimming training. (Aspenes & Karlsen, 2012)

The competitive swimming season is broken into a cardiovascular/endurance phase which takes place in the training season and a gradually shorter period which takes place in the competition season. (Hannula & Thornton, 2001) During the training season, swimmers participating in competitions perform a large volume of training with high intensity practice in order to gain strength and power. (Salo & Riewald, 2008)

In recent years, deep trunk muscle training has been adopted in various sports, including swimming. This is performed both in the everyday training and as part of the warm-up routine before competitions. Trunk stabilization exercises are considered to be effective in preventing injury as well as an aid in improving performance. (Iizuka, Imai, Koizumi, Okuno, & Kaneoka, 2016).

While studying the student swimmers training, we noticed that physical training is not treated in accordance with the performance level we aspire to. Also, in some cases it lacks from the training program. Therefore, through this research we tried to prove that on land physical training is very important in order to obtain good results in major competitions.

2. Material and Methods

2.1 Research Aim

The aim of the paper is to improve the physical training of the students.

2.2 Research Hypothesis

The hypothesis underlying the study is the following: to develop a system of means adapted to student swimmers in order to improve physical training, which can lead to increasing the efficiency of the specific training with effects on the performance in semifond trials.

2.3. Research Methods

The research methods we used were these: the direct and indirect observation method, the experimental method, the statistical-mathematical method and the graphic method. The evaluation tools of the subjects investigated consisted in the 400 m freestyle and 200 m butterfly semifond trials.

2.4. Subjects and Location

The lot of swimmers was made up of 24 students (aged 19-21) from the University "Politehnica" of Bucharest, who were randomly divided into two groups: experimental ($n = 12$) and control ($n = 12$). This method of distributing the athletes led to the homogeneity of the groups.

The swimmers participating in the study have been practicing swimming for 10-11 years. They were healthy people who did not have injuries that could get worse by testing. The research aimed to ensure the ethical and medical conditions of the subjects' participation. Before the experiment, the male students were informed about the particularities of the test and the types of evaluations used. They agreed to the way the experiment was conducted.

The research activity was carried out during one year of training, between 08.10.2016 and 08.10.2017. The research and its testing took place at the swimming pool in the "Lia Manoliu" National Complex.

In this study, we performed several tests: initial, intermediate and final - at an interval of 6 months.

We recorded the data as follows:

- the initial test was carried out between 08.10.2016 and 14.10.2016; its role is to understand the initial values of the parameters studied;
- the intermediate test took place between 12.02.2017 - 18.02.2017;
- the final test took place between 04.10.2017 - 08.10.2017;

We used the independent research variable during the training of the subjects in the experimental group.

2.5. Experimental Design

After the initial test for both groups of subjects, we elaborated the training program for the experimental group. We used the independent variable of the research in the training of this group, in order to improve the physical training specific to the 400 m freestyle and 200 m butterfly semifond trials. We employed this during one year of training.

In the training of the control group, we used the training program developed by the coach (which includes a physical training program), but without including the independent variable of our study. The number of hours of training in the water and physical training on land was identical for both groups.

For the purpose of this study, we made the classification of the specific means according to the criterion of the effect produced on the indicators for the physical training optimization and, implicitly, on the athletes' results in the semifond trials; we employed circuit training as methodical procedure.

The process means that the swimmers deal with a series of workshops, performing exercises that influence a number of muscle groups, which is identical to the number of workshops, with distinct effects on the development of the morpho-functional indices and physical capabilities.

The work in the circuit aims at using the muscular groups as well as the uninterrupted intervention of the cardiovascular system. It is focused on differentiated work for small and homogeneous groups or on individualized work. This process increases the efficiency of the exercises and extends the potential of the important functions.

We present in Table 1 a sequence of the training program followed by the experimental group:

Table 1. Physical training program specific to 400 m freestyle trial

Means	No. of repetitions	Nature of the pauses	No. of series	Intensity
Work on the Ergosim simulator	2'30"-3'	A	4	85%
Lying dorsally, raising the trunk to the vertical	45-50	A	4	80%

Pull-ups on the trolley for strength, inclined at 30-35°	2'-2'30"	A	4	80%
Lying facially, extensions of the back	45-50	A	4	80%
Pull-ups	3'	A	4	85%
Arms rotations alternatively forward with small dumbbells of 0,5 Kg	2'30"-3'	A	4	85%
Squats with jump	25-30	A	4	80%
Lying facially with arms support, flexion and extension of the arms	2'30"-3'	A	4	80%
Wide-Grip Pull downs, 20Kg load	1'30"-2'	A	4	85%
From lying facially, work on the legs crawl, with the gym mattress on the legs	2'30"-3'	A	4	80%
From lying dorsally, push at the press for thighs, weighing 25 Kg	2'-2'30"	A	4	85%
Push-ups on the knees	1'30"-2'	A	4	80%
Barbell bench press exercise with a weight of 25 Kg	1'-1'30"	A	4	90%

2.6. Results

The comparative analysis of the results obtained during the experiment at the three tests (initial, intermediate and final) in the 400 m freestyle trial is shown in Table 2 and refers to the value of the statistical indicators determined in the two groups (experimental and control):

Table 2. Comparative results obtained in the 400 m freestyle trial - experimental group vs. control group

TESTS	STATISTICAL INDICATORS					TEST t	p
	Experimental Group		Control Group		Gex-Gc		
	Average/ $\pm$ SD	Cv %	Average / $\pm$ SD .	Cv %.	Average _e Dif.		
Initial Testing	4.47 /0.3	6.71	4.49/0.3	6.68	0.02	0.84	>0.05
Intermediate	4.42/0.3	6.78	4.46/0.3	6.72	0.04	2.53	<0.05

Testing							
Final							
Testing	4.36/0.3	6.88	4.42/0.3	6.78	0.06	4.57	<0.05

In the 400 m freestyle trial, the results obtained at the initial test indicate close average values between the two groups, respectively $M = 4.47$ sec. (experiment group) and $M = 4.49$ sec. (control group); the coefficient of variability has a value of 6.71% for the experimental group and of 6.68% for the control group, which means a high homogeneity.

The verification of the statistical hypothesis carried out by means of the Independent Student Test t shows a statistically non- significant difference between the averages, $P = 0.84$ being higher than 0.05. (Table 2) At the intermediate test, the results obtained by the experimental group are superior to those obtained by the control group; the rate of progress from one test to another shows an average difference of 0.04 sec. between the two groups. At final test the average values of the experimental group ($M = 4.36$ sec.) were superior to the results obtained by the control group ($M = 4.42$ sec.). The coefficient of variability at the final test has a value of 6.88% for the experimental group and of 6.78% for the control group, which means a high homogeneity, the average being representative. The value of the "Student" test calculated " t " between the intermediate and the final test is of 4.57, so $4.57 > 2.074$ (at the value of $p < 0.05$); as a result, there are statistically significant differences between the averages of the two tests. We present in graphical form the dynamics of the averages obtained by the two groups in the 400 m freestyle trial, at the three tests:

Graph 1 Average values in the 400 m freestyle trial - experimental group vs. control group

Table 3 presents the results obtained during the experiment at the three tests (initial, intermediate and final) in the 200 m butterfly trial, according to the statistical indicators determined in the two groups (experimental and control):

Table 3. Comparative results obtained in 200 m butterfly trial - experimental group vs. control group

TESTS	STATISTICAL INDICATORS					TEST t	p
	Experimental Group		Control Group		Gex-Gc		
	Average/ $\pm$ SD	Cv %	Average / $\pm$ SD .	Cv %.	Average Dif.		
Initial Testing	2.40 /0.4	16.66	2.41/0.4	16.59	0.01	0.30	>0.05
Intermediate Testing	2.33/0.3	12.87	2.36/0.3	12.71	0.03	2.12	<0.05
Final Testing	2.26/0.3	13.27	2.33/0.3	12.87	0.07	5.25	<0.05

We find that in the 200 m butterfly trial the experimental group has, at the initial test, similar results to the control group, respectively $M = 2.40$ sec. (experimental group) and $M = 2.41$ sec. (control group). The verification of the statistical hypothesis carried out by the Independent Student Test t shows a statistically non-significant difference between the averages, $P = 0.30$ being higher than 0.05. (Table 3). At the intermediate test, the experimental group showed a progress of the average values of 0.03 sec. compared to the control group; the coefficient of variability at the intermediate test has a value of 12.87% for the experimental group and of 12.71% for the control group, which means an average homogeneity. A significant difference between the average values of the two groups is noted at the final test; the experimental group obtained better results ($M = 2.26$ sec.) compared to the control group ($M = 2.33$ sec.). The coefficient of variability shows an average homogeneity for both groups, the value being of 13.27% for the experimental group and of 12.87% for the control group. The value of the "Student" test calculated "t" between the intermediate and the final test is of 5.25, so $5.25 > 2.074$ (at the value of $p < 0.05$); as a result, there are statistically significant differences between the averages of the two tests. In Graph 2, we can see the dynamics of the averages obtained by the two groups in the 200m butterfly trial, at the three tests:

Graph 2 Average values in the 200 m butterfly trial - experimental group vs. control group

In conclusion, after analyzing the interpretation of the statistical data obtained at the initial test, we can affirm that the results of the two groups were approximately equal at the beginning of the research; at the intermediate test, after six months from the beginning of the research, we found different results between the two groups, and at the final test the differences between the experimental group and the control group were favorable for the experimental group.

3. Conclusions

The end of the research shows superior evolutions of experimental group results compared to those of the control group at both tests applied (400 m freestyle and 200 m butterfly). We found that the independent variable applied to the experimental group, relying on quantitative and qualitative accumulations, produced significant improvements from one test to another, based on the training methodology in all the indicators tested, which confirms the research hypothesis.

The whole research confirmed the increase of the experimental group performance compared to that of the control group; this evolution is due to the application of the independent variable of our research.

The results obtained during the study regarding the increase of the physical training parameters, with direct effect on the results of the trials carried out in the water tests for the 400 m freestyle and 200 m butterfly

trials, showed the efficiency of the experimental group training compared to that of the control group

The research results lead us to the conclusion that the independent research variable was accepted by the swimmers and resulted in accelerated and certain progress. The independent variable must be applied exactly as number of repetitions and duration of breaks, by taking into account the psychosomatic characteristics specific to the swimmers studied, in accordance with their training and performance.

The correct relation between increasing the stress level and increasing the potential to cope with the intensity and volume of the effort applied denotes the carefully correlated dosing consistent with the age, the bone and muscle development and performance of the student swimmers who participated in the research.

The experimental validation of the training program elaborated and applied to the experimental group produced relevant evolutions in the physical training that were successfully transferred to the water tests in the competition trials tested.

The increased physical training of the experimental group with transfer to the competition trials studied, highlighted by the results obtained at the three tests, proves the elaboration correctness of the conception and the methodology for conducting and evaluating the research carried out.

Sports training must be perceived as a phenomenon specialized in the smallest details, whose role is to develop and educate the swimmers in terms of physical-sports improvement and whose purpose is to reach the maximum performance capacity in competitions.

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