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The methodology of using training simulators at swimming lessons among the students of Udmurt State University

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Abstract: The article considers the dynamics of the results change among female students of the 2nd course at Udmurt State University (UdSU) at swimming lessons using non-standard swimming simulators. The following indices are presented: non-stop swimming and front crawl within 12 minutes, 50 m front crawl in full coordination, 25 m front crawl in full coordination, 25 m back crawl in full coordination. We estimated the following indices:12-minutes swimming (meters); at 25 and 50 meters distances - time of the distance overcoming; the article also describes the detailed algorithm of the held research. In general, 60 female students, who study at UdSU took part in the study. These studies show us the level of students' readiness, the dynamics of results change while using a non-standard swimming simulator. The presented research work is used for statistical analysis and further improvement of methods of working with a swimming simulator at swimming lessons among non-sports profile students. The scientific novelty of the work is in the fact that during the research we received new data concerning the development of students' physical qualities – the girls of the second course at Udmurt State University, using non-standard swimming training simulators at physical culture classes. The use of swimming simulators will positively affect the results improvement. ***Practical significance***. We recommend using the cumulative index for training simulators introduction at "Swimming" lessons. The aim of the study is to reveal the role and purpose of the simulators in physical qualities development at swimming lessons. ***Materials.*** Monitoring the effectiveness of swimming the set parts of the distance, the characteristics of the separate technique elements among female students at swimming lessons. Research methods. The main methods in our research work were the following: the introduction of a non-standard swimming simulator, pedagogical testing, analysis of results indices and statistical analysis of the data obtained. ***Results.*** We offered the experimental methodology based on the use of non-standard swimming simulators during swimming lessons directly at in water. ***Conclusion.*** The carried out research proves that the used swimming simulators form an effective training tool. The simulators increase the speed of movement, the power of the rowing movement, improve the technique, speed endurance, general endurance, improve the result with less training volume and number of lessons.
Keywords: swimming, students, improvement of physical qualities, swimming simulators.

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Introduction

Swimming is one of the directions of physical culture, which as an educational discipline presents the sphere of knowledge, which studies the laws of swimmer's organism interaction with water, where his or her motor actions are organized. [4] It is a well-known fact that the effectiveness of swimmer's movement depends on many factors, among which great role belongs to physical qualities development and spatial, speed characteristics of an arm stroke. [2]

Regular physical loads first of all stimulate musculoskeletal system and activate life processes in all inner organs. [6] The main physical qualities, which are developed at the lessons in the swimming pool, can be considered the following: speed, power and endurance. All these qualities in swimming are interconnected and form the unity. In order to

develop these qualities, we need a lot of time, which students at a higher educational establishment don't have. Swimming lessons are held twice a week (60 minutes each). This volume of the load is not enough for a full-fledged development of students' physical qualities. In this connection we set the following aim: to check and experimentally prove the effectiveness of a non-standard swimming simulator.

Materials and methods

The main methods in our research work were the following: the introduction of a non-standard swimming simulator, pedagogical testing, analysis of results indices and statistical analysis of the data obtained.

The research work had 6 stages and was held during the 1st term on the basis of Udmurt State University among female-students of non-sports profile. The students of the 2nd course, who entered the University in 2021 took part in the research.

Algorithm of the research organization:

- at the 1st and the 4th stage we gathered the information concerning the control norms: 12 minutes of a non-stop front crawl swimming in full coordination, 50 meters front crawl in full coordination with time control, 25 meters front and back crawl swimming in full coordination counting the amount of cycles of hands and legs movements, 25 meters front and back crawl swimming with the help of legs counting the amount of cycles of legs movements, 25 meters front and back crawl swimming counting the amount of cycles of hands movements.
- at the 2nd stage students, who took part in the research, were divided into two groups: control group and experimental group.
- at the 3rd stage we offered for the students of the experimental group the tasks with the experimental training simulator, in the control group the tasks were without the simulator.
- At the 5th stage we calculated the indices of a swimmer's movements characteristics.

The used formulae:

1. Step – the distance, which a swimmer moves along within one complete cycle of movements. The length of the step is calculated according to the following formula: $L = s/n$, where L – length of the step (m.); s – distance (m.); n – amount of cycles.
2. Duration of movements – time period between the beginning and the end of movement, or the duration of one cycle in the cyclic kinds. The following formula is used: $tcycle = t/n$, where tcycle – the average duration of one cycle of movements (s.); t – time, spent for all cycles fulfillment at the measured length (s.); n – amount of cycles.
3. Tempo – frequency of movements within the time unit, or the amount of cycles of movements, fulfilled within the time unit. Tempo is the value, which is inversely proportional to tcycle. The following formula is used: $f = n/t$, where f – tempo (cycle/s.); n – amount of cycles; t – time, spent for all cycles fulfillment at the measured length (s.).
4. The average speed of the length swimming – scalar value, which shows the average speed of the set distance overcoming $Vav = s/t$; v – speed (m/s); s – distance (m.); t – time (s.).
5. Results increase in percentage. $Pr=x2-x1/x1*100$; Pr – increase in percentage (%); x1 – the initial result (at the beginning of the experiment); x2 – the final result (in the end of the experiment).

- At the 6th stage we analyzed the received results.

At the 3rd stage we offered the students form the experimental group to fulfill the exercises using non-standard swimming training simulators. These training simulators decrease the area of the support during the movements in water fulfillment, providing physical qualities development.

"Foot fairing" swimming training simulator (Fig. 1) includes three parts: fairing, fixing bandage, sealant. The main part of the fairing is made of tube material, one side has a straight cut, the other side has a slanting cut.

The frame of the main part has the holes for the fixing bandage and a sealant placing.

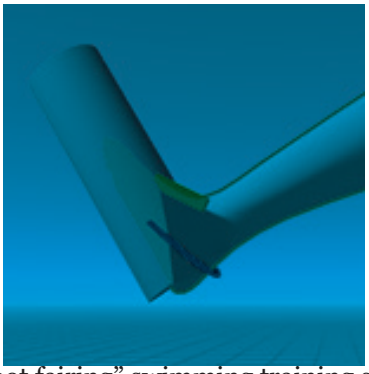

Fig. 1. "Foot fairing" swimming training simulator

"Hand fairing" swimming training simulator (Fig. 2) includes 4 parts: fairing, flat support and 2 fixing bandages. The main part of the fairing is made of tube material, the support is made of firm polymeric material, the frame has 4 holes for the fixing bandages attaching.

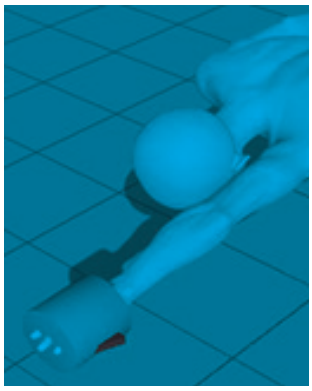

Fig. 2. "Hand fairing" swimming training simulator

This stage was divided into 3 sub-phases:

1. Preparatory – during this sub-phase, students got acquainted with the training simulator, the technique of the exercises fulfillment. The sub-phase duration was 4 lessons, general volume of one lesson was 1200 meters, 500 meters were with the simulators.

2. Main – during this sub-phase, students fulfilled the training tasks for strength-oriented and speed-strength oriented qualities development. The sub-phase duration was 18 lessons, general volume of one lesson was 1500 meters, 1200 meters were with the simulators.

3. Final – during this sub-phase the load decreased. The sub-phase duration was 4 lessons, general volume of one lesson was 1200 meters, 200 meters were with the simulators.

Results and discussion

The tables and diagrams below present the results of the control tests.

Table 1

Dynamics of the results change in the control and experimental groups

	Distance	25 front crawl		50 front crawl		12 min front crawl	
Group	Period	Time (sec.)	The result increase %	Time (sec.)	The result increase %	Distance(m.)	The result increase %
Experimental group	Beginning of the experiment	25,73±2,32		59,92±5,39		386,33±34,77	
	End of the experiment	24,08±2,17	6,51±0,59	54,39±4,89	8,86±0,8	433,33±33,39	12,18±1,1
Control group	Beginning of the experiment	23,85±2,15		49,79±4,48		415,67±37,41	
	End of the experiment	22,99±2,07	3,59±0,32	48,33±4,35	2,88±0,26	437±39,33	5,06±0,46

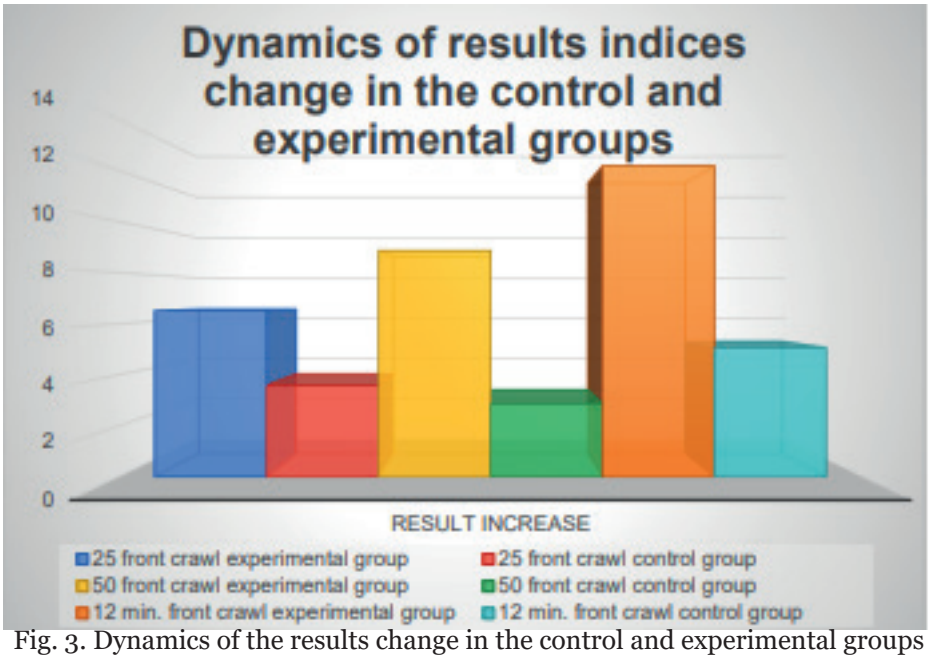

Fig. 3. Dynamics of the results change in the control and experimental groups

Time of swimming 25 meters distance front crawl in full coordination shows strength-oriented qualities development. This index increases both in the experimental and control group, in the experimental group the increase is higher, than in the control group.

Time of swimming 50 meters distance front crawl in full coordination shows sports result improvement. This index increase in the experimental group is higher, than in the control group.

Non-stop swimming within 12 minutes time period front crawl in full coordination shows general endurance development. This index increase we see both in the control and the experimental group, in the experimental group the increase of this index is twice higher.

Table 2

Dynamics of the average speed of the distances swimming change

Group	Distance / Period	25 front crawl		50 front crawl		12 min. front crawl	
		Speed(m/m)	Result increase %	Speed(m/m)	Result increase %	Speed(m/m)	Result increase %
Experimental group	Beginning of the experiment	1,01±0,09		0,88±0,08		0,54±0,05	
	End of the experiment	1,07±0,1	5,83±0,52	0,95±0,09	8,18±0,74	0,6±0,05	12,16±1,09
Control group	Beginning of the experiment	1,07±0,1		1,01±0,09		0,58±0,05	
	End of the experiment	1,1±0,1	3,42±0,3	1,04±0,09	2,98±0,27	0,61±0,05	4,95±0,45

Speed of 25 meters distance swimming front crawl in full coordination shows the ability to achieve maximal speed at a minimal length. This index increase in the experimental group is higher, than in the control group.

Speed of 50 meters distance swimming front crawl in full coordination shows the ability to achieve maximal speed at a competitive distance. This index increase in the experimental group is higher, than in the control group.

Speed of swimming within 12 minutes time period shows the ability to keep the average speed during a long time period. This index increase in the experimental group is higher, than in the control group.

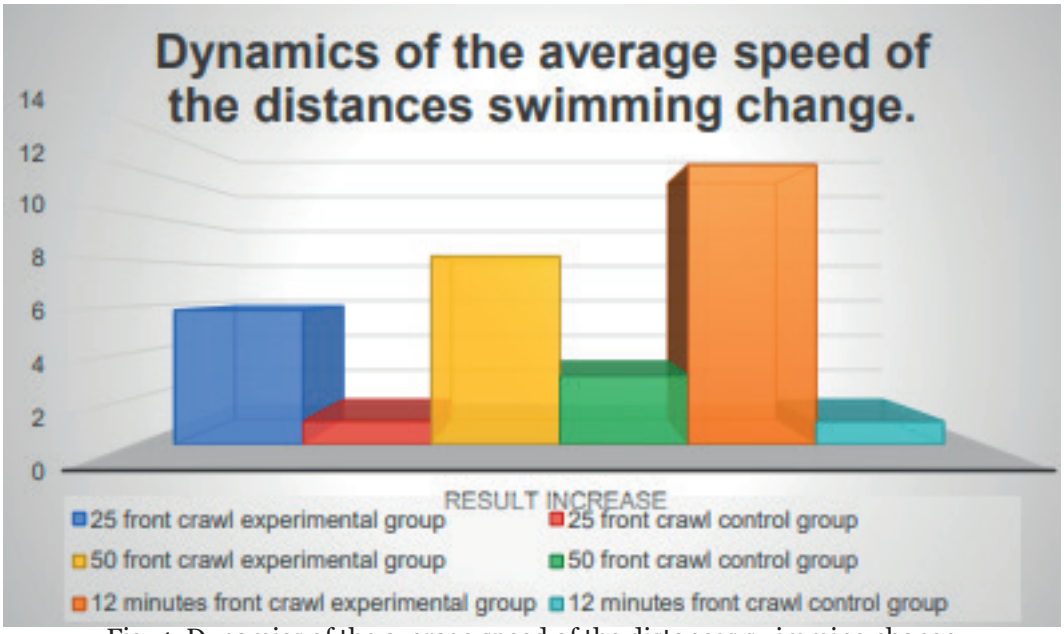

Fig. 4. Dynamics of the average speed of the distances swimming change

Table 3

Dynamics of indices change of swimmers front crawl movement at 25 meters distance in percentage

Front crawl in full coordination							
Group	t time (%)	n hands cycles (%)	n legs cycles (%)	F tempo, (%)	Vav (%)	L step (%)	Tc duration of the cycle (%)
Experimental	6,506±0,58	-13,69±	-10,246±0,91	-10,94±0,98	5,82±0,52	12,61±1,13	5,702±0,51
Control	3,59±0,32	-1±0,001	19,61±1,76	4,705±0,42	3,416±0,3	-0,93±0,081	-4,18±0,37
Front crawl with the help of hands							
Group	t time (%)	n hands cycles (%)	n legs cycles (%)	F tempo, (%)	Vav (%)	L step (%)	Tc duration of the cycle (%)
Experimental	10,26±0,91	-13,19±1,18	-	-3,94±0,35	9,325341	12,706±1,14	1,98±0,17
Control	0,58±0,052	-3,33±0,29	-	-3,44±0,3	0,48±0,043	2,85±0,25	2,27±0,204
Front crawl with the help of legs							
Group	t time (%)	n hands cycles (%)	n legs cycles (%)	F tempo, (%)	Vav (%)	L step (%)	Tc duration of the cycle (%)
Experimental	5,07±0,45	-	-11,1953	-5,07±0,45	5,099±0,45	14,77676	9,24±0,83
Control	1,36±0,12	-	25,55±2,29	26,39±2,37	2,608±0,23	-20,58±1,85	-21,401±1,92

Table 4

Dynamics of indices change of swimmers back crawl movement at 25 meters distance in percentage

	Back crawl in full coordination						
Group	t time (%)	n hands cycles (%)	n legs cycles (%)	F tempo, (%)	Vav (%)	L step (%)	Tc duration of the cycle (%)
Experimental	9,141±0,52	-12,79±1,15	-6,31±0,56	-3,31±0,29	8,94±0,804	9,81±0,88	2,25±0,202
Control	2,66±0,23	-8,904±0,801	3,97±0,357	-7,03±0,69	2,195±0,19	9,62±0,86	6,57±0,59
	Back crawl with the help of hands						
Group	t time (%)	n hands cycles (%)	n legs cycles (%)	F tempo, (%)	Vav (%)	L step (%)	Tc duration of the cycle (%)
Experimental	7,68±0,69	-7,407±0,66	-	-0,491±0,044	6,868362	6,28±0,56	-0,94±0,08
Control	3,53±0,31	-6,85±0,61	-	-3,69±0,332	3,08±0,27	6,01±0,54	2,69±0,24
	Back crawl with the help of legs						
Group	t time (%)	n hands cycles (%)	n legs cycles (%)	F tempo, (%)	Vav (%)	L step (%)	Tc duration of the cycle (%)
Experimental	6,98±0,62	-	6,57±0,59	13,99±1,25	8,09±0,72	-3,98±0,35	-11,67±
Control	2,68±0,24	-	18,74±1,68	23,23±2,09	4,302±0,38	-25,34±2,28	-28,003±2,52

The time (%) index shows the results change in swimming 25 meters distance front and back crawl in percentage. The table shows positive increase both in the experimental and control group, but in the experimental group the increase is higher.

n hands cycles (%) and n legs cycles (%) indices show the change of cycles amount, which are spent at the set distance in percentage. This index is connected with the time of swimming the distance. The greater the amount of the cycles decrease and better the time of swimming is, the higher the effectiveness of the technique is. The table shows the following: we see considerable cycles of movement decrease and significant result improvement in the experimental group; in the control group we see insignificant cycles of movement decrease, in some cases cycles of movement increase in terms of the result improvement.

F tempo (%) index shows the frequency of movements change within the time unit or the amount of the cycles of movements, fulfilled within the time unit in percentage. This index is directly connected with the speed of the swimmer Vav(average) (%). The higher the speed, the more powerful swimmer's arm strokes are. The table shows speed increase and tempo of movements decrease according to all indices in the experimental group; in the control group we see the tendency of speed increase in terms of tempo of movements increase.

L step (%) index shows the distance change, which a swimmer overcomes within one cycle of movements in percentage. The results show that in the experimental group this index increase is higher, than in the control group.

Duration of movements change index (Tc duration of the cycle %) shows the time period change between the beginning and the end of movement (duration of one cycle) in percentage. This index is directly connected with the speed of movement: the higher the speed and the lower the tempo, the more effective the fulfillment technique

is. In the experimental group we see this index increase in terms of the cycle duration decrease, in the control group we see insignificant speed increase in terms of the cycle duration increase.

Conclusion

The carried out research proves that the used swimming simulators form an effective training tool. The simulators increase the speed of movement, the power of the rowing movement, improve the technique, speed endurance, general endurance, improve the result with less training volume and number of lessons. In this connection we consider it reasonable to study this training simulator from different points of view: it is necessary to reveal the influence of the fulfilled tasks and different technical elements on the technique, study all physical qualities development using the simulators and study the effectiveness of the training simulator use in sport groups.

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